

IMPACT OF DISCOURSE ON INCREMENTAL COMPREHENSION PROCESSES:  
EVENT-RELATED POTENTIAL STUDIES OF WORD-BY-WORD READING

by

Joseph Z. Stafura

B.A. in Psychology, Purchase College, State University of New York, 2007

M.S. in Psychology, University of Pittsburgh, 2013

Submitted to the Graduate Faculty of the  
Dietrich School of Arts and Sciences in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy

University of Pittsburgh

2018

UNIVERSITY OF PITTSBURGH  
DIETRICH SCHOOL OF ARTS AND SCIENCES

This dissertation was presented

by

**Joseph Z. Stafura**

It was defended on

June 15, 2018

and approved by

Tessa Warren, Associate Professor, Departments of Psychology, Linguistics and

Communications Sciences and Disorders

Scott Fraundorf, Assistant Professor, Department of Psychology

Margaret McKeown, Clinical Professor, Department of Instruction and Learning, School of

Education

Dissertation Advisor: Charles Perfetti, Distinguished University Professor, Department of

Psychology

**IMPACT OF DISCOURSE ON INCREMENTAL COMPREHENSION PROCESSES:  
EVENT-RELATED POTENTIAL STUDIES OF WORD-BY-WORD READING**

Joseph Z. Stafura, Ph.D.

University of Pittsburgh, 2018

The EEG studies in this Dissertation examine readers' incremental, on-line reading comprehension. Study 1 tested the ability of words to trigger outdated mental representations. Participants read text passages in 3 conditions - Consistent, Inconsistent, and Causal. The Inconsistent condition differed from the Consistent condition due to protagonist inconsistencies. The Causal condition differed from the Inconsistent condition by the addition of single-sentence *causal* justifications for the inconsistencies. Results indicated that readers were sensitive to inconsistencies quite early in word processing, suggesting the functioning of semantically related attentional processes drawn to the meaning features of the input. At later time windows, words in both inconsistent and causal passages differed from those in consistent passages, with effects varying by location, suggesting related but somewhat functionally distinct memorial processes. Overall, the results are interpreted as reflecting on-line attentional and memorial mechanisms involved in detecting when a word "doesn't fit" in a text or discourse, and those involved when there is more than one available "interpretation" of a text. Study 2 tested the influence of contextually-guided referential semantics on processing. Participants read two-sentence texts that specified one conceptual feature in the first sentence. The second sentence contained a word that was either Consistent or Inconsistent with that feature. The results from Study 2 diverged from predictions in two ways. First, no N400 differences were found between conditions. This was similar to what was found in Study 1 and provides support for a connection between semantic

binding and the N400 in connected text. Second, a frontal P600 was found, but in the opposite direction as predicted, with related words eliciting more positive responses than unrelated words.

The studies in this Dissertation are entries into the literature on on-line reading comprehension.

## TABLE OF CONTENTS

<b>LIST OF TABLES</b> .....	viii	
<b>LIST OF FIGURES</b> .....	ix	
Preface .....	x	
<b>1. INTRODUCTION: LANGUAGE COMPREHENSION AND WORD</b>		
<b>COMPREHENSION</b> .....	1	
<b>1.1. BACKGROUND</b> .....	2	
1.1.1. Levels of Comprehension .....	2	
1.1.2. Incremental Language Processing .....	3	
1.1.3. Memory and Prediction in Language Comprehension .....	5	
1.1.4. Electrophysiology of Word-to-Text Integration .....	6	
<b>1.2. AIMS: CONNECTING WORDS AND TEXTS</b> .....	7	
1.2.1. Study 1: Passage Consistency .....	8	
1.2.2. Study 2: Referential Specificity .....	10	
<b>2. STUDY 1: PASSAGE INCONSISTENCY</b> .....		13
<b>2.1. INTRODUCTION</b> .....	13	
<b>2.2. METHODS</b> .....	27	
2.2.1. Participants .....	27	
2.2.2. Materials .....	27	
2.2.3. Design and Procedure .....	30	
2.2.4. Apparatus and ERP Recordings .....	33	
<b>2.3. RESULTS</b> .....	35	
2.3.1. Descriptive Data .....	35	

2.3.2. ERP – PCA Analysis .....	36
2.3.3. ERP – PCA and Individual Difference Correlations .....	46
2.4. STUDY 1 DISCUSSION .....	47
<b>3. STUDY 2: REFERENTIAL SPECIFICITY .....</b>	<b>55</b>
3.1. INTRODUCTION .....	55
3.2. METHODS .....	62
3.2.1. Participants .....	62
3.2.2. Materials .....	62
3.2.3. Design and Procedure .....	64
3.2.4. Apparatus and ERP Recordings .....	66
3.3. RESULTS .....	67
3.4. STUDY 2 DISCUSSION .....	70
<b>4. SUMMARY AND CONCLUSIONS .....</b>	<b>73</b>
4.1. SUMMARY AND GENERAL DISCUSSION OF STUDY 1 .....	73
4.2. SUMMARY AND GENERAL DISCUSSION OF STUDY 2.....	75
4.3. GENERAL CONCLUSION .....	76
<b>Bibliography .....</b>	<b>79</b>
<b>APPENDIX A. CONSISTENCY STIMULI .....</b>	<b>95</b>
<b>APPENDIX B. REFERENTIAL STIMULI .....</b>	<b>158</b>
<b>APPENDIX C. NELSON-DENNY COMPREHENSION TEST (COVER AND EXAMPLE PAGE) .....</b>	<b>165</b>
<b>APPENDIX D. NELSON-DENNY VOCABULARY TEST (COVER AND EXAMPLE PAGE) .....</b>	<b>167</b>

<b>APPENDIX E. TOWRE EXAMINATION BOOK (CONTAINS WORDS AND NON- WORDS .....</b>	<b>169</b>
<b>APPENDIX F. AUTHOR RECOGNITION TEST .....</b>	<b>173</b>
<b>APPENDIX G. INDIVIDUAL DIFFERENCE CORRELATIONS – STUDY 1 .....</b>	<b>174</b>

## LIST OF TABLES

Table 1. Example text passages from Study 1 .....	28
Table 2. Participant reading ability scores – Study 1 .....	35
Table 3. Reading Measure Correlations, Bivariate and Partial – Study 1 .....	36
Table 4. Example text passages – Study 2 .....	63
Table 5. Stimulus characteristics – Study 2 .....	64
Table 6. All text passages – Study 1 .....	95
Table 7. All text passages – Study 2 .....	158
Table 8. Reading skill by experimental effect correlations – Study 2 .....	174



## LIST OF FIGURES

Figure 1. Figure 3 from Albrecht and O'Brien (1993). The Dashed boxes were added to draw attention to the relevant rows of data .....	17
Figure 2. A visual schematic of the text comprehension paradigm .....	31
Figure 3. A scree plot contrasting variance accounted for by each component against variance accounted for by random data .....	38
Figure 4. Temporal Principal Components – Study 1. in terms of time of peak activity (left column), waveform from electrode at which peak activity was observed (second column from left), and voltage topography at time of peak activity in each condition separately, and together (4 right columns) .....	39
Figure 5. Temporal Factor – F196 .....	41
Figure 6. Temporal Factor – F304 .....	43
Figure 7. A. Temporal Factor – F640 posterior electrodes. B. Temporal Factor – F640 Anterior electrodes .....	45
Figure 8. Figure 1 from Halff, Ortony, and Anderson (1976) .....	57
Figure 9. ERP waveforms averaged over the international 10-20 electrode cluster locations ...	69

## Preface

I'm not short on words, as those know me will quickly tell you. Jeff tells me it's a feature, not a bug. I imagine that is a matter of perspective, like how a Dandelion is a weed, or a salad ingredient...Therefore, feel free to skip this wordy preface. I thank you for tuning in at all.

There has never been a straight line I couldn't crook, nor a short distance I couldn't lengthen. I thank the people mentioned below (and those I've forgotten at the moment) for always pointing out to me when something could be done just a little easier or better another way, but also sticking with me when I insisted on not taking their sage advice.

There are way too many people who are owed a thanks to include here, although Chance and Circumstance are owed perhaps my greatest expression of gratitude. I'm thankful for the unbelievable ride I've been on, and the amazing people I've rode along with.

I'm humbled on a daily basis to have had the luck to learn from, work with, and get to know, Charles Perfetti. There's no perfection in this world. Given that, I couldn't have chosen a better advisor. Chuck has the ultra-rare capability, that cannot be taught as far as I can tell, to get people to work like crazy to make him proud without his needing to SAY or DO much explicitly to motivate this behavior. (This is NOT to say Dr. Perfetti can't kick you in the butt for motivation...)

Within my lab, the Reading and Language Group, and Pitt as a whole, I've had the luck of being surrounded by Brilliance. In the P-Lab, Laura, Suzanne, Ben, Wendy, Lindsay, Xiaoping, Gina, Fan, JM, Kim, Hannah Chris, Paula, and Jen Dandy all taught me something, or otherwise helped me to do better research – thanks! In the RLG, I'm indebted to Chelsea, Alba, Evelyn, Katherine, and Michelle, among others. Outside of these groups, I thank Kyle, Travis A., Travis S., Allison L., Emily B., Ruizhe, Kevin, and all those crazy brains involved in the CNBC.

In terms of Faculty, there are fantastic people at Pitt and in the CNBC. It is pretty hard for me to name one faculty member in LRDC without thinking of another and another. So, if I've left you out of the following list, it's because of my declining memory (as we know, this starts early). Natasha, Tessa, and Julie all talked to me during times of need, related to work, but also related to life. Thank you. Other Faculty from whom I've gained an absurd amount of knowledge include: Moddy, Scott, Tim, Melissa, Ben, Mark, Elizabeth, Kirk, Tim V... As my family and friends know, about 1/3 of the Psychology I know I learned in Walt Schneider's Attention and Perception module (R.I.P.). A handful of others shared those 16 weeks with me, and I never, ever learned at such a rate in my life (I think you could feel new hippocampal neurons developing). Thanks, Walt. To the CNBC faculty who pushed my intellect literally to its limits: Alison, Nathan, Carl, Rob, Carol, Dave, etc. Thanks for your service, as well as your research. Special thanks to Mike Tarr, who, during a guest lecture, said that he stopped taking notes in Grad School so that he'd form his own thoughts and opinions. From that moment I stopped taking notes, other than a scribble here and there in the margins of a paper. That was scary but bumped my mind up a level.

I have a few friends, although they are basically family. Tim Snyder, my Day One. Jeff, the reason I finished. Mikey, my dude, let's take Play all over the place. John Riley: You told me I'd do this, even though a bunch of times I'd swear I wouldn't. Thanks,

When my brother, Dan, was a four or five, he said something like the following to my mother: "I have the best mom in the world. Every kid has the best mom in the world." Dan is still smarter and wiser than I am, even given my head start. (It's a good thing I'm so much better looking.) While young Dan was idealistic, I do have the best family in the world, and because I'm a scientist and don't believe I'm a special case, I think things are a little closer to what my 5-

year-old brother believed than otherwise.

My mom and grandma gave me this empathy, this ability to feel the cacophony of the world's emotions. It can be overwhelming, but it is my most coveted gift. My mom is also the strongest woman I know. My Grandmother, the wisest.

My Dad, even after all these years I've spent around the brilliant minds in academia, is one of the five smartest people I've ever met. To paraphrase Walt Schneider paraphrasing Forest Gump, "Smart is as smart does." My dad also quietly showed me how to be a man, when I took the time to pay attention. Royce Da 5'9" rhymed, "*I'm an unapologetic work-in-progress/product of a hard-working dedicated father with shortcomings/praying all his sons make it farther...*". I can't say anything better than Royce, so I'll leave it at that.

To Penny, I still can't believe you stuck around. You are really one of the most wonderful people I've known. You are so effortlessly kind and tolerant. I hope at time you do realize how special you are, and what a wonderful life you have led to this point. It really isn't what you do, it is how you do it.

My brother, Dan. In many ways you are my breath and my life. I would do anything for you, and I'm always here (whether you choose it, or not). I owe you everything, thank you.

To my wife, Jocelyn. There is no chance I'm writing this without you, none. You make me want to be a better person, and you understand things that baffle me so effortlessly it puts me in awe, again and again. Thanks for letting me share part of your life. I can't imagine how or why I got this lucky, but this is why we call it luck. It avoids our best scientific and commonsensical attempts to pin it down. I learned to go with it with you by my side.

**Dedicated to Dylan, Darger, and the Goose**

## **1. Introduction: language comprehension and word comprehension.**

Language comprehension is important not only in high-level professional performance, but also in navigating the millions of everyday occurrences of *words*. The emphasis points out a foundational skill for successful language comprehension – the comprehension of individual words. This skill consists of rapidly accessing meanings as a function of word form input (orthographic or phonological), context, and the reader’s background knowledge – and incrementally integrating these activated meanings with multiple levels of linguistic representation, both local and global. In previous work (Perfetti & Stafura, 2014; Perfetti, Yang, & Schmalhofer, 2008) this set of processes connecting word meanings to the on-going text or discourse meaning – at the local level - has been referred to as Word-to-Text Integration (WTI). These WTI processes may be more privileged and obligatory, or automatic, than more global comprehension processes. Critical questions remain as to what leads to the functioning of WTI, especially in connected text, as well as to the exact nature of incrementality in comprehension.

To be certain, high-level text and discourse processes and strategies such as inferencing (Cain & Oakhill, 1999; Graesser, Singer, & Trabasso, 1994; van den Broek, 1994), comprehension monitoring (Baker, 1989; Baker & Anderson, 1982; Fischer & Mandel, 1984; Garner, 1987), calibration of comprehension (Glenberg, Sanocki, Epstein, & Morris, 1987), and the establishment of textual coherence (Trabasso, Secco, & Van Den Broek, 1984) are critical factors in skilled comprehension. However, as the strong association between vocabulary and comprehension (Ouellette, 2006) indicates, knowledge of words remains a pressure point in the comprehension systems (Perfetti & Stafura, 2014; Stafura & Perfetti, 2018). Because of this, it is critical to track word processing – and, in particular, word processing *in context* – in order to develop anything like a complete framework of language comprehension. More narrowly,

understanding word processing in context can help us understand the nature of incremental language comprehension.

The overarching aim of this thesis is to examine readers' incremental, on-line reading comprehension, specifically, the connections between the word and propositional levels to higher-level, situation representations (Johnson-Laird, 1981; van Dijk & Kintsch, 1983). The studies use EEG to measure word-by-word neural responses during text reading; similar paradigms have been used to track word-by-word processing across sentences (Yang, Perfetti, & Schmalhofer, 2007; Perfetti, Yang, & Schmalhofer, 2008). **Study 1** tests the ability of words - as the final elements of propositions - to trigger outdated mental representations through discourse meaning overlap. **Study 2** tests the potential effects of contextually-guided referentially semantics.

## 1.1. Background.

**1.1.1. Levels of comprehension.** A language framework that connects the multiple levels of linguistic processing will include mechanisms of Word -to-Text Integration (WTI; Perfetti & Stafura, 2014; Perfetti et al., 2008), the processes by which comprehenders access the contextually relevant meanings of words and integrate these meanings with the on-going representations of text. These mechanisms operate on-line, are potentially automatic, and there are indications that they are less efficacious amongst less skilled comprehenders (Yang, Perfetti, & Schmalhofer, 2005; Stafura & Perfetti, 2014). Understanding these mechanisms, and conditions under which they are delayed, impaired, or non-functional, provides a way toward understanding the precise interactions between the levels of linguistic representation. For example, we can use responses to the meanings of individual words, or phrases, in context, to

draw conclusions about the representation(s) currently active in a comprehender's mind. From this, it is possible to infer the level(s) at which the representation is functioning, and/or the degree of interaction between those different levels. The empirical findings, as well as the theoretical inferences, can then be used for continued refinement of existing comprehension models (McNamara & Magliano, 2009), or for development of new ones.

Cognitive operations carried out over multiple levels of representation have been suggested to underlie language comprehension (Kintsch, 1988; Kintsch & Van Dijk, 1978). One level of representation is the verbatim (or surface) text, i.e., the words and punctuation that make up the text on the page. Memories at this level are short-lasting and limited by the capacity of working memory, and often function on a scale of a sentence or smaller (Jarvella, 1971). A representational level up from this is that of the text base, in which representations are structured assemblies of propositions extracted from the surface text or constructed via inference. The highest representational level is the mental, or situation, model of the text, wherein the comprehenders' background knowledge and elaborative inferences are added to the linguistic representation(s), potentially making the representation increasingly specified. The Reading Systems Framework (Perfetti & Stafura, 2014) in particular, focuses on the lexicon as part of reading comprehension, with word comprehension, or word reading in context, receiving the output of the word identification system, and providing input into the comprehension systems. The Studies in this dissertation both examine the effects of word meanings on reading text.

**1.1.2. Incremental language processing.** A number of critical questions revolve around the nature of incrementality in language processing. What is necessary for incremental processes to occur? What are the cognitive and neural processes involved in the incremental updating of text representations? It is clear that readers are sensitive at the word level to syntactic

manipulations (Boland, Tanenhaus, & Garnsey, 1990; Tyler & Marslen-Wilson, 1977), for example, but what other syntactic or semantic devices elicit such sensitivity? Recent research into WTI has been useful in understanding the nature of incrementality in comprehension, and the necessary conditions for integration to occur. Initial WTI studies suggested that integration processes could be fast and automatic across sentence boundaries, despite the absence of explicit word-form repetition, or pronominal reference (Yang et al., 2007; Stafura & Perfetti, 2015). However, in these studies, critical “paraphrase” words were always able to function as retrieval cues for prior text (e.g., “...the bomb hit the ground and *blew up*. The explosion...). The critical words in the paraphrase texts offered strong cues for previously encoded information, serving as binding sites for that information. This facilitated binding was reflected in reduced N400 ERP responses.

The retrieval cues provided in early WTI research may be necessary for triggering immediate WTI. This results from readers’ default predisposition to begin the construction of a new linguistic structure in cross-sentence text (Structure-Building; Gernsbacher, 2013). Without strong retrieval cues (e.g., via lexical association, pronominal reference, etc.) a reader adaptively defaults to the construction of a new structure – if something isn’t given it must be new. Empirically, Helder and colleagues (Helder, Perfetti, van den Broek, Stafura, & Calloway, In Revision) recently found that WTI processes were delayed until sentence-final words when local-binding opportunities weren’t readily available. Other researchers have found electrophysiological evidence for the memory cost for structure building, in the form of late positive inflections – P600/LPCs- of the ERP waveform during reading (e.g., Burkhardt, 2007; Schumacher & Huang, 2012). Thus, there remain interesting questions about the conditions under which incrementality is functional.



**1.1.3. Memory and prediction in language comprehension.** Recent research has demonstrated the functioning of proactive, or predictive, mechanisms in language processing (Altmann & Kamide, 1989; DeLong, Urbach, & Kutas, 2005; Lau, Almeida, Hines, & Poeppel, 2009; Staub & Clifton, 2006; Wicha, Moreno, & Kutas, 2004). Prediction has been shown to function in a wide-range of language tasks, from the simple (word-by-word semantic probe detection; Lau, Holcomb, & Kuperberg, 2013) to the more complex (discourse comprehension; van Berkum, Brown, Zwisterlood, Koojiman, & Hagoort, 2005).

These empirical demonstrations have been used in support of predictive models of language processing (Federmeier, 2007, Kuperberg, 2007; Levy, 2008). The more formal of these are probabilistic frameworks in which the comprehension systems base their predictions on on-going interactions between language input, language experience (on the part of the comprehender), and other available sources of knowledge and context (for an overview, see Kuperberg & Jaeger, 2016).

However, this proactive, “predictive agent” (Clark, 2013) view must be reconciled with the retrospective semantic and memory processes necessary for the coherent and cohesive understanding of the connected sentences, paragraphs, and pages that make up natural reading. The experiments in this thesis aim to provide a better understanding of the ways in which comprehenders utilize rapid memory-based processes during on-line reading, and thus inform the nature of incremental processing beyond prediction. The studies draw on a Reading Systems Framework (Perfetti & Stafura, 2014), in which the access and integration of word meanings both depends upon and influences processing at multiple levels of representation (Kintsch, 1988; Kintsch & van Dijk, 1978). A newly-enriched understanding of the cognitive and neurophysiological processes underlying lexical-semantic retrospective processing is critical for

understanding incremental language processing at multiple levels of text and discourse comprehension.

Word-to-text integration processes act in concert to activate semantic information, integrate this new information with existing information in active memory (and with certain structures in long term memory; Ericsson & Kintsch, 1995), and to check the representation of this linked-information against veridical world knowledge (Cook & O'Brien, 2014). The role of memorial mechanisms in text and discourse processing has been discussed extensively (for a review see McKoon & Ratcliff, 1998). Largely because they can account for incremental language processing, fast-acting, potentially automatic (McKoon & Racliff, 1986; O'Brien, Rizzella, Albrecht, & Halleran, 1998; Ratcliff, 1978) memory processes became a dominant feature of accounts of language processing (Kintsch, 1988; Kintsch, Welsch, Schmalhofer, & Zimny, 1990; McKoon & Ratcliff, 1992; O'Brien & Albrecht, 1992), with some suggesting a minimal role of on-line, predictive processes (McKoon & Ratcliff, 1992).

**1.1.4. Electrophysiology of word-to-text integration.** The studies in this Dissertation take advantage of several features of electrophysiological measurements as indices of the neuro-cognitive processing of text: the fine-temporal precision, the sensitivity to real-time neural responses, and the ability to simultaneously detect multiple, qualitatively different responses to stimuli. The use of electroencephalography (EEG) thus affords the ability to locate the earliest possible time-point at which processing differs between two conditions, establish connections between relatively well-understood circuit-level neurophysiology and cognition, and index distinct processes like phonology and semantics.

Beginning in the early 1980's, researchers began probing the ways in which the electrophysiology of language processing was sensitive to linguistic manipulations, including the

semantic congruence of words in context (Kutas & Hillyard, 1980; Kutas & Federmeier, 2011), and the syntactic legality of words in context (Kutas & Hillyard, 1983; Osterhout & Hagoort, 1992). Previous investigations into cross-sentence, WTI processes have revealed rapid, on-line integration of words that are good referential fits to events described in a previous sentence (Yang et al., 2007). Extensions of this original WTI study provided evidence that these integrative processes are not sensitive to word-to-word association strength (Stafura & Perfetti, 2014), but that they are sensitive to the dominant association direction between co-referential terms (Stafura, Rickles, & Perfetti, 2015). Additionally, there is some evidence that the incrementality in word-to-text integration is privileged at the local level, with higher, discourse-level factors such as structural centrality (Van den Broek, Helder, & Van Leijenhurst, 2013) only exerting an effect at text-final words (Helder, Perfetti, van den Broek, Stafura, & Calloway, In Revision; Helder, Stafura, van den Broek, & Perfetti, 2015)

## **1.2. Aims: Connecting Words and Texts.**

These studies provide several novel tests of the incrementality of language processing, and the nature of interactions between multiple levels of mental representation. Study 1 provides a test of WTI processes in the presence of long-distance discourse inconsistencies. Additionally, Study 1 provides a test of whether and how causal information is used during on-line reading. Study 2 tests how referential WTI effects are relative to more pure, lexical-semantic processes, by manipulating the encoding of critical concepts. Each experiment is aimed at furthering our understanding of WTI and moving this general paradigm of research to the text and discourse level.

The experiments in this Dissertation may provide novel information regarding the neural-temporal dynamics of on-line text processing. The experiments provide examinations of on-line reading comprehension, in which the meaning individuals words – reflecting local messages – can be used to explore the connections between psycholinguistic levels. These connections include: those between words that are or are not consistent with long-distance semantic information (Study 1), those between words and multiple sources of consistent or inconsistent information (Study 1), and those between referential and lexical representations (Study 2).

In summary, this Dissertation tests the nature of on-line WTI processes during on-line reading. Two key innovations are afforded by the use of EEG to study on-line comprehension of text and discourse; 1) WTI can be examined word-by-word, over very long distances, and 2) the potential impact of referential-specification on WTI, apart from that of lexical-semantics, can be explored word-by-word across sentence boundaries. The use of EEG is important not only for the ability to track word-by-word processes, a feature shared with eye-movement research, but also for its connection to real-time neural dynamics. Although the spatial resolution of EEG is coarse relative to other neural imaging technologies like MRI, it is a true measure of neural activity. This potentially provides a ground truth to cognitive processing and can potentially be used to constrain the types and number of cognitive operations occurring during an action, even within the time-frame of a single fixation. Thus, EEG is a complementary method to eye-tracking.

**1.2.1. Study 1: Passage Consistency. Hypothesis 1** is that single words that are the final elements of propositions are effective retrieval cues for long distance inconsistent information. Experiment 1 provides a test of this hypothesis. Because the critical information in these passages is related to a protagonist’s goals, actions, or beliefs, it is potentially the case that word-

level ERP differences would provide evidence of an interaction between readers' situation models (which contain protagonist-relevant information; Zwaan & Radvansky, 1998) and the incremental processing of propositions triggered by a single word.

Past research has demonstrated that “outdated” discourse information (information no longer in active memory) can nevertheless influence later comprehension processes (Albrecht & O'Brien, 1993; O'Brien & Albrecht, 1992). Although there is evidence from a handful of eye-tracking studies that comprehenders are sensitive to inconsistent information at the first point possible (Cook & Myers, 2004; Garrod & Terras, 2001; Rayner, Chace, Slattery, & Ashby, 2006), these studies differ in materials and results; so more work is necessary to clarify when, and through which mechanisms these comprehension processes operate. In Experiment 1, I use EEG methodologies to test the influence of the discourse inconsistencies during on-line reading. Findings of word-level responses can provide intriguing evidence of the on-line connection of propositional-level meaning and higher levels of meaning representations across large stretches of text.

An additional Causal Elaboration condition within Experiment 1 allows for a test of the ability of short, one-sentence causal elaborations to suppress the effects of discourse inconsistencies on on-line comprehension. The use of event-related potentials (ERPs) may provide novel insights into this paradigm, because causal-elaboration sentences have been shown to reduce inconsistency effects on reading times, even though more recall tasks revealed that this “outdated” information remained easily re-activated (Kendeou, Smith, & O'Brien, 2013).

**Hypothesis 2** rest on the assumption that single-sentence causal elaborations elicit text model updates, and states that semantic processing conflicts in Causal texts will be reduced relative to Inconsistent texts, but 2) incur increased memory costs relative to Consistent texts.

**1.2.2. Study 2: Referential Specificity.** In a second ERP experiment, I test the ability of referentially-specified representations, in contrast to pure lexical-semantic representations, to influence WTI across sentence boundaries. Many studies have explored the effects of polysemy – words with multiple related meanings – on word processing (for overviews see Burgess & Simpson, 1988; Degani & Tokowicz, 2010; Eddington & Tokowicz, 2015; Simpson, 1981). However, less is known about contextual influences on encoding or retrieval of different features of the same meaning (or sense). For example, an <apple> has (among others) features of shape, color, and taste, and a <piano> has the features of being a musical instrument, having keys, and being heavy. Research has suggested that words meanings are constructed from distributed semantic representations (Goldberg, Perfetti, & Schneider, 2006; Fernandino et al., 2015) that in part reproduce the modality-specific processes involved during initial encoding. Therefore, context may not only influence the specific meaning of a word that is retrieved, but also which particular features within a given sense of a word are particularly salient, or pre-activated. This feature activation may spread to other words within a clause or sentence, impacting their accessibility and integrability. Offline behavioral evidence of the influence of context on the encoding and interpretation of word meanings has existed at least 40 years (Anderson & Ortony, 1975; Half, Ortony, & Anderson, 1976). Recent on-line evidence comes from ERP experiments that demonstrate that simple contexts can influence the particular meaning features and event structures activated word-by-word (Amsel, DeLong, & Kutas, 2015). This leads to the assumption that a single sentence is sufficient to lead to a particularized encoding of events and entities (e.g., objects), and our **Hypothesis 3** that words that refer to features of these entities are processed differently depending on that encoding. This will provide a test of the how lexically-specific the

local WTI effects observed in several studies are (e.g., Stafura & Perfetti, 2014; Yang, Perfetti, & Schmalhofer, 2007).

Study 2 offers a novel test of the nature and flexibility of semantic processing and ambiguity, by examining ERP responses to words related to semantic features that are made more or less salient by prior context. There is some ERP evidence that context can pre-activate specific words, resulting in mis-match responses when those expectations are broken (Van Berkum et al., 2005; Wicha, Moreno, & Kutas, 2004; for opposing evidence *against* pre-activation of specific words, see Nieuwland et al., 2017). This semantic pre-activation can facilitate the processing of otherwise anomalous words that are semantically-related to the context (e.g., Federmeier & Kutas, 1999). However, to my knowledge, Study 2 of this dissertation is the first to examine words (e.g., modifiers) related to referentially-specific contextual information.

Evidence from work on semantic illusions has provided mixed evidence for the contextual modulation of on-line processing of semantic anomalies. For example, Sanford and colleagues (Sanford et al., 2010) found that only illusions that were detected by participants (as indicated explicitly after each trial) elicited greater N400 responses than non-illusory (and thus congruous) sentences. An example illusion is as follows:

Child abuse cases are being reported much more frequently these days. In a recent trial, a 10-year *sentence/care order* was given to the **victim**, but this was subsequently appealed.

In this example, the first sentence sets up the context of child abuse, which is followed either by an anomalous sentence in which the victim was given a 10-year sentence, or a non-

anomalous sentence in which the victim is placed in care. The authors note that the materials containing hard-to-detect anomalies differed from the other conditions in that they contained a large number of lexical-semantic associates. For example, In the Child Abuse case, “child abuse”, “case”, “trial” and “sentence” are all highly associated, which may cause similar meaning words to “fit” at a semantic level. This, and other reasons (e.g., passive voice in some materials) make the findings of the Sanford et al. study, although intriguing, potentially difficult to generalize.

In a study with findings somewhat at odds with those of Sanford et al.’s (2010), Amsel and colleagues (Amsel, DeLong, & Kutas, 2015) found that anomalous words that shared sensory-motor information with expected words elicited smaller N400 responses than anomalous, unrelated words. This suggests that certain aspects of a text (e.g., descriptions of a Protagonist or Event) can incrementally specify semantic referents, which can influence processing of up-coming words. The materials in Experiment 2 were created to focus on a specific perceptuo-motor aspect of a critical entity in the second sentence of two-sentence texts. Consistent with Amsel et al, we believe that the first sentences can provide sufficient semantic information to activate functional referential information, which will influence the more global semantic mental model of the situation, impacting on-going word processing. An incremental hypothesis predicts reduced N400 responses to critical words in the Feature Consistent condition relative to critical words in the Feature Inconsistent condition, even though words in both conditions are meaningful and non-anomalous. However, if a shallow processing hypothesis is true (Sanford et al., 2010), no difference between critical words is expected.



## 2. Study 1: Passage Inconsistency.

### 2.1. Introduction.

In Study 1 I examine the on-line semantic and memorial processes elicited by long-distance conflicting information in texts. Specifically, I use event-related potentials (ERPs) to monitor word-by-word comprehension of texts that either contain or do not contain conflicting information about protagonists. The inconsistencies are separated by multiple text and discourse boundaries (sentences, discourse focus changes), and thus are unlikely to co-exist in active memory. Additionally, the inconsistencies are located at words at the end of clauses or sentences. Thus, findings of differential ERP responses upon encountering inconsistent lexical-semantic information will suggest that word meanings – as the closing element of propositions - can act as strong retrieval cues for long-distance text inconsistencies. This would, in turn, be supportive of a version of WTI in text that is more broadly incremental than WTI processes linked to local binding operations. Given the substantial temporal and linguistic distance between discrepancies in these texts, the finding would also suggest immediate interactions between the surface text (word meanings), the text base (propositional structure), and the message (situations and events) level. **Hypothesis 1** is that the meaning of single words and the propositions that contain them are effective, on-line retrieval cues for long distance inconsistent information.

An additional condition within Experiment 1 tests the ability of short, one-sentence causal elaborations to suppress effects of discourse inconsistencies on comprehension processing. The use of event-related potentials (ERPs) may provide novel insights into this paradigm, because causal-elaboration sentences have been shown to remove inconsistency effects on reading times (Kendeou, Smith, & O'Brien, 2013). The ability for ERPs to yield

multiple measurements from a single word allows for tests of multiple cognitive processes. Additionally, ERPs allow for real-time neural measures during passive reading, outside of performing additional tasks (e.g., visual search and object processing in visual world paradigms). This is useful for researchers interested in the connections between reading per se and neural processing. **Hypothesis 2**, which rests on the assumption that single-sentence causal elaborations elicit text model updates, is that semantic processing conflicts in Causal texts will be reduced relative to Inconsistent texts, but that Causal texts will incur increased memory costs relative to Consistent texts.

Beginning in earnest in the 1980s, several lines of research focused on the reading of discourse inconsistencies (Albrecht & O'Brien, 1993; Johnson & Seifert, 1999; O'Brien & Myers, 1985; O'Brien, Rizzella, Albrecht, & Halleran, 1998; Zwaan & Madden, 2004). This research informed our understanding of both *how we read* inconsistencies, and *what we remember* from the texts that contain them. O'Brien and colleagues (Myers & O'Brien, 1998, O'Brien et al., 1998) have done the most work in this area, providing the foundation for the "inconsistency paradigm" (Kendeou, Smith, & O'Brien, 2013).

In an exemplary study using this paradigm, Albrecht and O'Brien (1993) had participants read text scenarios that did or did not contain global text inconsistencies revolving around protagonist characteristics. For example, following Introductions (Intro),

(Intro) Bill had always enjoyed walking in the early morning and this morning was no exception. During his walks, he would stop to talk with some of his neighbors.

Readers then read either a Consistent (C) text continuation, which was consistent with target sentences encountered later:

(C) Bill had just celebrated his twenty-fifth birthday. He felt he was in top condition and he worked hard to maintain it. In fact, he began doing additional workouts before and after his walks. He could now complete a 3-mile run with hardly any effort.

Or, they read an Inconsistent (I) text continuation:

(I) Bill had just celebrated his eighty-first birthday. He didn't feel as strong as he was twenty years ago. In fact, Bill began using a cane as he hobbled along on his morning walks. He could not walk around the block without taking numerous breaks.

In each scenario, the Consistent or Inconsistent continuation was followed by several sentences of backgrounding text, following by several sentences continuing the present scenario. In our example with "Bill", he stops to chat with a neighbor, and witnesses a young child laying in the street, seemingly hurt. The target (T) sentences were either a good fit, following the Consistent continuation, or a poor fit, following the Inconsistent continuation.

(T) He quickly ran and picked the boy up. Bill carried the boy over to the curb.

In Experiment 1, Albrecht and O'Brien (1993) compared sentence reading times between texts containing Consistent continuations, Inconsistent continuations, and Neutral<sup>1</sup> continuations. For both of the target sentences, reading times were longer for Inconsistent texts than either Consistent or Neutral texts. There were no differences between target sentence reading times for Consistent relative to Neutral texts. The results suggested that, although the inconsistent information was not in active memory, due to backgrounding devices and the length of the text, readers slowed when they encountered sentences that contained discourse-inconsistent information. This inconsistency effect on reading times has been replicated and extended in many experiments (Albrecht & Myers, 1995; O'Brien et al., 1998; O'Brien, Cook, & Gueraud, 2010).

In their Experiment 2, Albrecht and O'Brien (1993) explored the memorial consequences of encountering inconsistent information. To do so, they broke the different sections of the text into "idea units" (e.g., Trabasso & Sperry, 1985), and tested recall of these units after participants read the texts; Figure 1 replicates their Figure 3, with the addition of dash-outlined boxes to draw attention to relevant effects.

First, overall recall was highest for Inconsistent texts, consistent with previous research suggesting that encountering moderate difficulties in texts elicited increased processing and reprocessing of material, leading to greater memory for texts with difficulties in them (O'Brien & Myers, 1985). More interesting is the loci of the greatest effects: recall for the *continuation* (Elaboration) and the *first target sentence* (Critical sentence 1) was greatest for the Inconsistent

---

<sup>1</sup> The Neutral conditions in these various studies were aimed at validating certain aspects of the Consistent conditions, for example, and are less relevant to this Dissertation. For this reason, not much is said regarding the specific Neutral texts.

texts relative to both Consistent texts and Neutral texts. This suggests memory re-processing was focused specifically on the conflict in the text.

**Table 3**  
*Mean Proportion of Idea Units Recalled as a Function of Passage Condition and Location in the Passage in Experiment 2*

Location in the passage	Passage condition		
	Consistent	Inconsistent	Neutral
Introduction	.266	.288	.300
Elaboration	.318	.352	.289
Filler information	.287	.307	.288
Critical sentence 1	.678	.774	.622
Critical sentence 2	.344	.326	.363
Close	.287	.280	.271
Total proportion recall	.307	.328	.300
Proportion of passages showing recall	.930	.948	.944

Figure 1. Figure 3 from Trabasso and Sperry (1985). The Dashed boxes were added to draw attention to the relevant rows of data.

Greater memory for information in the continuation section of inconsistent texts, despite the fact that the conflicting information was backgrounded, provides a starting point for a “resonance” theory of memory for text (Myers & O’Brien, 1998). This resonance theory shares with other memory-based text processing theories (e.g., McKoon, Gerrig, & Greene, 1996) the assumption that contents in active memory can contact all of long term memory through conceptual/propositional overlap (Kintsch, 1988; Kintsch & van Dijk, 1978), or pattern matching mechanisms (Sanford, 1990). In terms of the greater recall of information from the out-dated continuation sections in Inconsistent texts, information from the conflicting target sentence (in

terms of preceding text) *resonates* with overlapping information in the continuation sentences. This passive resonance can lead to re-processing of this conflicting information, making it stronger through depth of processing, multiple encodings, as well as the formation of a greater amount of recall cues.

Most research in the inconsistency paradigm has used off-line measures of comprehension, such as recall, or relatively coarse on-line measures, such as sentence-reading times. An early exception is Garrod and Terras (2001), who examined the role that lexical and contextual influence had on early and late eye-movements during reading. In this study, participants read short passages: the first sentences provided general context and were followed by sentences that contained a critical verb and role-selecting context. Examples of these critical sentences are 1) and 2):

1) She was busy *writing* a letter of complaint to a parent.

2) She was busy *writing* an exercise on the chalkboard by the door.

The third sentence in each passage included an anaphoric reference to the verb (“writing”) that had either a dominant or subordinate role-filler relation to that verb. In 3), this anaphor is “pen”:

3) However, she was disturbed by a loud scream from the back of the class and the *pen* dropped on the floor.

The verb "writing" in 1) leads to a dominant verb-role pair in 3), whereas "writing" in context 2) leads to a subordinate verb-role pair. Eye-movement measures were taken from the region of the critical noun, and included early first-pass measures, and later-occurring second-pass measures.

For dominant passages, first pass reading times were longer for targets following inappropriate contexts than appropriate contexts. In second pass reading times, the authors found the same "context effect" occurred for subordinate role fillers. Thus, readers were fairly immediately disrupted by discourse-level characteristics of the text. It should be noted that the critical sentences were immediately successive, which is a distinction from most "inconsistency" materials.

Cook and Myers' (2004) carried out an eye-tracking study with materials taken directly from previous inconsistency paradigm work. In this study, participants read short passages that included protagonists in different roles, some appropriate for a given script, some inappropriate for that script. An example of an "Inappropriate" text intro (I) is:

(I) The rock band is becoming more and more popular. The band was still new on the  
rock scene,

Following the introduction, a reader either encountered a Neutral (N) continuation:

(N) and they weren't used to the adoring fans and all of the attention from the media.

Or, a Justifying (J) continuation:

(J) so some of the band members had to handle publicity and finances in addition to performing.

Following the continuations, all readers encountered the same conclusion (C):

(C) A contract was signed by the band's **guitarist** *who had arranged* a six-record deal. The band had been getting lots of calls recently, and they were having a very hard time figuring out how to handle their new success.

Cook and Myers focused on eye-tracking measures at the target region (in **bold**), and post-target region (in *italics*), finding equivocal results. Regarding the target region, there were no significant main effects in first pass measures, although there was a significant post-hoc simple contrast between Neutral and Justifying conditions in second pass reading times. There were no effects seen in regressions into the target region. In the post-target region, there was a marginal main effect such that first-pass reading times were longer for Inconsistent texts than Consistent texts, but this did not differ depending on whether the continuation was Neutral or Justifying. Although the second pass differences between the Neutral and Justifying conditions provided the first on-line, word-level evidence of the impact of inconsistency, the relatively weak nature of the results, in general, suggest a need for more on-line studies.

Most recently, Rayner et al. (2006) wrote an article that discussed the relatively paucity of eye-tracking (or word-by-word) studies into discourse comprehension. To this point, the authors described two empirical eye-tracking experiments, the second of which tested the effect of discourse inconsistency and text distance between the inconsistent text. The authors embedded



critical sentences into longer passages, such that the sentences of interest were consecutive ("near"), ~50 words apart ("intermediate"), or ~125 words apart (far). Eye movement measures were taken from critical words (and surrounding regions) that were either consistent or inconsistent with the antecedent sentence.

First, readers took longer to read (across several measures) inconsistent words relative to consistent words. This effect was true across all text distances. This indicates that readers were aware of inconsistencies, as they read them. The authors also looked at regressions, where in the "near" condition, they found that readers were more likely to regress in the inconsistent passages relative to consistent passages. However, this pattern was not seen in response "intermediate" and "far" passages. In these conditions, processing difficulties were seen on anaphors in both consistent and inconsistent conditions.

Thus, there is some on-line evidence that readers notice discourse inconsistencies immediately. However, this literature is limited and lacks input from measures more tightly connected to neural processing. Electrophysiology not only affords us word-by-word measures like eye-tracking, but because it is measure of real-time neural activity, not all of which is observable.

There are also a number of item and participant factors that may interact with comprehension of inconsistent texts. For example, the inconsistency effect is diminished by increasing the amount of intervening backgrounding material (e.g., O'Brien, 1987). In a study directly relevant to this Dissertation, Kendeou et al. (2013) added single-sentence *causal* justifications to their inconsistent texts to explore their potential to suppress inconsistency effects in terms of sentence reading times (Experiment 1) and in response times to verification probes related to the inconsistent information (Experiment 2).

For example, in a text I adapted for this Dissertation (the “Vegetarian” passage in Table 1), a woman is described as being a vegetarian and health fanatic in the Inconsistent continuation. The target sentences describe her ordering a cheeseburger, and lead to greater reading times in the Inconsistent condition relative to the Consistent condition, in which she is not a vegetarian. However, these reading time differences went away with the addition of a single, causal justification sentence (e.g., *She wasn’t getting enough vitamins because of her diet so her doctor said she had to start eating meat*).

The causal nature of the intervening material seems to be important for suppressing the inconsistency effect. For example, simply adding more intervening material (e.g. O’Brien et al., 2008), or providing a simple refutation of the inconsistent information (e.g. Rapp & Kendeou 2007; 2009), is not always enough to eliminate comprehension difficulties. Causality’s impact is likely a function of the critical role it plays in linking important structural information in text (Trabasso & van den Broek, 1985, Trabasso & Suh, 1993).

Interestingly, in Kendeou et al.’s (2013) Experiment 2, reader response latencies were measured to verification sentences presented either after the background “filler” sentences or after the target sentences. The verification statements were all written to contain information in the outdated characteristic, as well as to be true in the updated situation (e.g., “Mary used to not eat meat at all”). Probes were responded to more quickly following the target sentences relative to the background sentences. This result suggests that out-dated information that has no measurable impact in sentence reading times nevertheless remained readily available in memory, easily triggered by strong cues. These findings are consistent with the idea that multiple mental models are constructed by readers based on text and discourse characteristics, and that the processing and representation of these models is influenced and constrained by a highly

interactive mix of top-down contextual influences and bottom-up linguistic input (Cook & Myers, 2004; Ferguson, Scheepers, & Sanford, 2010).

There are also some reader characteristics that have been associated with differences in the comprehension of discourse inconsistencies, although the pattern of results is not entirely clear. For example, although less skilled comprehenders respond to local (e.g., sentence-level) inconsistencies like more skilled comprehenders, they are less sensitive than skilled readers to global (discourse-level) inconsistencies. Specifically, less skilled readers produce reading time increases only for short-distance inconsistencies; for the kinds of discourse inconsistencies focused on here, less skilled readers show no processing disruption (Long & Chong, 2001; O'Brien, Personal Communication). For this reason, in Study 1 we collected a number of reading-related measures that were quick to administer given the length of the reading sessions. These were included primarily as exploratory variables.

In recent WTI research, some of the limitations to incrementality within the comprehension systems have begun to be uncovered. For example, Helder and colleagues (Helder, Perfetti, van den Broek, Stafura, & Calloway, In Revision; Helder, Stafura, van den Broek, & Perfetti, 2015) found that that the incrementality in WTI across a sentence boundary is privileged at the local level, with higher, discourse-level factors such as structural centrality (Van den Broek, Helder, & Van Leijenhorst, 2013) only exerting an effect at text-final words.

In Helder et al.'s (In Revision) study, participants read passages from one of three conditions, two with central themes, and one baseline passage. In one example, Central Theme One (CT1) was *weather*:

(CT1) Cathy likes to check the weather all the time on her iPhone. She is always very excited when stormy weather is predicted. While Cathy was riding her bike in the park, dark clouds began to gather, and it started to *storm*. The **rain** ruined her beautiful **sweater**.

Central Theme Two (CT2 was *clothes*):

(CT2) Cathy loves clothes and bought herself a new wardrobe. She is getting ready to go outside and decides to wear her new outfit today. She noticed that a lot of people were looking at her clothes while it started to *storm*. The **rain** ruined her beautiful **sweater**.

And, the Baseline (B):

(B) Cathy lives close to a park. She likes to be there as much as she can during the summer. When Cathy saw there were no dark clouds in the sky, she took her bike for a ride in the park. The **rain** that was predicted never occurred.

Event-related potential measurements taken on critical (**bolded**) words allowed local (CT1 & CT2 vs B) and global (CT1 vs CT2 final words) tests of WTI processes. First, WTI processes seemed to be privileged in contexts in which the critical word could act as a local retrieval cue (i.e., binding location) for short-distance, cross-sentence related words (“*storm*” in the example here). This was indexed by reduced N400 responses to critical words in the Central Theme vs Baseline contrasts at “rain”. However, the central theme had no additional effect at this point, as “rain” elicited similar N400 responses in both the Weather and Clothing contexts.

Only at the text final word “sweater” was the effect the of structural centrality observed. Text-final words that were related to the central theme elicited smaller positivities than words that were unrelated to the central theme, suggested additional memory operations were needed to update the reader’s text model at that point. Similar late positivities have been attributed to updating of discourse models (Schumacher, 2007), suggesting a delay on at least some WTI processes.

To summarize, this study explores the potential for words that are the last element in propositions to act as retrieval cues for distant text inconsistencies on-line. Participants read text passages in each of 3 conditions - Consistent, Inconsistent, and Causal - while EEG is recorded from the scalp. The Inconsistent condition differs from the Consistent condition due to discourse inconsistencies that are potentially detectable at the propositional-level, as indexed by a word. Additionally, the Causal condition differs from the Inconsistent condition by the addition of a single-sentence *causal* justification for the inconsistency.

**Hypothesis 1** is that the meanings of single words that are the final words in a proposition are effective retrieval cues for long distance inconsistent information. There are multiple mechanisms that may be functional in this process. Inconsistent words may elicit a larger P300 response than consistent words due to an updating of the contents of active memory (Donchin & Coles, 1988; Polich, 2007), or updating of conceptual memory (Keenan & Jennings, 1995; Yang et al., 2007). The P300 may also reflect the passive resonance assumed to be a general memory mechanism that is functional during comprehension (Myers & O’Brien, 1998). More controlled, elaborative memory operations, that can selectively improve memory of text related to the inconsistent material (O’Brien & Myers, 1985), may be detectable in the P600 and/or Late Positive Complex responses (LPC).

Finally, according to a strong theory of incrementality, critical words in the Inconsistent condition should be more difficult to process semantically, thereby eliciting greater N400 responses relative to critical words in the Consistent condition. This is because the semantic information in the Consistent elaboration matches the lexical-semantics of the critical word in this condition, easing semantic activation and/or integration (Kutas & Federmeier, 2011; Kutas & Hillyard, 1980). An alternative view may be implied by recent WTI research that has found the cross-sentence N400 only when local binding opportunities were present (Helder et al., In Revision). Local binding would not be involved across the text distances in this study's materials, and thus no N400 differences may be observed.

**Hypothesis 2** is that semantic processing conflicts in Causal texts will be reduced relative to Inconsistent texts, and that Causal texts will incur increased memory costs relative to Consistent texts. A strong incremental hypothesis predicts reduced N400 responses to critical words in the Consistent condition relative to the Inconsistent condition. This is expected to result from the information entered into the readers' representations of the situations in the Consistent condition, which facilitates lexical-semantic processing of critical words (Kutas & Federmeier, 2011). However, given that the causal explanation adds relevant information to the discourse context, which in turns needs to be updated, it is expected that a greater P600/LPC will be elicited by words in the Causal condition, relative to critical words in Consistent condition. For critical words in the Inconsistent texts, I expect similar P600/LPC as seen in the Causal texts, as both conditions require extended memory processing relative to Consistent conditions.

The findings from Study 1 will inform our knowledge of the time-course of inconsistency processing during on-line reading; specifically, when is this inconsistency available to the comprehension systems, and what mechanisms does it act upon? The ERP measures allow us to

connect moment-by-moment neurophysiological markers to a well-studied cognitive-behavioral phenomenon. Viewed cognitively, the results will inform our understanding of the level of incrementality seen during interactions between linguistic levels.

## 2.2. Methods.

**2.2.1. Participants.** 36 participants were recruited from the University of Pittsburgh undergraduate student pool. This is a pool of voluntary student research hours made available as part of the Introductory Psychology course. All participants were right-handed, native English speakers with normal or correct-to-normal vision, without any history of head injury or epilepsy, and between the ages of 18 and 35 years old (Mean= 19.2; SD=1.7). Participants received course credit for their participation in the study, and all procedures were performed with permission from the University of Pittsburgh Institutional Review Board.

**2.2.2. Materials.** We created 90 text scenarios, each consisting of 3 conditions: Consistent, Inconsistent, and Causal Elaboration (from now on referred to as Causal). Our materials include adaptations of around 30 passages provided to us by the lab of Edward O'Brien (e.g., Albrecht & O'Brien, 1993; Kendeou et al, 2013; Personal Correspondence). Three primary changes were made to the O'Brien materials and guided the creation of 60 additional passages: 1) We shortened the passages (~6-8 sentences removed from each passage), 2) the passages were edited such that the out-dated inconsistencies are detectable at sentence- or clause-final. single, critical words (i.e., words that were the last element of propositions), and 3) the critical words are all followed by punctuation of some kind, such as periods at the end of sentences, and commas at the end of a clause. An additional set of 10 filler texts were included to help reduce strategic

effects arising from the majority of texts having an inconsistency. Example passages are shown in Table 1. (Full collection of passages is found in Appendix A).

Table 1. Example text passages from Study 1.

Condition	“Skydiving” Passage	“Vegetarian” Passage
Introduction	Carol had always wanted to be a construction worker. It was hard getting started but she found this job two years ago. It was exciting for her and she couldn’t have been happier.	Today, Mary was meeting an old friend for lunch. She arrived early at the restaurant and decided to get a table. After she sat down, she started looking at the menu.
A. Consistent	Carol enjoyed looking over the city from such soaring heights and was thrilled by the view of the river south of her town. She felt exhilarated watching the activity on the street far below.	This was Mary’s favorite restaurant because it had fantastic junk food. Mary enjoyed anything that was quick and easy to fix. She never worried about her diet and saw no reason for nutritious foods.
B. Inconsistent	Carol was extremely scared of heights and would only work on the ground level. While the others worked on the upper levels she worked on projects where she could stay safely on the ground.	This was Mary’s favorite restaurant because it had fantastic health food. Mary has been a strict vegetarian for years. She was serious about her diet and didn’t eat anything fried or cooked in grease.
C. Causal Justification	Because this was disrupting her life, her therapist suggested she try to do excited activities involving heights.	However, she wasn’t getting enough vitamins, so her doctor said she had to start eating meat.
Filler Sentences	Carol always ate lunch with her fellow workers. They were a friendly group of people. One of her co-workers, Lori, invited Carol to join her on a trip.	After about ten minutes, Mary’s friend arrived. They had a lot to talk about. After chatting for a moment, Mary signaled the waiter to come over to the table.
Target Sentence(s)	She now really wanted to go <b>skydiving</b> ; it sounded like an activity she would love.	Mary decided to order a <b>cheeseburger</b> , and handed the menu back to the waiter.

Note: Any given reader of a passage saw the Introduction, Filler, and Target text. Experimental Conditions on the reading of A. in the Consistent condition, B. in the Inconsistent condition, and B. + C. in the Causal condition. Complete list of items is available in Appendix A.



Passages in all conditions started with 3-4 sentences of *introduction*, followed by one of three *continuations* that contained the experimental manipulation, then by 3 *filler* sentences that backgrounded the information in the continuation, and finally 1-2 *target* sentences. The *critical word* for the ERP recording was always the last word in the first phrase, clause, or sentence of the Target sentence(s). This was intended to suppress sentence/clausal wrap-up effects (Just & Carpenter, 1980; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989).

The *continuation* portion of each passage included the experimental manipulation that yielded three conditions (corresponding to A., B., or B. + C in Table 1.). The Consistent condition has an elaboration that is consistent with information in the target sentence(s). For example, in the “Skydiving” Passage in Table 1., the Consistent continuation includes information about a protagonist, Carol, who enjoys heights; this information is consistent when Carol goes skydiving later in the passage. The Inconsistent condition has an elaboration that is inconsistent with target information: using our example Passage, Carol is described as afraid of heights in the elaboration, which is inconsistent with skydiving. Lastly, the Causal elaboration has the same framing as the Inconsistent condition but is followed by a single-sentence causal elaboration that provides a causal justification for a change in protagonist behavior or mind-state. In our example, Carol’s fear of heights is limiting her life, so her therapist suggests a change in behavior. Given this Causal continuation, then, Carol going skydiving is at least not completely illogical.

The Consistent passages (Mean # of words = 104.68, Standard Deviation (SD) = 10.5) did not differ on average in the number of words per passage compared to the Inconsistent passages (Mean # of words = 104.63; SD = 10.5),  $t(89) < 1$ ,  $p = .874$ . This was expected, as these conditions could only differ from the critical word onward, which was at most a single sentence.

Because the Causal passages (Mean # of words = 123.86; SD = 10.5) were created by appended a sentence to the Inconsistent passages, passages in the Causal conditions were reliably longer than those in the Inconsistent condition,  $t(89) = 58.611$ ,  $p < .001$ , and those in the Consistent condition,  $t(89) = 49.857$ ,  $p < .001$ .

The passages were broken into sets of three, by the first, second, and last third of the passages, and each participant was randomly assigned to one of the three lists. Participants only saw one passage per condition. This way, although no one participant was exposed to all stimuli in all conditions, across all conditions each passage was seen a roughly equivalent amount of time.

**2.2.3. Design and Procedure.** At the beginning of each of the two experimental sessions, participants were fitted with an electroencephalogram (EEG) net and seated in a sound-attenuated, electrically insulated booth. Participants were seated in an adjustable chair approximately 60 cm from the center of a 15-in (38.1 cm) CRT display. In both sessions, the text comprehension task occurred first, as this was our primary interest and we wanted to minimize fatigue. After the text comprehension task, participants were taken out of the booth, had the net removed from their head, and were given a short break. Then, in the first session, participants completed computerized versions of the Nelson-Denny Comprehension and Vocabulary tasks. In the second session, participants completed the Test of Word Reading Efficiency (TOWRE) and the O-span task.

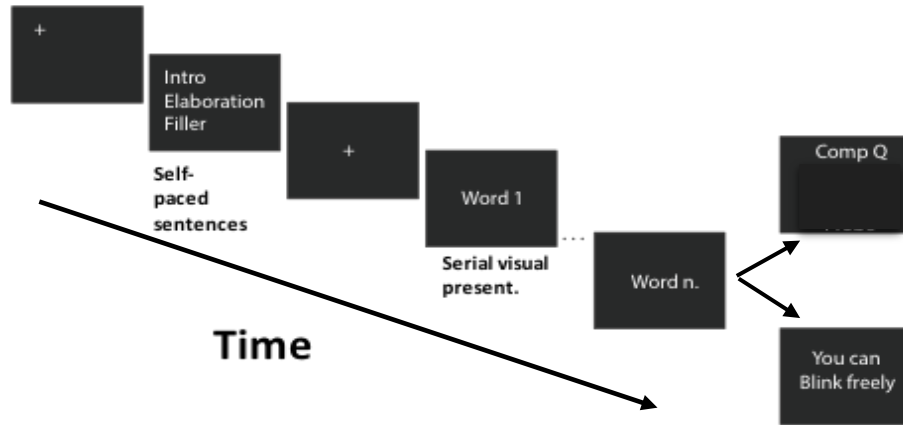


Figure 2. A visual schematic of the text comprehension paradigm.

During the text comprehension task, participants reads text passages for comprehension (see Figure 2.). The passages were presented one sentence at a time, with the participants controlling the pace at which they moved to the next screen, until the last Filler sentence (Table 1.). Beginning with the last Filler Sentence, and continuing through the end of the passage, the sentences were presented one word at the time in the center of a computer screen for a duration of 300 ms with an inter-stimulus interval (ISI) of 300 ms (i.e., stimulus-onset asynchronies (SOAs) of 600 ms). The ISI at the end of the sentences was increased to 600 ms to account for sentence wrap-up effects (Just & Carpenter, 1980; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989). The texts were preceded by a fixation cross (+) to orient the participants. Additionally, a second fixation cross preceded the last Filler sentence, to cue participants to focus their eyes at the center of the screen and not move the for the remainder of the trial. A true-false comprehension question based on the meaning of the passage followed 50% of the trials on a random basis. For each list, half of the questions required a ‘true’ response, and half required a ‘false’ response, with responses registered using a response box. The comprehension questions were used to ensure that participants read for comprehension, and immediate feedback was

displayed on the screen (“Wrong” in red for incorrect responses and “Good Job” in blue for correct responses). Two practice texts preceded the experimental trials. Participants read half of the experimental passages (n=45) in each session, along with an additional 8 consistent filler passages in the first session, and 7 consistent Filler passages in the second session. These 15 filler passages were of the same format as the experiment Consistent passages and were included to create more of a balance of consistency among all the passages. Limitations on participant fatigue and stimuli creation prevented us from using a full 30 Filler items.

In the first session, after the text comprehension task, participants completed the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 2012) and the Nelson-Denny vocabulary and comprehension tests (Nelson & Denny, 1973). Participants completed these tasks in a quiet room, set off of the main ERP room. First, the TOWRE was administered, and was audio recorded for offline scoring. The TOWRE consists of two tests of verbal fluency and decoding. In the word reading efficiency subtest participants were asked to orally read as many words as they could in 45 s from a sheet of paper consisting of 4 columns of words of increasing length and complexity (number of items = 104). In the non-word decoding subtest participants were asked to orally decode as many non-words as they could in 45 s from a sheet of paper consisting of three columns of non-words increasing in length and complexity (number of items = 63).

After the TOWRE, computerized versions of the Nelson-Denny vocabulary and comprehension tests were administered. Other than the change in viewing medium the tests were administered exactly the same as a paper version (e.g., they were time, readers could advance back and forth from passages to questions). The Nelson-Denny comprehension test features 6 text passages followed by comprehension questions (total number of questions = 36), and

participants were asked to complete as many questions as they could in 15 minutes. The Nelson-Denny vocabulary test has 100 questions that assess vocabulary knowledge, and participants were asked to complete as many questions as they could in 7.5 minutes.

In the second session, after the text comprehension task, participants completed the Author Recognition Test (ART; Stanovich & West, 1989) and an O-span task (Daneman, & Carpenter, 1980; Unsworth, Heitz, Schrock, & Engle, 2005), both tasks being computerized. The Author Recognition Test features a screen with 80 names on it, and participants were asked to click on the names of individuals that they knew to be writers. This was an untimed task, but generally takes less than 5 minutes. Then, participants completed an O-span task, in which they completed sets of trials in which they were asked to answer to the truth value of mathematical equations, followed by a screen with word on it for 5 seconds. After a certain number of trials, from 2-6, participants were asked to recall as many of the words they had seen in the previous set of trials in the order they were presented. Participants first completed 3 practice trials, followed by the experimental trials, which were composed of a randomized sequence of 2-6 equation-word-trial sets (2 each). After all tasks in the second session, participants were thanked for the participation and debriefed as to the purpose of the study, and its potential relevance to basic and educational science.

**2.2.4. Apparatus and ERP Recordings.** During the experimental session, participants wore a 128 electrode Geodesic sensor net (Tucker, 1993) with Ag/AgCl electrodes (Electrical Geodesics, Inc., Eugene, OR). During recording, all impedances were kept below 50k $\Omega$ , an acceptable level with this system (Ferree, Luu, Russell, & Tucker, 2001). A vertex reference was used during the recording. Six eye channels were monitored to allow for rejection of ocular artifacts. The EEG signals were digitally sampled at a rate of 1000 Hz, and hardware filtered

during recording between 0.1 and 200 Hz. After recording, the recorded EEG was run through a 30 Hz low-pass finite impulse response filter. The data were then segmented from 200 ms before to 800ms after the onset of the critical words (1000 ms segments). Next, channels were automatically removed from the datasets if they had activity of  $\pm 200 \mu\text{V}$ , using an 80ms moving average, on more than 20% of trials. Additionally, segments were removed on the basis of four separate criteria: containing more than 12 channels that were marked using the previous noisy channel thresholding step, containing blinks revealed by voltage fluctuations of  $\pm 140 \mu\text{V}$  at superior and inferior eye channels (excepting for the right superior eye channel removed during ocular artifact detection), or containing horizontal eye movements (e.g., saccades) revealed by voltage fluctuations of  $\pm 55 \mu\text{V}$  at the left outer canthi electrode. Finally, individual datasets were manually checked for additional noisy channels that may have been missed by the automatic algorithms.

The data for 5 participants were removed due to amplifier malfunction. The data for 6 participants were removed due to more than 10 trials per condition being marked bad (through the methods above). For the remaining 25 participants, an average of 8 electrodes were removed. The remaining trials for the different conditions in both tasks were not unbalanced. Removed channels were replaced by the data from neighboring channels using spherical spline interpolation (Ferree, 2006). The cleaned data were re-referenced to the average of the channels. The data were then averaged within participants for each condition. Following subtraction of the mean amplitude of the baseline period (200 ms pre-stimulus), the data were exported to EP Toolkit v2.66 (Dien, 2010) for PCA analysis, or to SPSS 23.0 for statistical analyses.

All computerized experimental tasks were programmed and carried out on E-Prime software v2.0.8 (Psychology Software Tools, Inc., Pittsburgh, PA). E-Prime also sent event

information to the EGI NetStation EEG recording system. Instructions and the computerized trials (i.e., text comprehension and meaning judgments) were presented on a 15-in. (38.1-cm) CRT display with a 60 Hz refresh rate.

## 2.3 Results

**2.3.1 Descriptive Data.** Table 2 displays the average scores and variability on a number of off-line reading tasks. Mean Comprehension, Vocabulary, and ART scores were within one standard deviation of the mean of 6328 participants in the Pittsburgh Adult Reading Database. Mean scores on the Word Reading (106.9) and Decoding (102.5) sub-tests of the TOWRE were within the average range of these standardized tests. Data from the O-Span task was lost due to disk failure, so no scores are listed.

Table 2. Participant reading ability scores – Study 1.

Reading Measure	Average Score (Mean (SD))
Word Reading <sup>1</sup>	105.6 (9)
Non-Word Decoding	102.6 (8)
Comprehension <sup>2</sup>	22.67 (5.6)
Vocabulary	63.72 (13.9)
Author Recognition <sup>3</sup>	1.50 (.5)

Note. <sup>1</sup>The Word Reading and Non-Word Decoding averages (SDs) are the Standardized scores calculated for the respective TOWRE sub-scale. <sup>2</sup>The Comprehension and Vocabulary averages are calculated using the raw number of items correct on the respective Nelson-Denny test. <sup>3</sup>D prime was used to calculate scores on the Author Recognition test, in order to account for individual bias and guessing.

The full and partial correlations among the reading related tasks are shown in Table 3.

The scores show the expected patterns of shared variance among reading-related measures.

Table 3. Reading Measure Correlations, Bivariate and Partial – Study 1

	Comprehension	Vocabulary	Word Reading	Non-Word Decoding	Author Recognition
Comprehension		.589* (.002)	.503* (.012)	.064 (.766)	.378~ (.075)
Vocabulary	.476* (.034)		.307 (.135)	.394~ (.051)	.538** (.007)
Word Reading	.404~ (.077)	-.011 (.964)		.202 (.332)	.187 (.381)
Non-Word Decoding	-.233 (.322)	.496* (.026)	.228 (.334)		-.025 (.908)
Author Recognition	.015 (.949)	.509* (.022)	.011 (.962)	-.314 (.178)	

Note. Correlations are presented as Pearson  $r$  correlations ( $p$ -value). ~ Marginally significant at the  $p < .1$ . \*Significant at the  $p < .05$  level. \*\* Significant at the  $p < .01$  level.

To put some of this sample’s skill levels into perspective, they can be compared to those in the larger population in the Pittsburgh Adult Reading Database. In the Database, Comprehension and Vocabulary are significantly, moderately correlated ( $r = .517, p < .001$ ), similar to that in this Study’s sample. There is a significant population correlation between Vocabulary and Author Recognition ( $r = .533, p < .001$ ), also similar to that in this Study’s sample. The correlation between Comprehension and Vocabulary was moderate and marginally significant ( $r = .378, p = .075$ ), and was numerically similar to the significant correlation in the larger population ( $r = .372, p < .001$ ). Overall, the Study sample appears quite similar to the larger Database in the correlational structure of reading related measures.<sup>2</sup>

**2.3.2 ERP-PCA Analysis.** In the text comprehension task, accuracy on the comprehension questions was above 90% across conditions, indicating that participants were attending to the text during the passive reading task. Therefore, all trials are included in subsequent analysis. A Principal Component Analysis approach was taken to the EEG data, in

<sup>2</sup> TOWRE Sight Word Reading and Decoding tests are not administered as part of the computerized battery of tests in the assessment.



which theoretical underpinnings of ERP components are combined with the algorithmic factor analysis in PCA. This approach has been used successfully by this author before (Stafura, Perfetti, & Rickles, 2015) as a means of constraining the exploration of novel datasets with expectations from the literature.

The temporal PCA used a Promax rotation (Hendrickson & White, 1964) and the covariance matrix; the rotation parameter was set to the default of 3, and Kaiser weighting (Kaiser, 1958) was used<sup>3</sup>. A scree plot contrasting variance accounted for by each component against variance accounted for by random data suggested retention of 9 principal components (Horn, 1965; Figure 3.). These components accounted for 95% of the variance of the ERP data. Four components were dropped for purposes of further testing the effect of experimental conditions: a factor that peaked in the baseline period (-192ms), an early (140ms) factor that accounted for little variance in the data (< 1%), a factor that captured that P100 visual component for both the critical word and the following word (104ms), and a factor that started and peaked during the subsequent word (784ms).

---

<sup>3</sup> Using an oblique rotation and Kaiser Normalization allows for a relaxation of the orthogonality constraint on principal components. This means that components are allowed to share some variance, which is more biologically-plausible. This process has been subjected to testing on simulated and real data (Dien, Beal, & Berg, 2005).

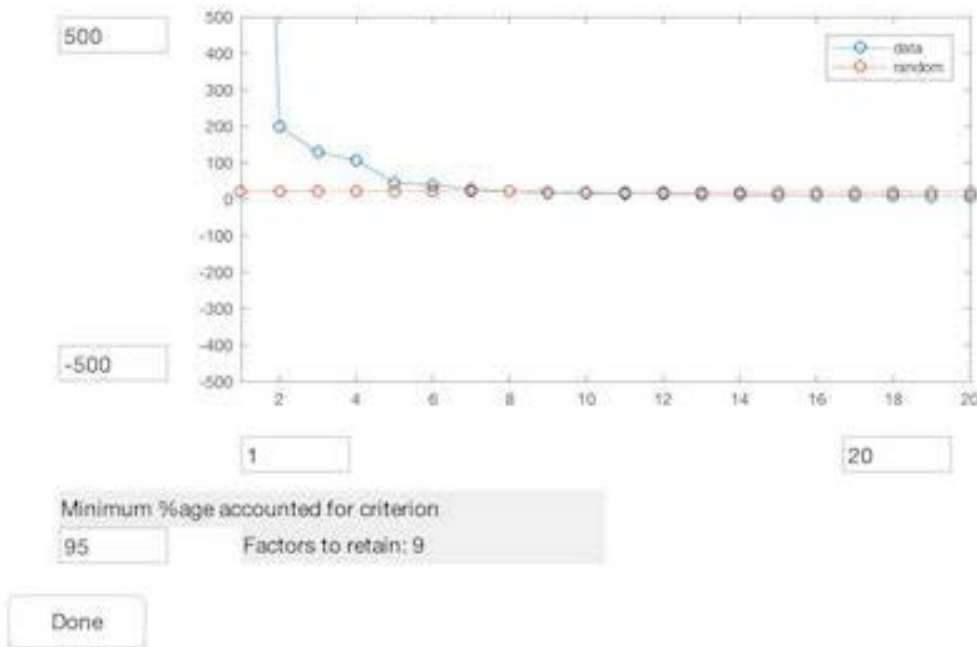


Figure 3. A scree plot contrasting variance accounted for by each component against variance accounted for by random data. Screenshot from EP Toolkit, V. 2.66 (Dien, 2010).

The remaining 5 principal components reflected co-varied voltage shifts that often correspond to conventional ERP components defined by latency and polarity. We refer to the PCA components by using “F” for Factor, followed by the time in milliseconds of peak activity. These include the F196, F304, F392, F496, and F640; these PCA factors captured variance associated with the conventional N170/P2, P300, N400, P600, and LPC ERP components, respectively (Figure 4).

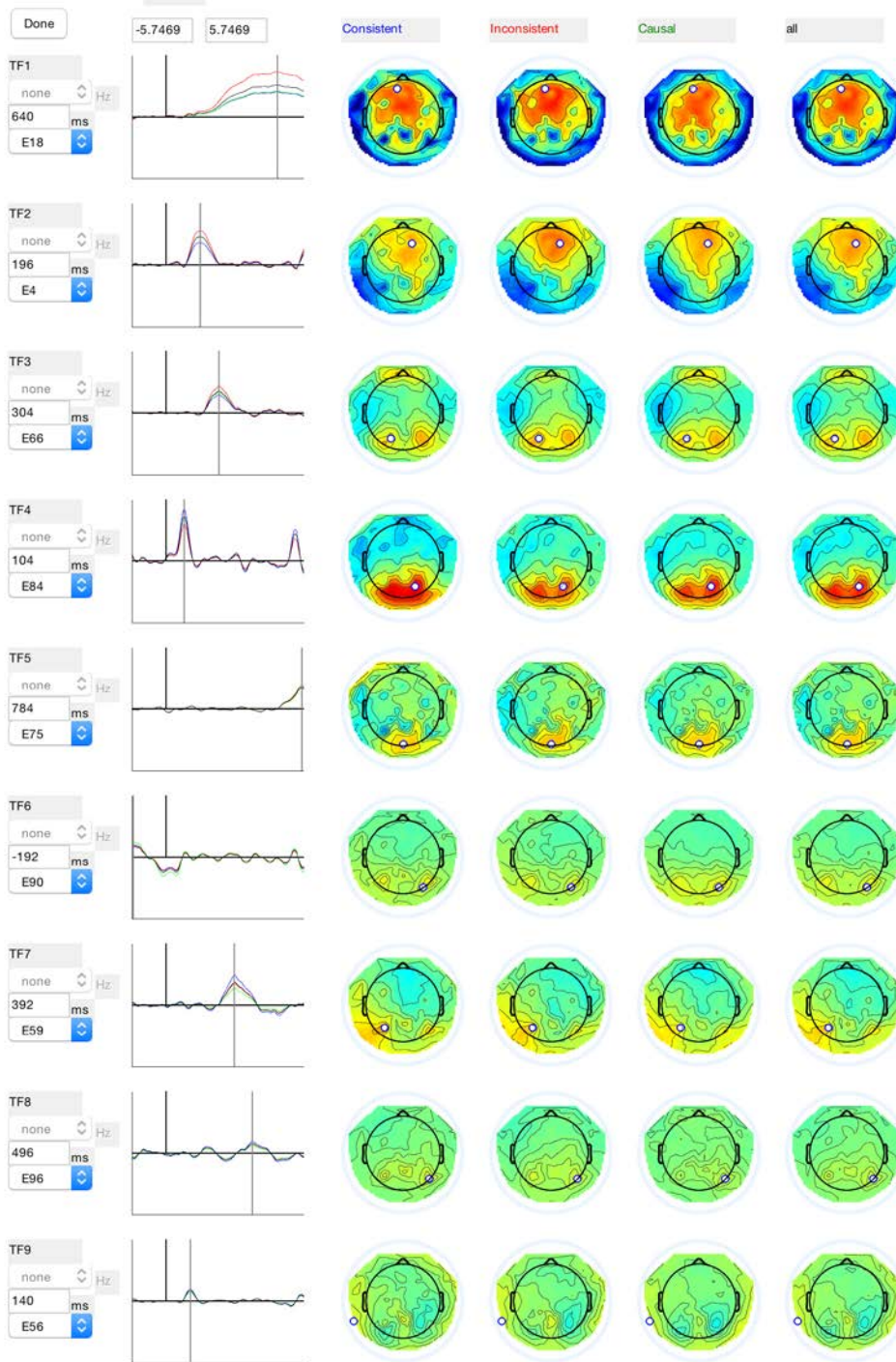


Figure 4. Temporal Principal Components – Study 1. in terms of time of peak activity (left column), waveform from electrode at which peak activity was observed (second column from left), and voltage topography at time of peak activity in each condition separately, and together (4 right columns).

For each factor, we examined the factor weightings at electrode clusters at which traditional effects are found, using a window centered on the time of peak activity, which reduces the likelihood of spurious findings resulting from fast transient voltage shifts. For all principal components, one or more repeated-measures ANOVA were carried out with Condition as the within-subjects factor. For principal components corresponding to relatively localized effects, i.e., F196, F304, and F496., one repeated-measures ANOVA was carried out over clusters of electrodes with Condition as the within-subject factor. For principal components corresponding to spatially-distributed effects, two repeated-measures ANOVAs were carried out, one for mid-line electrode clusters and one for lateral clusters. This procedure is adapted from a “columnar” procedure used in other ERP research in text and discourse (e.g., Kuperberg, Paczynski, & Ditman, 2011; Kuperberg, Kreher, Sitnikova, Caplan, & Holcomb, 2007), as well as in previous WTI research (Yang, Perfetti, Schmalhofer, 2007). Post-hoc contrasts were Bonferroni corrected. The results are reported below in temporal order.

*F196.* This factor appears to capture both activity associated with the N170 component, maximal over bi-lateral posterior electrodes, and the P2 component, maximal over frontal electrodes. Although, these components reflect identification processes early in the reading stream and were not expected to be influence by the experimental manipulation, this factor was the second principal factor (2.9% unique variance) and therefore was examined.

Two separate ANOVAs were carried out. For posterior (N170) analysis, a 3 X 2 repeated-measures ANOVA was carried out on the mean factor scores over the 150-200ms time window with Condition (Consistent, Inconsistent, Causal) and Cluster (O1 & O2) as within-subject factors. Main effect of Condition:  $F(2,48) = 2.888, p = .082, \eta_p^2 = .107$ . Main effect of

Cluster:  $F(2,24) = 25.589, p < .001, \eta_p^2 = .516$ . Condition X Cluster interaction:  $F(2,48) = .027, p = .968, \eta_p^2 = .052$ . The marginal effect of Condition reflects the relatively greater negativity for Inconsistent trials relative to Consistent trials, with Causal averages in between (Figure 5)

For the anterior (P2) analysis, a one-way repeated measures ANOVA was carried out on the factor scores between 175ms-225ms over a frontal-central electrode cluster (Figure 5.). There was a significant effect of Condition at this site,  $F(2,48) = 4.107, p = .030, \eta_p^2 = .146$ , reflecting a greater positivity in response to Inconsistent trials relative to Consistent trials ( $p = .012$ ), with Causal in between, but not significantly different than either Inconsistent ( $p = .181$ ) or Consistent trials ( $p = .105$ ).

## Temporal Factor: Peak Latency 196 ms – P2

Blue = Consistent; Red = Inconsistent; Green = Causal

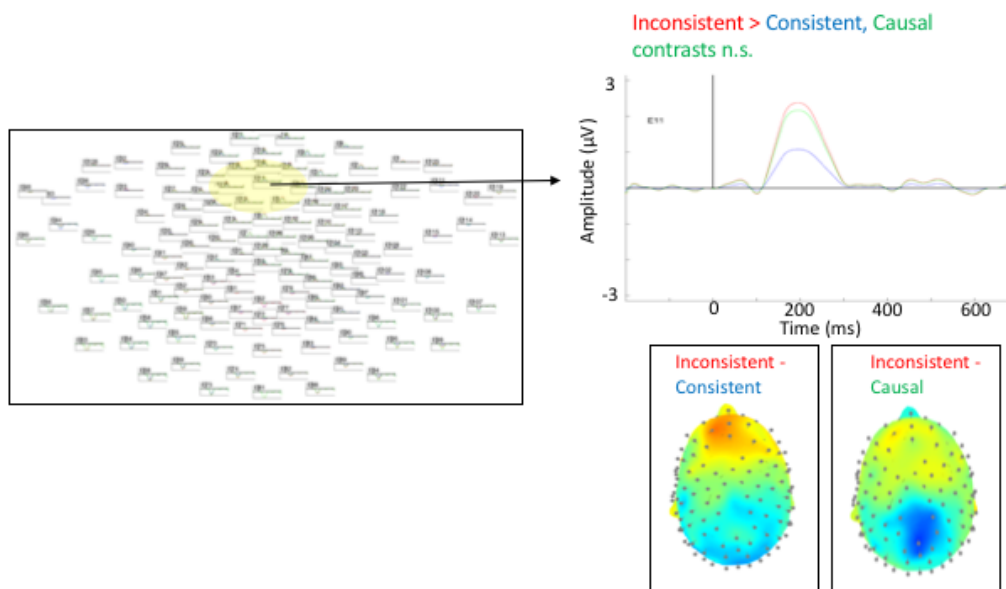


Figure 5. Temporal Factor – F196.

*F304*. This factor appears to correspond to the processes correlated with the P300 component and is maximal over central-parietal clusters. For this factor, a 3 X 3 repeated-measures ANOVA was carried out on the mean factor scores over the 250-350ms time window with Condition (Consistent, Inconsistent, Causal) and Cluster (Pz, P3, P4) as within-subject factors. Main effect of Condition:  $F(2,48) = 1.846, p = .172, \eta_p^2 = .071$ . Main effect of Cluster;  $F(2,48) = 2.017, p = .145, \eta_p^2 = .078$ . Condition X Cluster interaction:  $F(4, 96) = 1.671, p = .187, \eta_p^2 = .065$ .

Because this factor was directly related to one of the hypotheses, as well as the fact that visual analysis of waveforms indicated a potential central-parietal effect, follow up contrasts between conditions over the Pz cluster were conducted. Of these contrasts, only Consistent vs Inconsistent reached uncorrected significance ( $p = .008$ ); neither Consistent vs Causal ( $p = .115$ ) nor Inconsistent vs Causal ( $p = .892$ ) reached significance. Over this site, Inconsistent trials evoked a greater positivity than Consistent trials, with Causal trials in between (Figure 6.). Although this is a relatively modest effect, it is consistent with the P2 findings of greater positivities evoked by Inconsistent relative to Consistent texts early after exposure to the critical words. Additionally, for both factors the Causal condition falls somewhere in between the others, numerically more positive than Consistent trials, and numerically less positive than the Inconsistent trials.

## Temporal Factor: Peak Latency 304 ms – P300

Blue = Consistent; Red = Inconsistent; Green = Causal

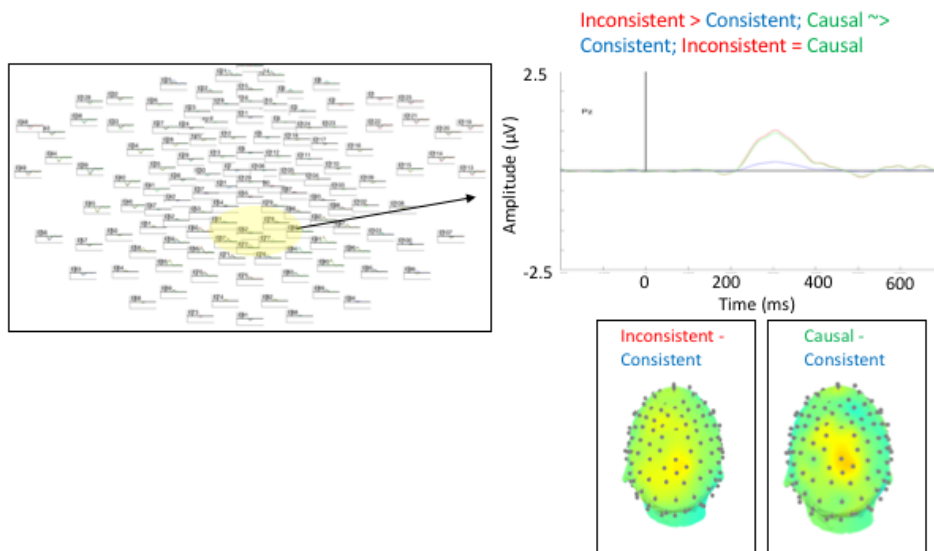


Figure 6. Temporal Factor – F304.

*F392*. This factor appears to correspond to the N400 ERP component. 2 ANOVAs were carried out on the average factor scores between 250ms-450ms: one 3 x 3 midline ANOVA with Condition (Consistent, Inconsistent, Causal) and Cluster (Fz, Cz, Pz) as within-factors. There was no main effect of Condition,  $F(2,48) = .068, p = .926$ , nor a Condition X Cluster interaction,  $F(4,96) = 1.191, p = .317$ .

A second 3 X 3 X 2 ANOVA was carried out with Condition (Consistent, Inconsistent, Causal), Anteriority (Frontal, Central, Posterior), and Laterality (Left, Right) as within-subject factors. The main effect of Condition was not significant,  $F(2,48) = .067, p = .934$ . Additionally, no interactions involving Conditions were significant: Condition X Anteriority,  $F(4,96) = 1.338, p = .272$ , Condition X Laterality,  $F(2,48) = 1.725, p = .192$ , Condition X Anteriority X Laterality,  $F(4,96) = .764, p = .501$ . There appears to be no difference among Conditions

reflected in this factor, which captured voltage shifts in the time-range and polarity of typical semantic (N400) ERP effects.

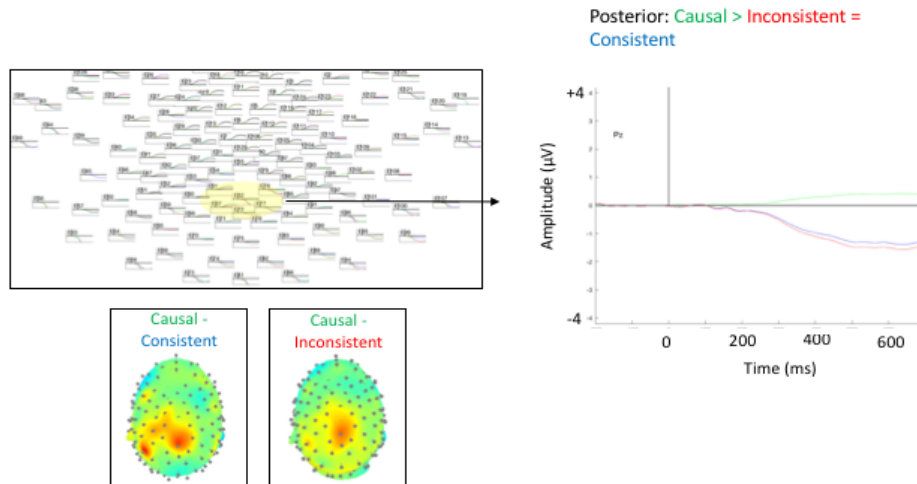
*F496.* This late peaking factor accounted for little variance in the data (< 1%), but had timing and topography consistent with a posterior P600 effect. For this factor, a 3 X 3 repeated-measures ANOVA was carried out on the mean factor scores over the 450-600ms time window with Condition (Consistent, Inconsistent, Causal) and Cluster (Pz, P3, P4) as within-subject factors. The Main effect of Condition was not significant:  $F(2, 48) = .492, p = .578, \eta_p^2 = .118$ . Nor was the Main effect of Cluster;  $F(2, 48) = 2.346, p = .108, \eta_p^2 = .448$ , or the Condition X Cluster interaction:  $F(4, 96) = .267, p = .874, \eta_p^2 = .011$ . There appears to be no difference between Conditions reflected in this factor.

*F640.* This factor appears to correspond to the LPC ERP component. Two ANOVAs were carried out on the average factor scores between 550ms-700ms: one 3 x 3 midline ANOVA with Condition (Consistent, Inconsistent, Causal) and Cluster (Fz, Cz, Pz) as within-factors. The Main effect of Condition was significant,  $F(2,48) = 3.533, p = .043, \eta_p^2 = .128$ . The Condition X Electrode interaction was marginally significant,  $F(4,96) = 2.557, p = .087, \eta_p^2 = .096$ . These results reflect the greater positivity elicited by Causal trials relative to Consistent and Inconsistent trials over posterior scalp locations, while over frontal Electrodes, Inconsistent trials elicited more positive responses (Figure 7.).



# Temporal Factor: Peak Latency 640 ms – LPC

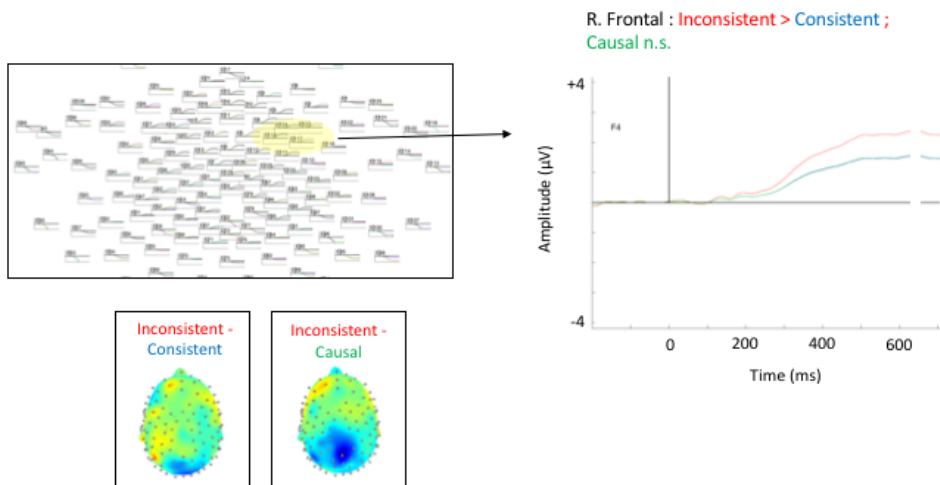
Blue = Consistent; Red = Inconsistent; Green = Causal



A.

# Temporal Factor: Peak Latency 640 ms – LPC

Blue = Consistent; Red = Inconsistent; Green = Causal



B.

Figure 7. A. Temporal Factor – F640 posterior electrodes. B. Temporal Factor – F640 Anterior electrodes.

A second 3 X 3 X 2 ANOVA was carried out with Condition (Consistent, Inconsistent, Causal), Anteriority (Frontal, Central, Posterior), and Laterality (Left, Right) as within-subject factors. The Main effect of Condition was not significant,  $F(2,48) = .862, p = .429$ . The Condition X Anteriority interaction was significant,  $F(4,96) = 3.802, p = .016, \eta_p^2 = .137$ . The Condition X Laterality interaction was not significant,  $F(2,48) = 2.057, p = .304$ . Finally, there was a significant Condition X Anteriority X Laterality interaction,  $F(4,96) = 5.486, p = .003, \eta_p^2 = .186$ . Although there was no main effect of Condition in this analysis, the interaction, along with the previous midline ANOVA, points to this picture: A greater positivity elicited by Causal texts compared to Consistent and Inconsistent texts over parietal scalp (esp. left parietal), with a potentially greater response to Inconsistent trials over right frontal scalp areas. This Inconsistency effect may be a continuation of the earlier (P2) positivity captured by a separate factor.

**2.3.3 PCA and Individual Difference Correlation Analysis.** A correlation analysis was performed on the PCA condition effects and the off-line reading measures to explore potential skill-reading interactions in this paradigm. There were only two marginally significant correlations (full matrix in Appendix H.).

First, there was a marginal positive correlation between Vocabulary and the difference between the Causal and Consistent conditions during the factor interpreted as reflecting the P300 ( $r = .343, p = .094$ ). This effect reflects the fact that as vocabulary increased, the causal condition elicited increasingly larger positivities than the Consistent condition over central-parietal electrodes.

A second, marginal correlation was that between non-word decoding and the late right-frontal differences between Inconsistent and Consistent conditions ( $r = .336, p = .100$ ). The positive direction of this relationship reflects that fact that as decoding skills increased, the Inconsistent condition elicited increasingly larger late-frontal positivities relative to the Consistent condition.

#### 2.4. Discussion.

In this study, I examined the potential effects of out-dated discourse-level inconsistencies on on-line processing at the word level. **Hypothesis 1** was that the meaning of single words, and the propositions they close, are effective retrieval cues for long distance inconsistent information. Hypothesized mechanisms included increased attentional or active memory “resonance” processes (Myers & O’Brien, 1998), indexed by a larger P300 (Donchin & Coles, 1988) in inconsistent texts relative to consistent texts. Additionally, I hypothesized that inconsistent words may lead to controlled memory retrieval and analysis related to the earlier conflicting “episode”, which could be reflected in late positivities that are greater in the inconsistent condition than in the consistent condition. Finally, because the inconsistencies are lexical-semantic, I hypothesized a potential impact on on-line semantic processing, reflected in more negative N400 responses (Kutas & Federmeier, 2011) to the Inconsistent texts relative to the Consistent texts.

The second aim of Study 1 was to examine the potential for causal justifications to suppress inconsistency effects during reading. **Hypothesis 2** rested on the assumption that single-sentence causal elaborations elicit text model updates and stated that semantic processing conflicts in Causal texts would be reduced relative to Inconsistent texts, but that Causal text would incur increased memory costs relative to Consistent texts. The Causal justifications were

hypothesized to result in reduced N400 responses to critical words in the Causal condition relative to the Inconsistent condition. However, given that the causal explanation adds new information to the discourse, it was expected that a greater P600/LPC would be elicited by words in Causal texts, relative to critical words in Consistent texts. For critical words in the Inconsistent texts, we expect similar P600/LPC responses as seen in the Causal texts, as both conditions require extended memory processing relative to Consistent conditions.

Regarding the effects of discourse inconsistencies on processes elicited by single words during reading, the ERP-PCA analysis revealed relatively consistent support for **Hypotheses 1**. The predictions and results did diverge some along the *types* of processes elicited by the target words. Temporal Factors were found that distinguished Consistent texts from Inconsistent texts during times and at locations that are suggestive of high level attention/feature analysis (F196/P2), active memory (F304/P300), and long-term memory and/or episodic memory (F640/LPC). In each case, Inconsistent texts elicited greater positivities than Consistent texts, suggestive of a greater amount of processing required in the Inconsistent condition. Notably, individual words were able to elicit these responses. Although these effects were consistent with predictions, we saw no distinction, at the word level, between lexical-semantic processing in response to critical words in the Inconsistent and Consistent conditions (F392/N400).

The earliest effect we saw was an unanticipated one, occurring around 200ms after reading of the critical word, with a mid-frontal locus (Figure 5.). Critical words in the Inconsistent condition elicited a greater frontal positivity than critical words in the Consistent condition. Critical words in the Causal condition elicited positivities that were in between, but not significantly different from, the other two conditions. The location and timing of this effect are suggestive of a P2 component, which has been found in studies of visual attention,

employing visual search paradigms (Luck & Hillyard, 1994). Taken as a replicable effect, it is possible that the critical words in the inconsistent texts triggered early high-level attention processes directed towards feature analysis, perhaps emanating from frontal regions in control of conflict monitoring (e.g., Anterior Cingulate Cortex: Botvinick, Cohen, & Carter 2004; Van Veen & Carter, 2002). This would be the first moment readers “notice” something isn’t right with a text, whether or not they are conscious of it, and begin to increase attention to the meaning of the stimuli. Although, this is somewhat early for a semantic effect, it is not novel to the literature. Semantic differences have been seen in several language-related ERP studies (Kiefer, Sim, Herrnberger, Grothe, & Hoenig, 2008; Moseley, Pulvermuller, & Shtyrov, 2013; Pulvermuller, Lutzenberger, & Preissl, 1999). For example, enhanced P2 responses have been found for subsequently recalled words in a memory paradigm (Dunn, Dunn, Languis, & Andrews, 1998), and for repeated words relative to non-repeated words during on-line reading of text (Van Petten et al., 1991).

A central-parietal effect emerged 300ms after the onset of the critical word, in which Inconsistent words elicited greater positivities than Consistent words (Figure 6.). This effect was relatively circumscribed, with the effect being observed only over the Pz cluster of electrodes. Nevertheless, the P300 component was a response of interest, having been interpreted as reflecting the updating of active memory (Donchin, 1981; Donchin & Coles, 1988), as well as the updating of conceptual memory (Keenan & Jennings, 1995; Yang et al., 2007). Given that the inconsistent texts contained words that conflicted with the contents of active memory, it is feasible that this effect is an indicator of resonance processes that link contents of active memory with relevant information in long term memory (LTM), including the memory of the inconsistent text. Additionally, the causal texts elicited greater P300 responses than consistent texts. This

marginally reliable effect is consistent with out-dated information being readily available given an appropriate and strong retrieval cue.

Condition effects also appeared in a late positivity. The factor, peaking around 650ms, was greater for the Inconsistent texts than the Consistent texts (Figure 7.)<sup>4</sup>. The locus of this effect was frontal, where positivities have been associated with controlled memory operations (Frishkoff, Tucker, Davey, & Scherg, 2014; Thornhill & Van Petten, 2012). Although it is impossible to say without testing memory recall explicitly, this late positivity may be the ERP correlate of the additional reading time reported in previous inconsistency studies (e.g., Albrecht & O'Brien, 1993; O'Brien et al., 1998). If so, this may involve memory retrieval operations focused on the critical regions of the text (Albrecht & O'Brien, 1993).

The word-level locus of the inconsistency led to the prediction of greater lexical-semantic processing difficulty for the Inconsistent texts relative to Consistent texts, as indexed by N400 responses. A Temporal Factor taken to correspond to the N400 showed no difference between the Inconsistent and the Consistent conditions. Potentially, the lack of local binding opportunities in the materials is the reason for the lack of differences across conditions: i.e., no condition had any more or less binding propensity at the critical word than any other, so no N400 differences were seen. Additionally, although discourse level effects have been shown previously at the first word possible (e.g., Van Berkum et al., 2005), slightly different paradigms have revealed that discourse-level effects are somewhat delayed relative to local effects and carry over to subsequent words (Cook & Myers, 2004; O'Brien & Myers, 1985), or to text-final words (Helder et al., In Revision; Helder, Stafura, Calloway, van den Broek, & Perfetti, July 2015). The

---

<sup>4</sup> This factor, the first principal component, is often ignored in analysis, as it reflects averaged drifts across trials, along with any experimental effects. Therefore, interpretations should be taken with some caution.

existing set of materials did not control for words that followed the critical words, so I was unable to explore some of these potential paths.

These results, as a whole, reflect a series of comprehension processes functional during the reading of inconsistent and casually-justified texts. At the sentence- or clause-final critical words, attention systems monitor links between propositional meaning in active memory and more global aspects of text meaning and are able to notice and react to meanings that don't fit (P2). These attentional responses encourage feature analysis, leading to resonance based on semantic features in active memory, and features in long term memory (P300). More controlled, and elaborative processing proceeds from here, focusing on critical areas of text, such as that involving long-distance text inconsistencies (LPC).

Moving on to **Hypothesis 2:** that semantic processing conflicts in Causal texts would be reduced relative to Inconsistent texts, and that Causal texts would incur increased memory costs relative to Consistent texts. First, there was no evidence that the causal texts reduced semantic processing needs relative to inconsistent texts. However, in a later time window, a posterior positivity interpreted as an LPC was greater for words in the Causal condition than those in either than Consistent or the Inconsistent conditions. Posterior positivities has been used as an index of the activation of episodic traces (Perfetti, Wlotko, & Hart, 2005; Rugg & Curran, 2007; Rugg & Wilding, 2000), and in this case may reflect that the words in causal texts could serve as cues to two *distinct* situation models: one that is consistent (now) with the critical words, and one that is inconsistent (but out-dated) with the critical words. This general idea was expressed in Kendeou et al. (2013): “consider what happens when a causal explanation is added...When subsequent text makes reference to the outdated information, the outdated information continues to be reactivated; but along with the outdated information, the refutation information as well as

the causal explanation for why the outdated information was no longer relevant will also be reactivated.” This dual activation may result in greater episodic trace retrieval in causal texts.

The majority of theoretical work within the inconsistency paradigm has examined that nature of memory activation and retrieval processes during reading of target sentences (Cook & O'Brien, 2014, 2017). This research assumes that information is activated through a largely passive, contextually unrestricted "resonance" process (Myers & O'Brien, 1998; O'Brien & Myers, 1999). To use the "Vegetarian" example, the idea is that when "cheeseburger" is encountered, it acts as a memory-retrieval cue for the antecedent information, which includes inconsistent information. In the inconsistent condition, the information that is activated via resonance does not fit with the model a reader has in their memory, so integration processes fail. In consistent conditions, the new information is integrated with previous text in an on-going series of processing cycles that build a situation model of the discourse as a whole.

Cook and O'Brien (2014, 2017) noted that the materials used in the inconsistency paradigm are built around violations of real world knowledge. That is, in each passage, some protagonist characteristic is established (Mary is a vegetarian). Later, some action takes place (Mary orders a cheeseburger) that is inconsistent with this characteristic. Critically, this inconsistency is mediated through the readers world knowledge, and this influences processing. Cook and O'Brien's RI-Val model of discourse processing captures this mediating role of validation.

Looking at the findings of this study through the lens of the RI-Val model provides a jumping off point for future research. First, RI-Val assumes that inconsistency effects are a result of integration processes failing on inconsistent words after resonance processes activate antecedent (inconsistent) information related to those words. The conflicting information itself is



inconsistent with world knowledge. The inconsistent passages elicited greater positivities in early, as well as later, time-windows. In the materials for this study I aimed for the strongest inconsistencies possible, to have the greatest chance of observing differences between conditions. A prediction from the RI-Val model is that those differences – early and/or late positivities – should be proportion to the strength of connection between the information in the inconsistent target sentences and that in world knowledge. The materials used in Experiment 2 of Cook and O'Brien (2014) provide a head-start down this empirical path.

Last, no significant correlations were found between the off-line reading measures – comprehension, vocabulary, word reading, coding, reading experience – and the effects of the experimental manipulations. This is likely due to two factors. One, due to data loss, the sample in this study was smaller than usually is needed for examining these kinds of correlations (e.g., Stafura and Perfetti (2014) had  $n=38$  in the final dataset). Two, the data were noisier than expected. Collecting data across two sessions proved extremely difficult in terms of maintaining data quality. Even with a rather conservative cleaning approach, the final dataset is highly variable in terms of effects.<sup>5</sup>

Given these caveats, two marginal skill-ERP correlations can be mentioned. First, there was a positive relationship between participants' vocabulary knowledge and the size of the difference between the P300 responses to Causal and Consistent words. This likely reflects the fact that the Causal texts were more difficult than the Consistent texts.

---

<sup>5</sup> For anecdotal comparison, in my previous published ERP studies only one (Stafura & Perfetti, 2014) or four (Stafura et al., 2015) participants data were removed due to noise. In this study, eleven participants data were removed. Additionally, the data for each participant who remains is a combination of two sessions data, and electrode nets were placed without the guidance of digital registration.

The second marginal correlation was a positive relationship between decoding skill and the difference between the Inconsistent and Consistent conditions during the LPC/P600. It may be the case that those who have greater decoding abilities have additional resources available for later stages of comprehension, such as integration. This, of course, should be tempered by the marginal, uncorrected nature of the correlation.

### 3. Study 2: Referential Specificity

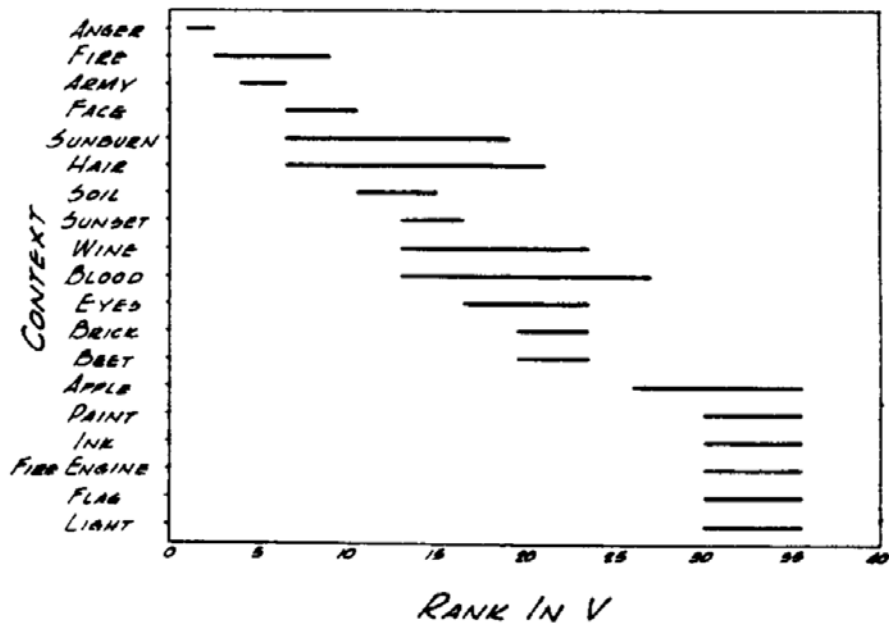
#### 3.1. Introduction.

Is word-to-text integration (WTI) strictly lexical? That is, how influential is the referential context to the lexical-semantic processing of words? **Hypothesis 3** is that words that refer to features of concrete entities are processed differently depending on the encoding of those entities. This experiment uses context to examine the effects of such referential specification across sentences. This will provide a test of the referential-level vs lexical-level locus of the WTI effects (e.g., Stafura & Perfetti, 2014; Yang et al., 2007). Additionally, this experiment will provide knowledge on the nature of on-line lexical-semantic processing as it relates to interactions between message-level features and individual words (e.g., event structures; Amsel, DeLong, & Kutas, 2015).

What's in the meaning of a word? Most often, we begin with the lexical-semantic, largely experiential information of the type we codify in dictionaries. However, when we hear or read a word in context – the usual state of affairs – is this all that remains of our mental representation of a word? Its entry in Merriam-Webster? In Wikipedia? This is a bit of a strawman, as over 40 years of psycholinguistic and psychological research has pointed to the ways in which our interpretation of a word depends on its context. For example, Anderson and Ortony (1975) found that the probabilities of participants' offline recall of simple sentences (“Coins can be flipped.”) was dependent on the relation of a retrieval cues to information *beyond* what was literally in the texts. These early findings were at odds with the then dominant associative theories of cueing and memory (e.g., Anderson & Bower, 1971).

In a clever study, Halfff, Ortony, and Anderson (1976) had participants read 19 sentences, each containing the word “red”. The sentences were focused on different contexts in which “red” was well-fit or associated in some way, e.g., “Anger”, “Apple”, “Fire Engine”, “Wine”. After reading the sentences, participants were asked to compare all possible pairs of the sentences as to whether the “red” in one sentence was “definitely redder than”, “definitely less red than”, or “possibly equally red” as the “red” in the other sentence. By using a logical interval ordering system (Fishburn, 1970), the authors could illustrate the perceived *redness* of the word “red” in each sentence.

Figure 8 shows the full version of Figure 1 from Halfff et al. The sentence contexts are represented on the y-axis, and *redness* is represented on the x-axis ( $V = redness$ ). The lines running parallel to the x-axis are representations of the lower (L(a)) and upper (U(a)) bounds of *redness* according to one participant. This showed that even simple words were represented in complex ways depending on the surrounding context, and that context need not be extensive. Interestingly, the authors note that, although a distribution of “reds” was found for each subject, the particular rankings were idiosyncratic.



**Figure 1. The intervals  $[U(a), L(a)]$  for each context,  $a$ , as determined by the data from Subject 1.**

Figure 8. Figure 1 from Half, Ortony, and Anderson (1976).

Since then, research has explored the *on-line* processing of words in context. These temporally fine-grained studies have revealed a relatively tight interplay between multiple components of language during comprehension (MacDonald, 1993). For example, words that elicit animacy violation responses in ERP studies, have the same effects disappear given just one sentence of “normalizing” context (Nieuwland & Van Berkum, 2006). For example, the following sentence doesn’t make sense:

The Psychotherapist advised the **yacht** to be honest not only with her, but especially with himself.

Indeed, when ERP measurements are taken from the work “yacht” in that sentence in isolation, it elicits a much more negative N400 response than to the word “sailor” in that same context. This makes sense, as a yacht receiving advice from a therapist breaks our models of what an inanimate object can do (i.e., it cannot take advice). However, when Nieuwland and Van Berkum (2006) added just a couple of additional animacy-violating sentences prior to this critical sentence, e.g.:

Once upon a time, a psychotherapist was consulted in her home office by a *yacht* with emotional problems. The *yacht* confided in her that everything in life had gone wrong and started crying.

The N400 differences between animacy-violating words and animacy-non-violating words disappeared. Thus, we quickly attributed living attributes to non-living things, and this was functional on-line moments after similar sentences elicited error responses.

One interesting paradigm using ERPs involves a comparison between words that are ill-fitting, or anomalous, in a given context but have *associations* or other *relations* with words that are well-fitting, to words that are simply ill-fitting, with no such relations to well-fitting words. In a sentence reading paradigm, Federmeier and Kutas (1999) compared ERP responses to words in several different text contexts. Each text started with a background sentence (B):

*(B) Everyone agreed that the stone-washed kind were out of style.*

Following this, participants read one of three follow-up sentences, which differed only at the final, critical word. One condition ended with an expected (E) word, as defined by cloze scores. In the example we are using, this word was “jeans”:

*(E) But he continued to wear the same old pair of **jeans**.*

Another condition ended with an unexpected word, that was nevertheless from the same category, and was thus related (R) to the critical word:

*(R) But he continued to wear the same old pair of **shorts**.*

The last condition ended with an unexpected, unrelated (U) word:

*(U) But he continued to wear the same old pair of **sandals**.*

The authors compared N400 ERP responses to the critical (**bolded**) words across the three conditions. The N400 component is sensitive to the amount of lexical-semantic processing elicited by a given word (Kutas & Federmeier, 2011), which can be interpreted in terms of the amount of effort needed to fully access the meaning of word in its context. First, the unexpected, unrelated words elicited much greater N400 responses relative to the expected words. This was expected given past literature (e.g., Kutas & Federmeier, 2011; Kutas & Hillard, 1980). The interesting result was that, even though the unexpected, related words elicited greater N400 responses than the expected words, they elicited *lesser* N400 responses than the unexpected, unrelated words.

Amsel, DeLong, and Kutas (2015) used this “related-anomaly” paradigm to explore responses to contextually-anomalous words that shared sensory-motor, or other event-related

information, with the expected continuations of passages. For example, an introductory sentence (I) described an event, or situation:

(I) My date was taking me to a romantic Italian restaurant for dinner tonight.

The introduction was followed by a sentence (C) that contained one of four critical words, corresponding to the four conditions: expected (“garlic”), incongruent (“ice”), perceptuomotor-related (“tobacco), and event-related (“napkins”).

(C) I was worried that afterward I might reek of garlic/ice/tobacco/napkins so I brought gum.

Amsel and colleagues found that, although both the perceptuomotor- and event-related words elicited larger N400 responses than the expected words, they elicited smaller N400 responses than the incongruent words, even though they were all equally unexpected. It appears that the comprehension system incrementally activates both event information, and perceptuomotor information, during on-line reading, and tries to make use of this information to the extent that it can.

The last sentence provides a caveat: “to the extent that it can”, that provides some grounding to an “ideal” that perfectly balances on-going activation patterns with in-coming information. That is, there is a great deal of evidence that listeners and readers often engage in “good-enough” processing (Ferreira, Bailey, Ferraro, 2002) in which certain features of a text are processed at a shallow level, especially if they fit in with the on-going context. Indeed,



researchers (Sanford & Sturt, 2002, Sanford et al., 2010) have found that comprehenders miss significant errors in text relatively often, in particular if the erroneous information is related to the correct information (e.g., Moses building an Ark in the Bible vs. Noah building an Ark). Thus, there is the potential that the findings from Amsel et al., (2015) will be limited in generalizability.

It should be noted that there is a distinct interpretation of the Amsel et al. (2015) data that does not need recourse to sensory-motor features or event structures. This comes from the WTI research (Helder et al., In Revision; Helder et al., 2015) that showed a preference for local binding opportunities at the cross-sentence level. The example from Amsel et al. (2015) can be interpreted in this framework: that is, the verb “reek” provides a *local* semantic binding site for “garlic” and “tomato” and even some affordance for “napkins”. The N400 response pattern reflects these “graded” binding opportunities provided by the verb.

Our **Hypothesis 3** is that words that refer to features of entities (referred to be nouns) are processed differently depending on the encoding of those entities. Because of the better semantic “fit” in the Consistent condition relative to the Inconsistent condition, the N400 component is the primary focus. Given my hypothesis, I expect a greater N400 reduction for the Feature Consistent words than the Feature Inconsistent words. This would suggest, at least partially, a referential locus for the WTI effects in this experiment, consistent with hypotheses drawn from prior experimentation (e.g., Stafura & Perfetti, 2014; Yang, Perfetti, & Schmalhofer, 2007)

Additionally, a larger P300 response for inconsistent words may indicate the updating of current mental representations of the situation. Greater P600/LPC responses to inconsistent words may also reflect memory processes, but in this case would more likely indicate retrieval of the earlier context, perhaps updating the structure of the mental model accordingly.

## 3.2. Methods.

**3.2.1. Participants.** Twenty-one participants were recruited from the University of Pittsburgh undergraduate student pool. This is a pool of voluntary student research hours made available as part of the Introductory Psychology course. All participants were right-handed, native English speakers with normal or correct-to-normal vision, without any history of head injury or epilepsy, and between the ages of 18 and 35 years old (Mean= 18.82; Standard Deviation (SD)=0.8). Participants were compensated at a rate of \$10 per hour, and all procedures were performed with permission from the University of Pittsburgh Institutional Review Board.

One participant's data were removed after notifying experimenters that they had a learning disability after the onset of the experiment. Two more participants were removed during data cleaning (3.2.4. Apparatus and ERP Recordings). This left us with a final sample of 18 participants. These participants had an average Nelson-Denny Comprehension<sup>6</sup> score of 23.35 (SD=4.4), and an average Nelson-Denny Vocabulary score of 59.41 (SD=14.4). These measures were not significantly correlated in this small population,  $r = .373$ ,  $p = .140$ .

**3.2.2. Materials.** Materials consisted of 60 pairs of two-sentence texts (examples shown in Table 4), each consisting of two conditions defined by the relationship between the first, context sentence and a word in the second sentence that refers to a feature that is either Consistent or Inconsistent with the concepts introduced in the first sentence. The words refers to features associated with referents/concepts chosen from the McRae et al. conceptual feature production norm database (McRae, Cree, Seidenberg, & McNorgan, 2005) according to the following criteria: they are represented by frequent, familiar nouns that represent concrete entities (Wu & Barsalou, 2009), are between 3-9 letters in length and consist of 1-3 syllables, are

---

<sup>6</sup> One participant's Nelson-Denny comprehension and vocabulary data was lost due to technical error (i.e., computer crash).

associated with multiple features (>2), and, critically, have two features that were produced a similar number of times in the feature norms (McRae et al., 2005) and are not synonyms.

Table 4. Example experimental test passages – Study 2.

<b>“Piano” Passage</b>	<b>“Apples” Passage</b>	<b>“Ants” Passage</b>
The movers saw the piano in the corner of the room. The <b><u>weight/sound</u></b> of the piano was substantial/beautiful.	The runner walked past the apples on his table. The <b><u>sweet/colorful</u></b> fruit tasted/looked amazing.	The biologist watched the ant under the microscope. The <b><u>tiny/black</u></b> insect was easy to follow.

Note: Critical words are bolded and underlined. Blue critical words are Feature Consistent. Red critical words are Feature Inconsistent.

The first sentence of each text was created to influence a representation that specifies one conceptual features. This is done through the use of protagonists drawing focus to the specific features. The second sentence contains a word that is either Consistent or Inconsistent with that feature. It should be noted that the use of “Inconsistent” refers to a feature that is not focused on in the first sentence, it is not locally inconsistent, such as that in previous ERP studies (e.g., Kutas & Hillyard, 1980; Federmeier, 2009).

In our materials that part-of-speech of the critical words was allowed to be variable, in order to be able to hold constant the location of the critical words, the general plausibility of the texts, and to be able to create enough materials for this ERP study. Specifically: 21 pairs contained critical words that were both adjectives that were part of an initial noun-phrase (e.g., The *sweet/colorful* fruit...), 9 pairs contained critical words that were both nouns referring to a feature/attribute (e.g., The *weight/sound* of the...), 2 pairs contained critical words that were both verbs referring to a feature/attribute (e.g., It *floated/popped*...), 16 pairs contained one critical word that was a noun and one that was an adjective as part of an initial noun-phrase (e.g.,

The *wicker* basket was.../The *handle* was...), and 2 pairs contained one critical word that was a verb and one that was an adjective as part of an initial noun-phrase (e.g., It *ate*.../Its *furry*...). An additional 30 Filler texts of a similar format were included to help suppress stimuli-driven strategic effects.

The Critical words in the Consistent and Inconsistent conditions did not differ reliably in length, log word frequency, or number of syllables, all  $ps > .1$  (Table 5). The Consistent texts did not differ in length from the Inconsistent texts,  $t(59) = 1.561, p = .124$ . Additionally, fifteen Filler texts were included that had the same structure as the Consistent experimental texts, in order to include more consistent materials overall. The Filler texts were similar in length to the experiment texts (Average # of words per text = 15.90, SD = 2.4).

Table 5. Stimulus characteristics – Study 2.

	Mean # Words/Text (SD)	Mean Log WF (SD)	Mean # Letter (SD)	Mean # Syllables
Consistent	16.23 (3.0)	3.056 (.76)	5.02 (1.3)	1.3 (.5)
Inconsistent	16.07 (2.8)	3.157 (.62)	5.43 (1.3)	1.4 (.5)

**3.2.3. Design and Procedure.** At the beginning of the experimental session, participants were fitted with an electroencephalogram (EEG) net and seated in a sound-attenuated, electrically insulated booth. Participants were seated in an adjustable chair approximately 60 cm from the center of a 15-in (38.1 cm) CRT display.

During the text comprehension task, participants read two-sentence passages for comprehension. The sentences were presented one word at the time in the center of a computer screen for a duration of 300 ms with an inter-stimulus interval (ISI) of 300 ms (i.e., stimulus-

onset asynchronies (SOAs) of 600 ms). The ISI after the last word of the first sentence was increased to 600 ms to account for sentence wrap-up effects (Just & Carpenter, 1980; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989). The texts were preceded by a fixation cross (+) to orient the participants. A true-false comprehension question based on the meaning of the passage followed 30% of the trials on a random basis. For each list, half of the questions required a ‘true’ response, and half required a ‘false’ response, with responses registered using a response box. The comprehension questions were used to ensure that participants read for comprehension, and immediate feedback was displayed on the screen (“Wrong” in red for incorrect responses and “Good Job” in blue for correct responses). The text comprehension portion of the experimental session consisted of two blocks of trials taking approximately 15 minutes each, to allow for breaks, and the stimuli were presented in random order. Three practice texts preceded the experimental trials.

After the text comprehension task, participants were lead from the ERP booth, and the electrode net was removed. After a short break, participants sat in a quiet room in the back of the ERP lab and computerized versions of the Nelson-Denny vocabulary and comprehension tests were administered. The Nelson-Denny comprehension test features 6 text passages followed by comprehension questions (total number of questions = 36), and participants were asked to complete as many questions as they could in 15 minutes. The Nelson-Denny vocabulary test has 100 questions that assess vocabulary knowledge, and participants were asked to complete as many questions as they could in 7.5 minutes. After completion of the comprehension and vocabulary tests, participants were debriefed as to the purpose of the study, and its potential relevance to basic and educational science.

**3.2.4. Apparatus and ERP Recordings.**<sup>7</sup> During the experimental session, participants wore a 128 electrode Geodesic sensor net (Tucker, 1993) with Ag/AgCl electrodes (Electrical Geodesics, Inc., Eugene, OR). During recording, all impedances were kept below 50k $\Omega$ , an acceptable level with this system (Ferree, Luu, Russell, & Tucker, 2001). A vertex reference was used during the recording. Six eye channels were monitored to allow for rejection of ocular artifacts. The EEG signals were digitally sampled at a rate of 1000 Hz, and hardware filtered during recording between 0.1 and 200 Hz. After recording, the recorded EEG was ran through a 30 Hz low-pass finite impulse response filter. The data were then segmented from 200 ms before to 800ms after the onset of the critical words (1000 ms segments). Next, channels were automatically removed from the datasets if they had activity of  $\pm 200 \mu\text{V}$ , using an 80ms moving average, on more than 20% of trials. Additionally, segments were removed on the basis of three separate criteria: containing more than 12 channels marked using the previous noisy channel thresholding step, containing blinks revealed by voltage fluctuations of  $\pm 140 \mu\text{V}$  at superior and inferior eye channels (excepting for the right superior eye channel removed during ocular artifact detection), or containing horizontal eye movements (e.g., saccades) revealed by voltage fluctuations of  $\pm 55 \mu\text{V}$  at the left outer canthi electrode. Finally, individual datasets were manually checked for additional noisy channels that may have been missed by the automatic algorithms.

The data for 4 participants were removed due to more than 10 trials per condition being marked bad (through the methods above). For the remaining datasets, an average of 6.5 electrodes were removed. The remaining trials for the different conditions in both tasks were not unbalanced. Removed channels were replaced by the data from neighboring channels using

---

<sup>7</sup> This section is largely the same as for Study 1, excepting number of participants removed during artifact detection, and is included for completeness sake.

spherical spline interpolation (Ferree, 2006). The cleaned data were re-referenced to the average of the channels. The data were then averaged within participants for each condition. Following subtraction of the mean amplitude of the baseline period (200 ms pre-stimulus), the data were exported to EP Toolkit V 2.66 (Dien, 2010) for PCA analysis, or to SPSS 23.0 for statistical analyses.

All computerized experimental tasks were programmed and carried out on E-Prime version 2.0.8 (Psychology Software Tools, Inc., Pittsburgh, PA). E-Prime also sent event information to the EGI NetStation EEG recording system. Instructions and the computerized trials (i.e., text comprehension and meaning judgments) were presented on a 15-in. (38.1-cm) CRT display with a 60 Hz refresh rate.

### 3.3. Results.

**ERP Analyses.** Planned analyses focused on traditional ERP components associated with semantic and memorial processing: the P300 (~250-350ms), the N400 (~300-500ms), and the P600/LPC (~550-700ms). Critical comparisons are between ERP measures on the critical modifiers in the Feature Consistent and Feature-Inconsistent conditions.

For the P300, a 2 X 3 repeated-measures ANOVA was carried out on the mean amplitude data between 250ms-450ms with Condition (Consistent, Inconsistent), and Electrode Cluster (P3, Pz, P4) as within-subject factors. There was no Main Effect of Condition,  $F(1,17) = .223, p = .643$ , or Condition X Cluster interaction,  $F(2,34) = .005, p = .993$ .

For the N400, two repeated-measures ANOVAs were carried out on the averaged amplitude between 300ms-500ms, separately for midline and lateral electrodes. First a 2 x 3 midline ANOVA with Condition (Consistent, Inconsistent,) and Cluster (Fz, Cz, Pz) as within-

factors was performed. There was no Main Effect of Condition,  $F(1,17) = .062, p = .806$  nor Condition X Cluster interaction,  $F(2,34) = .027, p = .920$ .

A second 2 X 3 X 2 ANOVA was carried out with Condition (Consistent, Inconsistent), Anteriority (Frontal, Central, Posterior), and Laterality (Left, Right) as within-subject factors. The main effect of Condition was not significant,  $F(1,17) = .504, p = .487$ . Additionally, no interactions that involved the experimental Conditions were significant: Condition X Anteriority,  $F(2,34) = .056, p = .915$ , Condition X Laterality,  $F(1,17) = .890, p = .359$ , Condition X Anteriority X Laterality,  $F(2,34) = 1.397, p = .260$ .

For the LPC, two repeated-measures ANOVAs were carried out on the averaged amplitude between 550ms-700ms, separately for midline and lateral electrodes. First a 2 x 3 midline ANOVA with Condition (Consistent, Inconsistent) and Cluster (Fz, Cz, Pz) as within-factors was performed. The main effect of Condition was significant,  $F(1,17) = 8.695, p = .009, \eta_p^2 = .338$ , as was the Condition X Cluster interaction,  $F(2,34) = 4.523, p = .038, \eta_p^2 = .210$ . The effect seems to reflect a greater positivity over right, frontal electrodes for the Consistent condition relative to the Inconsistent condition (Fig 9.).



# ERPs (10-20 montage)

Blue = Consistent; Red = Less Consistent

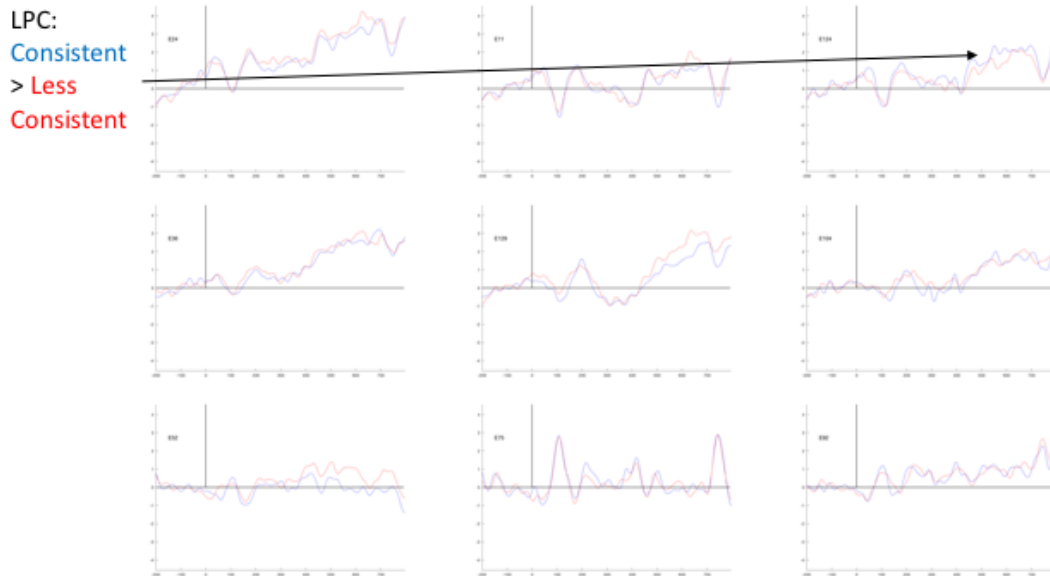


Figure 9. ERP waveforms averaged over the international 10-20 electrode cluster locations.

A second 2 X 3 X 2 ANOVA was carried out with Condition (Consistent, Inconsistent), Anteriority (Frontal, Central, Posterior), and Laterality (Left, Right) as within-subject factors. The main effect of Condition was not significant,  $F(1,17) = .332, p = .572$ . Additionally, no interactions that involved the experimental Conditions were significant: Condition X Anteriority,  $F(2,34) = .249, p = .713$ , Condition X Laterality,  $F(1,17) = 1.162, p = .296$ , Condition X Anteriority X Laterality,  $F(2,34) = 1.622, p = .220$ .<sup>8</sup>

<sup>8</sup> I collected Comprehension and Vocabulary scores for participants in this study, however, given the limited ERP results, correlations between effects and individual differences were not carried out excepting those between Comprehension and Vocabulary and LPC difference effects. None of these correlations were significant,  $p > .5$ .

### 3.4. Study 2 Discussion.

**Study 2** tested how referential WTI effects are relative to more purely lexical-semantic processes, by manipulating the referential specificity of critical concepts through pre-ceding context. **Hypothesis 3** is that words that refer to meaning features of concrete entities (e.g., objects) are processed differently depending on the encoding of those entities. The incremental hypothesis predicted a reduced N400 response to Feature Consistent modifiers relative to Feature Inconsistent modifiers. A shallow processing hypothesis (Sanford et al., 2010) predicted no difference between critical words. A secondary set of predictions involved memorial processes. Early, P300 responses may indicate updating of active memory, and greater P600/LPC responses to Inconsistent words may reflect episodic memory processes, indicating retrieval of the earlier context.

In terms of the first Hypothesis, predictions were unfounded. There was, clearly, no difference between N400 responses to Feature Consistent modifiers and Feature Inconsistent modifiers (Figure 9.). These results are consistent with theories that under most circumstances, readers engage in relatively shallow, or “good-enough”, processing (Ferreira et al., 2002; Ferreira & Lowder, 2016) unless something structurally-significant enough attracts attention. In our materials, nothing was necessarily anomalous, so it’s possible readers couldn’t distinguish between feature-consistent and feature-inconsistent words. If the N400 reflects semantic processing effort, it wouldn’t be modulated by these materials.

These results are also consistent with a view of the cross-sentence N400 as reflecting local binding (Calloway & Perfetti, 2017; Helder et al., In Revision) In neither condition in this Study was the critical words a particularly strong retrieval cue or a semantic binding site. The materials unsystematically mixed adjectives that were part of noun phrases with modifiers that

preceded their nouns by several words. Additionally, there was a lack of systematic cues in the first sentences. From a semantic binding perspective, null N400 findings are not surprising.

The shallow processing hypothesis is also consistent with the first experimental contrast related to our secondary predictions. Specifically, there were no differences between conditions in the P300 component (Figure 9.). This component has been suggested to reflect updating of information in active memory (e.g., Donchin, 1981) that is relevant to the on-going mental model of the text (Yang et al., 2007). The lack of effect suggests that readers weren't aware of the differences in encodings (Sanford, 2010).

Finally, a significant late effect was found, a right frontal positivity that was greater in the Feature Consistent condition relative to the Feature Inconsistent condition (Figure 9). This is opposite of my prediction, which rested on the belief that the Inconsistent condition would incur a cost in terms of memorial re-processing, and that this cost would be indicated by a late positivity (Luka & Van Petten, 2012). Taken as an effect of controlled memory operations, it may be that the consistent words initiated an updating response to their discourse representation (Burkhardt, 2007).

There is also the possibility that this frontal positivity reflects, in part, a P2 response to the word following the critical word. In this case, the readers' may have noticed a difference between the modifiers in the Feature Consistent condition and the Feature Inconsistent condition, and this devotion of greater attention is an elaboration of an updating effect.

The results from Study 2 diverged from predictions in two ways. First, no N400 differences were found between conditions. This is similar to what was found in Study 1 and provides support for a relation between semantic binding and the N400 in connected text. Second, a frontal P600 was found, but in the opposite direction as predicted. In this case, related

words elicited more positive responses than unrelated words. This may reflect the ability of modifiers in the Feature Consistent texts to act as retrieval cues for related features in the first sentence.

## 4. Summary and Conclusions.

### 4.1. Summary and General Discussion of Study 1.

**Hypothesis 1** was that the meaning of single words - as the final elements of propositions - are effective retrieval cues for long distance inconsistent information in text. The results from Study 1 reveal a chain of WTI processes involved in reading inconsistent, and causally-justified texts. At the sentence- or clause-final critical words, attention systems monitor some aspects of text meaning, and are able to notice and react to new propositional meaning that does not fit (P2). These attentional responses encourage feature analysis word-by-word, leading to resonance based on semantic propositional features in active memory with those in long term memory (P300). Then, more controlled, elaborative processing proceeds from here, focusing attention and memory on critical areas of text, such as long-distance inconsistencies (LPC).

**Hypothesis 2** was that semantic processing conflicts in Causal texts would be reduced relative to Inconsistent texts, but that Causal texts would incur increased memory costs relative to Consistent texts. First, there was no evidence that the causal texts reduced semantic processing needs relative to inconsistent texts in the form of N400 responses. This may result from the lack of local binding differences between conditions. However, in a later time window, a posterior positivity interpreted as an LPC was greater for words in the Causal condition than those in either than Consistent or the Inconsistent conditions. Posterior positivities have been interpreted as the activation of episodic memory traces, and, in this case, may reflect the fact that words in causal texts serve as cues to two *distinct* situation models: one that is consistent (now) with the critical words, and one that is inconsistent (but out-dated) with the critical words.

Given that this was the first electrophysiological study of the inconsistency paradigm, there are next steps to take empirically to solidify our understanding of the results, as well as

some limitations of the current design that should be addressed in the future. The semantically-driven, early attention effect (i.e., the P2) was unexpected. Although, it is interpretable within our framework of inconsistency detection and processing, additional work should examine this effect to 1) determine if the P200 is indeed a replicable effect in this and similar paradigms, and 2) explore its functional significance within WTI and comprehension, in general. The mid-frontal P200 has most commonly been associated with visual attention in search tasks (Luck & Hillyard, 1994), and in reading materials with high predictability at critical words (Wicha et al., 2004). This study is one of the first I'm aware of to find a P200 effect in text reading without strong cloze constraints on the words, so this is an interesting new avenue to pursue. On the one hand, it can expand our understanding of the processes – domain general or not – that are active during reading. On the other hand, it can expand our understanding of the mechanisms underlying the P200, and in what conditions they are functional.

There were a number of decisions made in the development of this study that hamper the ability to draw strong conclusions about certain things. First, we took ERP measurements from single words that were also the final elements in sentences or clauses. This led to our discussion of effects as relying on propositional meaning. However, this leaves open aspects of incremental processing that may be functional at words that don't occupy such a position.

Second, there is behavioral evidence from recall tasks (e.g., Albrecht & O'Brien, 1993) that additional time taken when reading inconsistent texts relative to consistent texts is devoted to re-processing of information in the regions of the text related to the inconsistency. I interpreted the LPC effects for inconsistent and causal texts as memory re-processing, perhaps for such text regions, but without some measure of recall for the material it is not possible to claim this. A future study could include follow-up recall tests.

Third, the causal texts were created by adding a single sentence to the inconsistent texts, and therefore were significantly longer (by number of words) than the other conditions. Although simply adding this approximate number of words, without causal information in them, doesn't cause observable behavioral effects relative to inconsistent texts (e.g., O'Brien et al., 1998), this may not apply to more sensitive electrophysiological measures. Including a non-causal filler condition would allow for a test that effects are not related to the relatively small differences in word length between conditions.

#### 4.2. Summary and General Discussion of Study 2.

**Hypothesis 3** is that referentially-specific encodings, provided by single sentence frames, were enough to influence WTI at the word level in a subsequent sentence. The results from Study 2 diverged from predictions in two ways. First, no N400 differences were found between conditions. Second, a frontal P600 was found, but in the opposite direction as predicted: feature-related words elicited more positive responses than unrelated words. This may reflect stronger discourse connections in the Feature Consistent texts, but this is a quite tentative interpretation.

From a structure-building view of WTI (e.g., Helder et al., In Revision), there were a number of limitations that may have prevented between-condition lexical-semantic effects (N400) from emerging. This view of WTI states that readers default to the construction of a new structure when reading new words in connected text, unless there are sufficiently strong retrieval cues that link this newly encountered material to prior material. In this study, both sentences could have been constructed to better encourage a test of this. In the first sentence, a more systematic inclusion of semantic cues, perhaps providing greater structural centrality (van den Broek, Helder, & Van Leijenhorst, 2013) to the sentence, may have led to more developed mental models on the part of the reader. This would assist on the encoding side of the equation.

In the second sentence, there were not consistent bindings sites to link material across sentences. For example, some of the critical words were modifiers of nouns that occurred later in the sentence. Only some were adjectives that were part of a sentence-initial noun-phrase (NP) in the second sentence. A future study could use all adjective-noun constructions, which are more likely to benefit from NP anaphoric operations (for a review and theory of NP anaphora, see Almor, 1999).

#### **4.3. Conclusions.**

The two studies in this Dissertation provided examinations of on-line reading comprehension, in which the meanings of words and propositions were examined in relation to text messages. These relations include: those between messages that are or are not consistent with long-distance semantic information (Study 1), those between messages and causal justifications of inconsistent protagonist information (Study 1), and those between referential and lexical representations (Study 2). Each experiment was aimed at furthering our understanding of WTI and moving the general paradigm of research to the text and discourse level.

The first WTI studies suggested that integration processes could be fast and automatic across sentence boundaries (Yang et al., 2007; Stafura & Perfetti, 2015). However, in these studies, critical “paraphrase” words were always able to function as local binding sites for prior text, and these sites may be necessary for triggering immediate integration (Helder et al., In Revision). In Study 1, the propositional meaning available with the reading of the critical words in the inconsistent and causal texts was sufficient to act as a cue for previous text. In the case of inconsistent texts, these cues initiated a chain of WTI processes beginning with meaning-sensitive attention to memory updating and elaborated re-processing. However, in Study 2 the



predicted lexical-semantic (N400) effects were not observed. This may have resulted from a lack of strong retrieval cues at the word level in these materials.

The use of ERPs in this Dissertation adds to the field of comprehension research by providing real-time neural measures of long-distance text processing. There are very few studies that have examined ERP responses to texts beyond a few sentences. This is a critically important endeavor, as subtle differences in task and paradigm can greatly change cognitive operations and strategies. For example, the impact of associations between words is far greater in isolation than in a sentence frame and is far greater within a sentence frame than across a sentence boundary (e.g., Camblin et al., 2007). Research from my own lab (Helder et al., In Revision) has begun to discover differences in how very well-studied ERP components (e.g., N400) function depending on text length and complexity. The N400 is always associated with meaning, but the level of representation it is sensitive to seems to change based on context. Future work should continue to explore longer, more naturalistic texts, as these are most commonly encountered in real life, and can possibly constrain models that come from research at other, single levels of comprehension (e.g., sentence reading, *per se*).

Another, more practical line of thought may be to consider how reader abilities relate to on-line processing of texts such as those in this Dissertation. The sample sizes in my studies were too small for a considerate look at this. For example, readers have been characterized as having “standards of coherence” that guide their reading of texts (van den Broek, Bohn-Gettler, Kendeou, Carlson, & White, 2011), and help them strategically re-read and think about the coherent meaning of the text. These standards – if set too low – limit the ability of a reader to notice when something isn’t quite right, and even small mis-comprehensions add up over tens and hundreds of words. How do standards of coherence relate to good-enough processing

(Ferreira et al., 2002; Ferreira & Lowder, 2016), and empirical studies of the “Moses Illusion” (Sanford, 2010)? Are similar meta-skills involved in multiple situations? How do educators craft materials to provide “nudges” in the right direction? There is no lack of future work in this area. What is exciting is the amount of work being done, with different populations, using different methods. I truly believe such methodological convergence is more and more necessary as our theories and questions get more complex.

The Readings Systems Framework (Perfetti & Stafura, 2014) focuses on the lexicon as a crucial part of reading comprehension, with word comprehension, or word reading in context, receiving the output of the word identification system, and providing input into the comprehension systems. In both studies in this Dissertation, effects across levels of linguistic representation were observed, albeit to a lesser extent in Study 2. This Dissertation is an entry of on-line, word-level analysis into text comprehension, two research areas that are rarely commensurate in theoretical foundations, empirical aims, and methodologies. It is heartening, as it should be, that a greater number of questions exists after conducting these studies than before conducting them.

## Bibliography

- Albrecht, J. E., & O'Brien, E. J. (1993). Updating a mental model: Maintaining both local and global coherence. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19(5), 106-1070.
- Almor, A. (1999). Noun-phrase anaphora and focus: The informational load hypothesis. *Psychological review*, 106(4), 748.
- Altmann, G. T., & Kamide, Y. (1999). Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition*, 73(3), 247-264.
- Altmann, G., & Steedman, M. (1988). Interaction with context during human sentence processing. *Cognition*, 30(3), 191-238.
- Amsel, B. D., DeLong, K. A., & Kutas, M. (2015). Close, but no garlic: Perceptuomotor and event knowledge activation during language comprehension. *Journal of Memory and Language*, 82, 118-132.
- Anderson, R. C., & Ortony, A. (1975). On putting apples into bottles—A problem of polysemy. *Cognitive Psychology*, 7(2), 167-180.
- Baker, L. (1989). Metacognition, comprehension monitoring, and the adult reader. *Education Psychology Review*, 1(1), 3-38.
- Baker, L., & Anderson, R. I. (1982). Effects of inconsistent information on text processing: Evidence for comprehension monitoring. *Reading and Reading Quarterly*, 17, 281-294.
- Benjamini, Y., & Yekutieli, D. (2001). The control of the false discovery rate in multiple testing under dependency. *Annals of Statistics*, 1165-1188.
- Boland, J. E., Tanenhaus, M. K., & Garnsey, S. M. (1990). Evidence for the immediate use of

- verb control information in sentence processing. *Journal of Memory and Language*, 29(4), 413-432.
- Botvinick, M. M., Cohen, J. D., & Carter, C. S. (2004). Conflict monitoring and anterior cingulate cortex: an update. *Trends in cognitive sciences*, 8(12), 539-546.
- Burkhardt, P. (2007). The P600 reflects cost of new information in discourse memory. *Neuroreport*, 18(17), 1851-1854.
- Burgess, C., & Simpson, G. B. (1988). Neuropsychology of lexical ambiguity resolution: The contribution of divided visual field studies. In K. L. Small, G. W. Cottrell, & M. K. Tanenhaus (Eds.), *Lexical Ambiguity Resolution: Perspectives from Psycholinguistics, Neuropsychology, and Artificial Intelligence* (pp. 411-430). San Mateo, CA: Morgan Kaufmann Publishers, Inc.
- Cain, K., & Oakhill, J. V. (1999). Inference making ability and its relation to comprehension failure in young children. *Reading and Writing*, 11(5-6), 489-503.
- Calloway, R. C., & Perfetti, C. A. (2017). Integrative and predictive processes in text reading: the N400 across a sentence boundary. *Language, Cognition and Neuroscience*, 32(8), 1001-1016.
- Camblin, C. C., Gordon, P. C., & Swaab, T. Y. (2007). The interplay of discourse congruence and lexical association during sentence processing: Evidence from ERPs and eye tracking. *Journal of Memory and Language*, 56(1), 103-128.
- Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences*, 36(03), 181-204.
- Cook, A. E., & Myers, J. L. (2004). Processing discourse roles in scripted narratives: The

- influences of context and world knowledge. *Journal of Memory and Language*, 50(3), 268-288.
- Cook, A. E., & O'Brien, E. J. (2014). Knowledge activation, integration, and validation during narrative text comprehension. *Discourse Processes*, 51(1-2), 26-49.
- Cook, A. E., & O'Brien, E. J. (2017). Fundamentals of inferencing during reading. *Language and Linguistics Compass*, 11(7), e12246.
- Craik, F. I., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of verbal learning and verbal behavior*, 11(6), 671-684.
- Craik, F. I., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of experimental Psychology: general*, 104(3), 268-304.
- Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of verbal learning and verbal behavior*, 19(4), 450-466.
- Degani, T., & Tokowicz, N. (2010). Semantic ambiguity within and across languages: an integrative review. *Quarterly Journal of Experimental Psychology*, 63(7), 1266–1303.
- DeLong, K. A., Urbach, T. P., & Kutas, M. (2005). Probabilistic word pre-activation during language comprehension inferred from electrical brain activity. *Nature Neuroscience*, 8(8), 1117-1121.
- Dien, J., Beal, D. J., & Berg, P. (2005). Optimizing principal components analysis of event-related potentials: matrix type, factor loading weighting, extraction, and rotations. *Clinical Neurophysiology*, 116(8), 1808-1825.
- Dien, J., & Frishkoff, G. A. (2005). Principal components analysis of event-related potential datasets. In T. C. Handy (Ed.), *Event-Related Potentials: A Methods Handbook* (pp. 189-208). Cambridge, MA: MIT Press.

- Donchin, E. (1981). Surprise!... surprise?. *Psychophysiology*, *18*(5), 493-513.
- Donchin, E., & Coles, M. G. (1988). Is the P300 component a manifestation of context updating? *Behavioral and Brain Sciences*, *11*(03), 357-374.
- Eddington, C. M., & Tokowicz, N. (2015) How meaning similarity influences ambiguous word processing: The current state of the literature. *Psychonomic Bulletin and Review*, *22*, 13-37.
- Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological Review*, *102*(2), 211-245.
- Federmeier, K. D. (2007). Thinking ahead: The role and roots of prediction in language comprehension. *Psychophysiology*, *44*(4), 491-505.
- Federmeier, K. D., & Kutas, M. (1999). A rose by any other name: Long-term memory structure and sentence processing. *Journal of memory and Language*, *41*(4), 469-495.
- Federmeier, K. D., & Kutas, M. (2002). Picture the difference: Electrophysiological investigations of picture processing in the two cerebral hemispheres. *Neuropsychologia*, *40*(7), 730-747.
- Ferree, T. C. (2006). Spherical splines and average referencing in scalp electroencephalography. *Brain Topography*, *19*(1-2), 43-52.
- Ferree, T. C., Luu, P., Russell, G. S., & Tucker, D. M. (2001). Scalp electrode impedance, infection risk, and EEG data quality. *Journal of Clinical Neurophysiology*, *112*, 536-544.
- Ferguson, H. J., Scheepers, C., & Sanford, A. J. (2010). Expectations in counterfactual and theory of mind reasoning. *Language and Cognitive Processes*, *25*(3), 297-346.
- Fernandino, L., Humphries, C. J., Seidenberg, M. S., Gross, W. L., Conant, L. L., & Binder, J. R.

- (2015). Predicting brain activation patterns associated with individual lexical concepts based on five sensory-motor attributes. *Neuropsychologia*, 76, 17-26.
- Ferreira, F., Bailey, K. G., & Ferraro, V. (2002). Good-enough representations in language comprehension. *Current directions in psychological science*, 11(1), 11-15.
- Ferreira, F., & Lowder, M.W. (2016). Prediction, information structure, and good-enough language processing. In *Psychology of Learning and Motivation* (Vol. 65, pp. 217-247).
- Frazier, L., & Fodor, J. D. (1978). The sausage machine: A new two-stage parsing model. *Cognition*, 6(4), 291-325.
- Fishburn, P. C. (1970). Intransitive indifference with unequal indifference intervals. *Journal of Mathematical Psychology*, 7(1), 144-149.
- Fischer, P. M., & Mandl, H. (1984). Learner, text variables, and the control of comprehension and recall. In H. Mandl, N. L. Stein, & T. Trabasso (Eds.), *Learning and Comprehension of Text* (pp. 213-254). Hillsdale, NJ: Erlbaum.
- Frishkoff, G. A., Tucker, D. M., Davey, C., & Scherg, M. (2004). Frontal and posterior sources of event-related potentials in semantic comprehension. *Cognitive Brain Research*, 20(3), 329-354.
- Garner, R. (1987). *Metacognition and Reading Comprehension*. Norwood, NJ: Ablex.
- Glenberg, A. M., Meyer, M., & Lindem, K. (1987). Mental models contribute to foregrounding during text comprehension. *Journal of memory and language*, 26(1), 69-83.
- Garrod, S., & Terras, M. (2000). The contribution of lexical and situational knowledge to resolving discourse roles: Bonding and resolution. *Journal of Memory and Language*, 42(4), 526-544.

- Gernsbacher, M. A. (2013). *Language comprehension as structure building*. Psychology Press.
- Glenberg, A. M., Sanocki, T., Epstein, W., & Morris, C. (1987). Enhancing calibration of comprehension. *Journal of Experimental Psychology: General*, *116*(2), 119-136.
- Goldberg, R. F., Perfetti, C. A., & Schneider, W. (2006). Perceptual knowledge retrieval activates sensory brain regions. *The Journal of Neuroscience*, *26*(18), 4917-4921.
- Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, *101*(3), 371-395.
- Groppe, D. M., Urbach, T. P., & Kutas, M. (2011). Mass univariate analysis of event related brain potentials/fields II: Simulation studies. *Psychophysiology*, *48*(12), 1726-1737.
- Half, H. M., Ortony, A., & Anderson, R. C. (1976). A context-sensitive representation of word meanings. *Memory & Cognition*, *4*(4), 378-383.
- Hauk, O., Davis, M. H., Ford, M., Pulvermüller, F., & Marslen-Wilson, W. D. (2006). The time course of visual word recognition as revealed by linear regression analysis of ERP data. *Neuroimage*, *30*(4), 1383-1400.
- Helder, A., Perfetti, C.A., van den Broek, P., Stafura, J. Z., & Calloway, R.C. (In Revision). ERP indicators of local and global text influences on word-to-text integration.
- Helder, A., Stafura, J., Calloway, R., van den Broek, P., & Perfetti, C. (July 2015). Centrality effects on word to text integration during reading: an ERP study. Presented at the 25th Annual Meeting of the Society for Text & Discourse, Minneapolis, MN.
- Hendrickson, A. E. & White, P. O. (1964). Promax: A quick method for rotation to oblique simple structure. *The British Journal of Statistical Psychology*, *17*, 65–70.
- Hickok, G. (2012). The cortical organization of speech processing: Feedback control and



- predictive coding the context of a dual-stream model. *Journal of Communication Disorders*, 45(6), 393-402.
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179–185.
- Jarvella, R. J. (1971). Syntactic processing of connected speech. *Journal of Verbal Learning and Verbal Behavior*, 10(4), 409-416.
- Johnson, H. M., & Seifert, C. M. (1999). Modifying mental representations: Comprehending corrections. In H. van Oostendorp & S. Goldman (Eds.), *The construction of mental representations during reading*. (pp 303-318). Mahwah, NJ: Lawrence Erlbaum Associates.
- Johnson-Laird, P. N. (1980). Mental models in cognitive science. *Cognitive Science*, 4(1), 71-115.
- Johnson-Laird, P. N. (1981). Comprehension as the construction of mental models. *Philosophical Transactions of the Royal Society of London, Series B*, 295(1077), 353-374.
- Just, M. A., & Carpenter, P. A. (1980). A theory of reading: from eye fixations to comprehension. *Psychological Review*, 87(4), 329-354.
- Kaiser, H. F. (1958). The varimax criterion for analytic rotation in factor analysis. *Psychometrika*, 23(3), 187-200.
- Keenan, J. M., & Jennings, T. M. (1995). The role of word-based priming in inference research. In R. F. Lorch, Jr. & E. J. O'Brien (Eds.), *Sources of coherence in reading* (pp. 37-50). Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.
- Kendeou, P., Smith, E. R., & O'Brien, E. J. (2013). Updating during reading comprehension:

- Why causality matters. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 39(3), 854-865.
- Kiefer, M., Sim, E. J., Herrnberger, B., Grothe, J., & Hoenig, K. (2008). The sound of concepts: Four markers for a link between auditory and conceptual brain systems. *Journal of Neuroscience*, 28(47), 12224-12230.
- Kintsch, W. (1988). The role of knowledge in discourse comprehension: a construction integration model. *Psychological Review*, 95(2), 163-182.
- Kintsch, W., Welsch, D., Schmalhofer, F., & Zimny, S. (1990). Sentence memory: A theoretical analysis. *Journal of Memory and Language*, 29(2), 133-159.
- Kintsch, W., & Van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review*, 85(5), 363.
- Kuperberg, G. R. (2007). Neural mechanisms of language comprehension: Challenges to syntax. *Brain Research*, 1146, 23-49.
- Kuperberg, G. R., & Jaeger, T. F. (2016). What do we mean by prediction in language comprehension?. *Language, cognition and neuroscience*, 31(1), 32-59.
- Kuperberg, G. R., Kreher, D. A., Sitnikova, T., Caplan, D. N., & Holcomb, P. J. (2007). The role of animacy and thematic relationships in processing active English sentences: Evidence from event-related potentials. *Brain and language*, 100(3), 223-237.
- Kuperberg, G. R., Paczynski, M., & Ditman, T. (2011). Establishing causal coherence across sentences: An ERP study. *Journal of cognitive neuroscience*, 23(5), 1230-1246.
- Kutas, M., & Federmeier, K.D. (2011). Thirty years and counting: Finding meaning in the N400 component of the event related potential (ERP). *Annual Review of Psychology*, 62, 621-647.

- Kutas, M., & Hillyard, S.A. (1980). Reading senseless sentences: Brain potentials reflect semantic incongruity. *Science*, *207*, 203-205.
- Kutas, M., & Hillyard, S. A. (1983). Event-related brain potentials to grammatical errors and semantic anomalies. *Memory & Cognition*, *11*(5), 539-550.
- Lau, E., Almeida, D., Hines, P. C., & Poeppel, D. (2009). A lexical basis for N400 context effects: Evidence from MEG. *Brain and Language*, *111*(3), 161-172.
- Lau, E. F., Holcomb, P. J., & Kuperberg, G. R. (2013). Dissociating N400 effects of prediction from association in single-word contexts. *Journal of Cognitive Neuroscience*, *25*(3), 484-502.
- Laszlo, S., & Federmeier, K. D. (2009). A beautiful day in the neighborhood: An event-related potential study of lexical relationships and prediction in context. *Journal of Memory and Language*, *61*(3), 326-338.
- Levy, R. (2008). Expectation-based syntactic comprehension. *Cognition*, *106*(3), 1126-1177.
- Long, D. L., & Chong, J. L. (2001). Comprehension skill and global coherence: A paradoxical picture of poor comprehenders' abilities. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*(6), 1424-1429.
- Luck, S. J., & Hillyard, S. A. (1994). Electrophysiological correlates of feature analysis during visual search. *Psychophysiology*, *31*(3), 291-308.
- MacDonald, M. C. (1993). The interaction of lexical and syntactic ambiguity. *Journal of memory and language*, *32*(5), 692-715.
- Mani, K., & Johnson-Laird, P. N. (1982). The mental representation of spatial descriptions. *Memory & Cognition*, *10*(2), 181-187.

- McKoon, G., Gerrig, R. J., & Greene, S. B. (1996). Pronoun resolution without pronouns: some consequences of memory-based text processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22(4), 919.
- McKoon, G., & Ratcliff, R. (1986). The automatic activation of episodic information in a semantic memory task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 12(1), 108-115.
- McKoon, G., & Ratcliff, R. (1998). Memory-based language processing: Psycholinguistic research in the 1990s. *Annual Review of Psychology*, 49(1), 25-42.
- McKoon, G., & Ratcliff, R. (1992). Inference during reading. *Psychological Review*, 99(3), 440-466.
- McNamara, D. S., & Magliano, J. P. (2009). Towards a comprehensive model of comprehension. In B. Ross (Ed.). *The Psychology of Learning and Motivation* (vol. 51, pp. 29–384). New York, NY, US: Elsevier Science.
- McRae, K., Cree, G. S., Seidenberg, M. S., & McNorgan, C. (2005). Semantic feature production norms for a large set of living and nonliving things. *Behavior Research Methods*, 37(4), 547-559.
- Morrow, D. G., Greenspan, S. L., & Bower, G. H. (1987). Accessibility and situation models in narrative comprehension. *Journal of Memory and Language*, 26(2), 165-187.
- Moseley, R. L., Pulvermüller, F., & Shtyrov, Y. (2013). Sensorimotor semantics on the spot: brain activity dissociates between conceptual categories within 150 ms. *Scientific reports*, 3 (1928), 1-7.
- Myers, J. L., & O'Brien, E. J. (1998). Accessing the discourse representation during reading. *Discourse Processes*, 26(2), 131-157.

- Nelson, M. J., & Denny, E. C. (1973). *The Nelson-Denny reading test*. Boston, MA: Houghton Mifflin.
- Nieuwland, M. *et al.* (2017). Limits on prediction in language comprehension: A multi-lab failure to replicate evidence for probabilistic pre-activation of phonology. *bioRxiv* 111807, <https://doi.org/10.1101/111807>
- Nieuwland, M. S., & Van Berkum, J. J. (2006). When peanuts fall in love: N400 evidence for the power of discourse. *Journal of cognitive neuroscience*, *18*(7), 1098-1111.
- O'Brien, E. J. (1987). Antecedent search processes and the structure of text. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *13*(2), 278-290.
- O'Brien, E. (October, 2013) Personal Communication.
- O'Brien, E. J., & Albrecht, J. E. (1992). Comprehension strategies in the development of a mental model. *Journal of experimental psychology: learning, memory, and cognition*, *18*(4), 777-784.
- O'Brien, E. J., & Myers, J. L. (1985). When comprehension difficulty improves memory for text. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *11*(1), 12-21.
- O'Brien, E. J., Rizzella, M. L., Albrecht, J. E., & Halleran, J. G. (1998). Updating a situation model: a memory-based text processing view. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *24*(5), 1200-1210.
- Osterhout, L., & Holcomb, P. J. (1992). Event-related potentials elicited by syntactic anomaly. *Journal of Memory and Language*, *31*, 785-806.
- Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology*, *98*(3), 554-566.

- Perfetti, C., & Stafura, J. (2014). Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading, 18*(1), 22-37.
- Perfetti, C. A., Wlotko, E. W., & Hart, L. A. (2005). Word learning and individual differences in word learning reflected in event-related potentials. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31*(6), 1281-1292.
- Perfetti, C., Yang, C. L., & Schmalhofer, F. (2008). Comprehension skill and word-to-text integration processes. *Applied Cognitive Psychology, 22*(3), 303-318.
- Polich, J. (2007). Updating P300: an integrative theory of P3a and P3b. *Clinical Neurophysiology, 118*(10), 2128-2148.
- Pulvermüller, F., Lutzenberger, W., & Preissl, H. (1999). Nouns and verbs in the intact brain: evidence from event-related potentials and high-frequency cortical responses. *Cerebral cortex, 9*(5), 497-506.
- Rapp, D. N., & Kendeou, P. (2007). Revising what readers know: Updating text representations during narrative comprehension. *Memory & Cognition, 35*(8), 2019-2032.
- Rapp, D. N., & Kendeou, P. (2009). Noticing and revising discrepancies as texts unfold. *Discourse Processes, 46*(1), 1-24.
- Ratcliff, R. (1978). A theory of memory retrieval. *Psychological Review, 85*(2), 59-108.
- Rayner, K., Chace, K. H., Slattery, T. J., & Ashby, J. (2006). Eye movements as reflections of comprehension processes in reading. *Scientific studies of reading, 10*(3), 241-255.
- Rayner, K., Sereno, S. C., Morris, R. K., Schmauder, A. R., & Clifton, C. (1989). Eye movements and on-line language comprehension processes. *Language and Cognitive Processes, 4*, SI21–SI49.

- Rugg, M. D., & Curran, T. (2007). Event-related potentials and recognition memory. *Trends in Cognitive Sciences*, 11(6), 251-257.
- Rugg, M. D., Mark, R. E., Walla, P., Schloerscheidt, A. M., Birch, C. S., & Allan, K. (1999). Dissociation of the neural correlates of implicit and explicit memory. *Nature*, 392(6676), 595-598.
- Rugg, M. D., & Wilding, E. L. (2000). Retrieval processing and episodic memory. *Trends in cognitive sciences*, 4(3), 108-115.
- Sanford, A. J., Leuthold, H., Bohan, J., & Sanford, A. J. (2011). Anomalies at the borderline of awareness: An ERP study. *Journal of Cognitive Neuroscience*, 23(3), 514-523.
- Sanford, A. J., & Sturt, P. (2002). Depth of processing in language comprehension: Not noticing the evidence. *Trends in cognitive sciences*, 6(9), 382-386.
- Sereno, S. C., & Rayner, K. (2003). Measuring word recognition in reading: eye movements and event-related potentials. *Trends in cognitive sciences*, 7(11), 489-493.
- Simpson, G. B. (1981). Meaning dominance and semantic context in the processing of lexical ambiguity. *Journal of Verbal Learning and Verbal Behavior*, 20, 120-136.
- Singer, M. (2013). Validation in reading comprehension. *Current Directions in Psychological Science*, 22(5), 361-366.
- Singer, M., Halldorson, M., Lear, J. C., & Andrusiak, P. (1992). Validation of causal bridging inferences in discourse understanding. *Journal of Memory and Language*, 31(4), 507-524.
- Stafura, J. Z., & Perfetti, C. A. (2014). Word-to-text integration: Message level and lexical level influences in ERPs. *Neuropsychologia*, 64, 41-53.
- Stafura, J. Z., Rickles, B., & Perfetti, C. A. (2015). Memory and predictive mechanisms in on-

- line text comprehension: Lexical association direction and word-to-text integration assessed with ERPs. *Language, Cognition, and Neuroscience*.
- Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly*, 402-433.
- Staub, A., & Clifton Jr., C. (2006). Syntactic prediction in language comprehension: evidence from either... or. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 32(2), 425-436.
- Thornhill, D. E., & Van Petten, C. (2012). Lexical versus conceptual anticipation during sentence processing: Frontal positivity and N400 ERP components. *International Journal of Psychophysiology*, 83(3), 382-392.
- Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1999). Test of word reading efficiency. Austin, TX: Pro-Ed.
- Trabasso, T., Secco, T., & Van Den Broek, P. (1984). Causal cohesion and story coherence. In H. Mandl, N. L. Stein, & T. Trabasso (Eds.), *Learning and Comprehension of Text* (pp. 83-111). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Trabasso, T., & Suh, S. (1993). Understanding text: Achieving explanatory coherence through on-line inferences and mental operations in working memory. *Discourse processes*, 16(1-2), 3-34.
- Trabasso, T., & Van Den Broek, P. (1985). Causal thinking and the representation of narrative events. *Journal of memory and language*, 24(5), 612-630.
- Tucker, D. M. (1993). Spatial sampling of head electrical fields: The geodesic sensor net. *Electroencephalography and Clinical Neurophysiology*, 87, 154-163.
- Tyler, L. K., & Marslen-Wilson, W. D. (1977). The on-line effects of semantic context on



- syntactic processing. *Journal of Verbal Learning and Verbal Behavior*, 16(6), 683-692.
- Unsworth, N., Heitz, R. P., Schrock, J. C., & Engle, R. W. (2005). An automated version of the operation span task. *Behavior research methods*, 37(3), 498-505.
- Van Berkum, J. J., Brown, C. M., Zwitserlood, P., Kooijman, V., & Hagoort, P. (2005). Anticipating upcoming words in discourse: evidence from ERPs and reading times. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 31(3), 443.
- Van den Broek, P. (1994). Comprehension and memory of narrative texts: Inferences and coherence. In M. A. Gernsbacher (Ed.), *Handbook of Psycholinguistics*, (pp. 539-588). San Diego, CA: Academic Press.
- Van den Broek, P., Bohn-Gettler, C. M., Kendeou, P., Carlson, S., & White, M. J. (2011). When a reader meets a text: The role of standards of coherence in reading comprehension. In M. T. McCrudden, J. P. Magliano, & G. Schraw (Eds.), *Text relevance and learning from text* (pp. 123-139). Charlotte, NC, US: IAP Information Age Publishing.
- Van den Broek, P. W., Helder, A., & Van Leijenhorst, L. (2013). Sensitivity to structural centrality: Developmental and individual differences in reading comprehension skills. In M. A. Britt, S. R. Goldman, & J-F Rouet (Eds.), *Reading: From Words to Multiple Texts* (pp. 132-146). New York: Routledge.
- Van Petten, C., & Luka, B. J. (2012). Prediction during language comprehension: Benefits, costs, and ERP components. *International Journal of Psychophysiology*, 83(2), 176-190.
- Van Veen, V., & Carter, C. S. (2002). The anterior cingulate as a conflict monitor: fMRI and ERP studies. *Physiology & behavior*, 77(4-5), 477-482.
- Wicha, N.Y.Y., Moreno, E.M. & Kutas, M. (2004). Anticipating words and their gender: an

- event-related brain potential study of semantic integration, gender expectancy, and gender agreement in Spanish sentence reading. *Journal of Cognitive Neuroscience*, 16, 1272–1288.
- Wu, L. L., & Barsalou, L. W. (2009). Perceptual simulation in conceptual combination: Evidence from property generation. *Acta Psychologica*, 132(2), 173-189.
- Yang, C. L., Perfetti, C. A., & Schmalhofer, F. (2005). Less skilled comprehenders' ERPs show sluggish word-to-text integration processes. *Written Language & Literacy*, 8(2), 157-181.
- Yang, C. L., Perfetti, C. A., & Schmalhofer, F. (2007). Event-related potential indicators of text integration across sentence boundaries. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33(1), 55-89.
- Zwaan, R. A., & Madden, C. J. (2004). Updating situation models. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 30(1), 283-288.
- Zwaan, R. A., & Radvansky, G. A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin*, 123(2), 162-185.

**APPENDIX A. CONSISTENCY STIMULI**

Table 6. All Text Passages – Study 1.

<b>BLOCK</b>	<b>1 ("Skydiving")</b>	<b>2 ("Teaching")</b>
<b>Introduction (All)</b>	Carol had always wanted to be a construction worker. It was hard getting started but she found this job two years ago. It was exciting for her and she couldn't have been happier.	Owen had just completed graduate school and had just begun the nervewracking task of looking for a job. Most jobs he looked at were academic positions which required both teaching and research.
<b>Consistent Elaboration</b>	Carol enjoyed looking over the city from such soaring heights and was thrilled by the view of the river south of her town. She felt exhilarated watching the activity on the street far below.	The part of graduate school that Owen liked most was teaching. His students all had favorable things to say about him and he was proud of his accomplishments. He was not interested in research.
<b>Inconsistent Elaboration</b>	Carol was extremely scared of heights and would only work on the ground level. While the others worked on the upper levels she worked on projects where she could stay safely on the ground.	Owen particularly liked the research that he performed while in graduate school. To him, there was nothing more enjoyable than discovering something that had not been known before. He was not interested in teaching.
<b>Causal Elaboration</b>	Carol was extremely scared of heights and would only work on the ground level. While the	Owen particularly liked the research that he performed while in graduate school. To him,

	others worked on the upper levels she worked on projects where she could stay safely on the ground. Because this was disrupting her life, her therapist suggested she try to do exciting activities involving heights.	there was nothing more enjoyable than discovering something that had not been known before. He was not interested in teaching. Because there were no research positions currently available, his mentor told him to find a decent teaching program.
<b>Filler (All)</b>	Carol always ate lunch with her fellow workers. They were a friendly group of people. One of her co-workers, Lori, invited Carol to join her on a trip.	An additional constraint that Owen faced was geographical. He enjoyed the seasons and the occasional cold weather. With all of this in mind, Owen searched through the paper for jobs.
<b>Target Sentences (All)</b>	She now really wanted to go <b>skydiving</b> , it sounded like an activity she would love.	Owen finally took a position in <b>teaching</b> , and was glad to be done with his search.
<b>Comprehension Question</b>	Was Carol liked by her co-workers?	Was Owen an auto mechanic?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>3 ("Vegetarian")</b>	<b>4 ("Kid in the Street")</b>
<b>Introduction (All)</b>	Today, Mary was meeting an old friend for lunch. She arrived early at the restaurant and decided to get a table. After she sat down, she started looking at the menu.	Bill always enjoyed walking in the early morning and this morning was no exception. During his walks, he would stop to say hello and chat with some of his neighbors.
<b>Consistent Elaboration</b>	This was Mary's favorite restaurant because it	Bill had just celebrated his twenty-fifth birthday.

	had fantastic junk food. Mary enjoyed anything that was quick and easy to fix. She never worried about her diet and saw no reason for nutritious foods.	He felt he was in top condition and had recently added additional workouts before and after his walks. He could run a mile with hardly any effort.
<b>Inconsistent Elaboration</b>	This was Mary's favorite restaurant because it had fantastic health food. Mary has been a strict vegetarian for years. She was serious about her diet and didn't eat anything fried or cooked in grease.	Bill had just celebrated his eighty-first birthday. He wasn't as strong as he was twenty years ago and used a cane on his morning walks. He couldn't walk around the block without taking breaks.
<b>Causal Elaboration</b>	This was Mary's favorite restaurant because it had fantastic health food. Mary has been a strict vegetarian for years. She was serious about her diet and didn't eat anything fried or cooked in grease. However, she wasn't getting enough vitamins so her doctor said she had to start eating meat.	Bill had just celebrated his eighty-first birthday. He wasn't as strong as he was twenty years ago and used a cane on his morning walks. He couldn't walk around the block without taking breaks. Nevertheless, his age never prevented him from acting in emergencies.
<b>Filler (All)</b>	After about ten minutes, Mary's friend arrived. They had a lot to talk about. After chatting for a moment, Mary signaled the waiter to come over to their table.	Today, Bill stopped to talk with Mrs. Jones. They started talking about how hot it had been. As they were talking, Bill saw a young boy who was lying in the street hurt.
<b>Target Sentences (All)</b>	Mary decided to order a <b>cheeseburger</b> , and	After seeing the boy, Bill started <b>running</b> , and

	handed the menu back to the waiter.	picked the boy up.
<b>Comprehension Question</b>	Was Mary meeting her friend for lunch?	Did Bill hate walking in the morning?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>5 ("Environmental")</b>	<b>6 ("Culture Shock")</b>
<b>Introduction (All)</b>	Steven recently graduated from college and was going to graduate school. As an undergraduate, he was involved in numerous organizations. This helped Steven to narrow his interests for graduate school.	Jessica had always been fascinated by different cultures. Her family had decided to take a trip to Germany last summer. She was glad her parents had chosen Germany as a vacation spot.
<b>Consistent Elaboration</b>	In college, he was an officer of the mechanical and industrial student organizations. Steven felt that natural resources should be exploited for human benefit and that it didn't matter if it destroyed the environment.	Jessica was able to use the language she had been studying for seven years. She had always gotten A's in her German classes and had received the outstanding German student award in high school.
<b>Inconsistent Elaboration</b>	In college, he was an officer in the numerous clean up and recycling student organizations. Steven was an active environmentalist on campus. Once, he lead a protest against dumping waste into a local river.	It was the first time Jessica had left her small midwestern town. She had no idea what Germany would be like. None of the schools in her town offered foreign culture or language classes.
<b>Causal Elaboration</b>	In college, he was an officer in the numerous clean up and recycling student organizations.	It was the first time Jessica had left her small midwestern town. She had no idea what

	Steven was an active environmentalist on campus. Once, he lead a protest against dumping waste into a local river. It turns out, however, that he only presented himself that way to build his resume, and he never actually recycled outside of school.	Germany would be like. None of the schools in her town offered foreign culture or language classes. Jessica was able to learn German because she borrowed library cds of a complete course in the language.
<b>Filler (All)</b>	Because he didn't have much money, Steven worked on his own car. To change oil, he first drained the old oil into a pan. Then, he would put in fresh fluids.	While in Germany the family went to the Berlin Wall. They also attended Oktoberfest and the Faschings festival. At the festivals, the greatest experience was eating in the huge dining halls.
<b>Target Sentences (All)</b>	He dumped the oil out in his <b>backyard</b> , always getting some on his shoes in the process.	Jessica ordered all her meals in <b>German</b> , speaking fluently with a good accent.
<b>Comprehension Question</b>	Did Steven graduate from college?	Did Jessica and her family visit Cape Cod?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>7 ("Proposal")</b>	<b>8 ("Hearing")</b>
<b>Introduction (All)</b>	As he got out of the shower, Tim was thinking about what needed to be done. He was going to have one shot at this and he wanted to get it right.	Jennifer enjoyed walking in the park near her house. She took a walk every day. During the summer months, she would often stop and watch the ducks swimming in the small pond.
<b>Consistent Elaboration</b>	He was going to tar his roof before going to	Jennifer was a healthy, athletic, twenty-two

	dinner with his girlfriend. Tim knew tarring was messy work. He knew by the end of the day he would be covered with the stuff.	year old woman. She had just graduated with a degree in musicology, and loved singing. In fact, her appreciation of music was the thing she was most proud of.
<b>Inconsistent Elaboration</b>	Tim would propose to his girlfriend at Chez Loui, a very formal, elegant French restaurant. Tim wanted to look his best. After he proposed a toast, Tim would ask for her hand in marriage.	Jennifer was quite old and had hearing problems. She was legally deaf. She had tried to use a hearing aid, but it had stopped helping years ago. She was in her own silent world.
<b>Causal Elaboration</b>	Tim would propose to his girlfriend at Chez Loui, a very formal, elegant French restaurant. Tim wanted to look his best. After he proposed a toast, Tim would ask for her hand in marriage. He needed to dress casual because he didn't want her to know this was a special night.	Jennifer was quite old and had hearing problems. She was legally deaf. She had tried to use a hearing aid, but it had stopped helping years ago. She was in her own silent world. However, now she is able to hear loud noises because her doctor gave her a newer model hearing device.
<b>Filler (All)</b>	With a towel around his waist, Tim went about getting ready. He went into the bathroom and shaved. Next, he opened his closet.	One day, while Jennifer was taking a walk, a mugging took place. A man approached a woman and demanded her money. The woman screamed as the man ran away.
<b>Target Sentences (All)</b>	At last he grabbed some old <b>jeans</b> , and quickly pulled them	Jennifer paused at the woman's <b>voice</b> , and looked up to see what



	on.	was happening.
<b>Comprehension Question</b>	Was Tim getting ready to go on a date?	Did Jennifer enjoy swimming in the pond?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>9 ("The Date")</b>	<b>10 ("Maths")</b>
<b>Introduction (All)</b>	Carl and Sarah had only been dating for about two weeks. However, Carl wanted to plan a special night for their next date. A friend suggested that they attend a baseball game.	Fred always wanted to go to college. He studied really hard in high school so he would get good grades and be able to achieve his goal. He graduated with high honors.
<b>Consistent Elaboration</b>	Carl loved baseball and thought that this was a great idea. He had always been a huge fan of the Red Sox. He thought that going to a game would be the perfect date.	Fred's favorite subject in school was math. He could not think of a bigger challenge in school and even solved complex math equations in his spare time. The intellectual challenge of math excited him.
<b>Inconsistent Elaboration</b>	Carl thought this was a terrible idea. When he was younger his father would drag him to baseball games even though he hated them. He was sure that he could think of something better.	Fred had done well in all his classes except math. He struggled through each math class even with the help of a tutor. He took the minimum number of math courses required to graduate.
<b>Causal Elaboration</b>	Carl thought this was a terrible idea. When he was younger his father would drag him to baseball games even though he hated them. He was sure that he could think of something	Fred had done well in all his classes except math. He struggled through each math class even with the help of a tutor. He took the minimum number of math courses required

	better.He knew, however, that Sarah would love to go to the game on their date because she loved baseball.	to graduate. Because he wouldn't let his high school experience influence him, he took several summer math courses and improved his skills.
<b>Filler (All)</b>	He called Sarah to set a time for their next date. Although they had only been dating for a short while, he really liked her. Carl decided that this would be a special night.	Because of Fred's hard work, he had been accepted to a prestigious university. It was time to select his classes. He wanted to pick classes he knew he would do well in.
<b>Target Sentences (All)</b>	He called and ordered tickets for a <b>ballgame</b> , hoping to get good seats.	He decided to take two courses in <b>calculus</b> , believing they would be challenging but interesting.
<b>Comprehension Question</b>	Were Carl and Sarah dating?	Did Fred want to go into the Marines?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>11 ("Do You Even Lift")</b>	<b>12 ("Animals")</b>
<b>Introduction (All)</b>	Ken had been looking for a hobby for quite some time. With his new job he had much more free time. Now he had plenty of time to devote to a hobby.	Elizabeth's daughter, Kim, had just started kindergarten. Elizabeth was happy that Kim had made a lot of friends. Kim would often tell her mom about what she did with her friends at school.
<b>Consistent Elaboration</b>	Ken was a big man and always tried to keep in shape by jogging and lifting weights. His 250 pound body was solid muscle. Ken loved tough	In addition, little Kim loved animals. Every time she saw an animal she became very excited. She immediately wanted to run up and

	physical contact sports like football and wrestling.	pet it. Elizabeth didn't know why Kim loved animals so much.
<b>Inconsistent Elaboration</b>	Ken was a small man and didn't worry about staying in shape. His small 120 pound body was all skin and bones. Ken only enjoyed non-contact sports, like bowling which he could practice alone.	Unfortunately, little Kim hated animals and was terribly frightened of them. Every time an animal approached her, she ran away and began to cry. Elizabeth didn't know why Kim was so frightened of animals.
<b>Causal Elaboration</b>	Ken was a small man and didn't worry about staying in shape. His small 120 pound body was all skin and bones. Ken only enjoyed non-contact sports, like bowling which he could practice alone. Because his friends often teased him about his weight, he wanted to do a more physical sport.	Unfortunately, little Kim hated animals and was terribly frightened of them. Every time an animal approached her, she ran away and began to cry. Elizabeth didn't know why Kim was so frightened of animals. However, Kim wasn't afraid of animals when her mother was in the room because she knew her mother would protect her.
<b>Filler (All)</b>	While walking downtown, Ken passed a new gymnasium. He noticed the display in the window. It was a list of their summer sports programs. They seemed interesting so Ken went inside.	Elizabeth usually just dropped Kim off at school, but today Kim wanted Elizabeth to come in with her. As Elizabeth and Kim entered, Kim looked around. Someone had brought in their pet.
<b>Target Sentences (All)</b>	Ken decided to take lessons in <b>boxing</b> , as he felt this would be the perfect hobby.	Kim ran across the room to greet the <b>dog</b> , and smiled as she brushed the dog's fur.

<b>Comprehension Question</b>	Was Ken looking for a hobby?	Was Elizabeth's daughter in high school?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>13 ("Winter")</b>	<b>14 ("Car Trouble")</b>
<b>Introduction (All)</b>	Todd woke up and hopped out of bed to brew some fresh, hot coffee. Mornings were his favorite time of the day and he did not want to waste it laying in bed.	As Linda was driving to her job interview, her car overheated and stopped running. The car was very old and she knew she needed to buy a new one.
<b>Consistent Elaboration</b>	Todd ran over to the wood stove and quickly lit a fire. During the winter months, his house got very cold. He enjoyed watching the fire burn while he had breakfast and warmed up.	Fortunately, this wasn't a problem for Linda. Her parents were rich and would give her money for a new car. They gave her money for whatever she wanted even after she graduated from college.
<b>Inconsistent Elaboration</b>	It had been the warmest winter in the past fifty years. In fact, it was so warm that people could open their windows and turn off the heat. Todd decided he would go outside after he finished breakfast.	Unfortunately, Linda didn't have the money for a new car. She already owed thousands of dollars in student loans. Linda knew she would not be able to get a loan to buy a car.
<b>Causal Elaboration</b>	It had been the warmest winter in the past fifty years. In fact, it was so warm that people could open their windows and turn off the heat. Todd decided he would go outside after he finished breakfast. Even so, there were icicles in the	Unfortunately, Linda didn't have the money for a new car. She already owed thousands of dollars in student loans. Linda knew she would not be able to get a loan to buy a car. Because her parents wanted her to have a

	windowsill because Todd left the windows open and it was still freezing at night.	reliable vehicle, they co-signed a loan for buying a car.
<b>Filler (All)</b>	Todd lived in a house which he had built. It was a simple log house on a couple acres of land. However, it was his own design and he loved his view.	Right now, though, Linda had to call a tow truck. Also, she had to find a way to her interview. As Linda waited for the tow truck, she thought about what to do.
<b>Target Sentences (All)</b>	Todd thought that his house was <b>cold</b> , so he grabbed a sweater from his closet.	Linda decided to buy a <b>Mercedes</b> , as she had always liked them.
<b>Comprehension Question</b>	Did Todd like the morning?	Was Linda on her way to the beach?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>15 ("Speeding Ticket")</b>	<b>16 ("City Driver")</b>
<b>Introduction (All)</b>	Al and Sue were siblings on their way to a friend's house for a party. This was the first time in quite awhile that Al and Sue had traveled to see their friends.	Karen called her friend Ralph at his dormitory. She had just returned from spring vacation and asked if he could arrange for someone to pick her up at the airport.
<b>Consistent Elaboration</b>	They were cruising along the highway at about 85 mph. Al described to Sue the perfect condition of his new sports car. He loved control of the car, which could drive at speeds over 95 mph.	Ralph enjoyed driving to the airport in Boston. Because he grew up in the city, and could easily navigate his way around. Ralph often offered to take his friends into the city and to the airport.
<b>Inconsistent Elaboration</b>	They were crawling along the highway at about 30 mph. Al described to Sue the terrible condition of his	Even though Ralph had drove in the country for years, he was petrified of driving in Boston. He refused to drive in the

	old, beat-up car. He complained about how the car would often stall at speeds over 35 mph.	city. If he needed to go anywhere near the city, Ralph took public transportation.
<b>Causal Elaboration</b>	They were crawling along the highway at about 30 mph. Al described to Sue the terrible condition of his old, beat-up car. He complained about how the car would often stall at speeds over 35 mph. Because Sue often enjoyed driving fast, she told Al to test the limits of his car and drive faster.	Even though Ralph had drove in the country for years, he was petrified of driving in Boston. He refused to drive in the city. If he needed to go anywhere near the city, Ralph took public transportation. He had to go pick her up because he couldn't find anyone else that could go.
<b>Filler (All)</b>	Al and Sue always enjoyed the scenery on the drive to their friend's home. Suddenly, Al noticed police lights in his rearview mirror. Al looked for a place and pulled over.	Ralph and Karen were both sophomores in college. They had taken classes together and became good friends. He was anxious to hear all about her vacation.
<b>Target Sentences (All)</b>	The officer told Al he had been <b>speeding</b> , and that the fine would be fifty dollars.	Ralph drove his car into <b>Boston</b> , stopping downtown to eat lunch.
<b>Comprehension Question</b>	Were Al and Sue going to visit their friend?	Did Karen call Ralph at his house?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>17 ("Hoarders")</b>	<b>18 ("Public Speaking")</b>
<b>Introduction (All)</b>	Phil relaxed while his wife finished unpacking. They had gone away for the weekend and left the house a mess. His wife	George was a senior in high school and was in the process of applying to college. During this time, he realized he

	sat down and they began to discuss cleaning up the house.	needed to participate in some extracurricular activities before he graduated.
<b>Consistent Elaboration</b>	Phil had a habit of throwing everything away, especially when it came to receipts and bills. He would read letters once and then toss them. Phil had not kept any kind of a record for years.	George had always been outgoing and loved to talk and thought that performing in front of people was exciting. When he had to give an oral report for class, he was always the first to volunteer.
<b>Inconsistent Elaboration</b>	Phil was a true "packrat" and saved everything. He had been saving receipts, letters, and newspapers for years. He had a storage room in which he put important papers and other things he wanted to save.	George had always been shy and detested speaking in front of strangers. When he had to give an oral report for class, George would become sick to his stomach and would often break out in hives.
<b>Causal Elaboration</b>	Phil was a true "packrat" and saved everything. He had been saving receipts, letters, and newspapers for years. He had a storage room in which he put important papers and other things he wanted to save. Because his storage room was becoming crowded, he stopped saving old documents after his wife demanded that he clean.	George had always been shy and detested speaking in front of strangers. When he had to give an oral report for class, George would become sick to his stomach and would often break out in hives. Because George wanted to become an actor, he was determined to overcome his fear of speaking in front of people.
<b>Filler (All)</b>	Phil's wife mentioned that she needed their	His high school offered many different after-

	last bank statement. They had received a overdue notice for their car bill. Suddenly, Phil remembered what he had done with it.	school activities. He decided to check the activities bulletin board for a couple ideas. He noticed a colorful poster with several characters on it.
<b>Target Sentences (All)</b>	He had thrown away his <b>receipts</b> , taking them out to the trash last week.	He decided that this was the time to <b>audition</b> , and was really hoping for a part.
<b>Comprehension Question</b>	Did Phil's wife unpack?	Was George in college?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>19 ("Glasses")</b>	<b>20 ("Guitar")</b>
<b>Introduction (All)</b>	As a child Aaron always had trouble seeing far away. His parents took him to the doctors and they told Aaron that he needed to get glasses. That day Aaron got a new pair of glasses.	When Samantha's friends began learning how to play instruments they asked her if she would like to join their band. Samantha said she would love to and began learning guitar.
<b>Consistent Elaboration</b>	Aaron was extremely excited about his new glasses. He no longer had to sit in the front to see the chalkboard, and peoples' faces were a lot less blurry. Aaron was very happy.	Samantha was a natural at the guitar. It did not take her very long at all before she could play the best rock songs by the best artists. She even began writing her own music.
<b>Inconsistent Elaboration</b>	Aaron hated his new glasses with a passion. They were too big and kept falling off and all his classmates would make fun of him. Four-eyes was a favorite insult of theirs.	Samantha was hopeless at the guitar. She couldn't play any of the notes in tune and she was absolutely terrible at holding a beat. Her friends told her she could not be in the band until she got better.



<b>Causal Elaboration</b>	Aaron hated his new glasses with a passion. They were too big and kept falling off and all his classmates would make fun of him. Four-eyes was a favorite insult of theirs. Aaron's teacher overheard the bullying and put an end to it by speaking to the class.	Samantha was hopeless at the guitar. She couldn't play any of the notes in tune and she was absolutely terrible at holding a beat. Her friends told her she could not be in the band until she got better. Samantha practiced every day until her fingers hurt, but eventually she was able to play the songs her friends wanted her to play.
<b>Filler (All)</b>	In the new school year, Aaron got better grades and started doing very well in art class. He helped his classmates become comfortable with their projects. The teacher also liked Aaron.	Samantha's friends won a talent show at school and were able to participate in their town's celebration. They were excited and nervous at the prospect. Samantha was particularly nervous.
<b>Target Sentences (All)</b>	Aaron liked to show off his <b>glasses</b> , and talked to everyone he could about them.	Samantha played a great song on the <b>guitar</b> , helping her band win at the talent show.
<b>Comprehension Question</b>	Was Aaron doing well at school?	Was Samantha on the track team?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>21 ("Mohawk")</b>	<b>22 ("Ocean")</b>
<b>Introduction (All)</b>	Lisa's granddaughter came to visit. She looked quite different than how her grandmother remembered her because she now had a	Diane went on a beach trip with her friends last summer. There were many things to do, including shopping, sun tanning and beach

	mowhawk. It was the biggest mohawk Lisa had ever seen.	volleyball.
<b>Consistent Elaboration</b>	Lisa was pleasantly surprised with her granddaughter's new style. Lisa told her granddaughter that she looked very beautiful and that the mohawk complimented her.	Diane loved to run into the ocean and splash in the waves. The beach had been one of her favorite destinations since she was a child.
<b>Inconsistent Elaboration</b>	Lisa was horrified by her granddaughter's new style. Lisa's granddaughter said that her mohawk was the style of her new favorite music genre.	Diane couldn't swim, so she felt left out when her friends went into the water. She would sit on the beach and watch.
<b>Causal Elaboration</b>	Lisa was horrified by her granddaughter's new style. Lisa's granddaughter said that her mohawk was the style of her new favorite music genre. After Lisa's granddaughter had her listen to the music, she ended up loving it and wanting to learn more about it.	Diane couldn't swim, so she felt left out when her friends went into the water. She would sit on the beach and watch. Her friends told her that the water wasn't very deep at all, and Diane was soon splashing about like everyone else.
<b>Filler (All)</b>	Lisa often had friend's over on the weekends her granddaughter visited. Several friends were due to come over that particular day, to spend time drinking tea and chatting.	Diane and her friends had rented a house on the beach. They even spoiled themselves by hiring a chef to come and cook. But, early each day they went outside to enjoy the sun.
<b>Target Sentences (All)</b>	Lisa was excited to show off her granddaughter's	Diane happily dove into the <b>waves</b> , joining her

	hair. She knew her friends would be delighted by the look.	friends in the fun.
<b>Comprehension Question</b>	Did Lisa's granddaughter get a mohawk?	Did Diane and her friends go to the city on vacation?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>23 ("Traveling")</b>	<b>24 ("Camping")</b>
<b>Introduction (All)</b>	Jamie went to the study abroad office at his school. He was interested in learning about opportunities he could take to visit a foreign country.	After years of studying far from home, Catherine recently took a job in the town she grew up in. Within a month of coming home, her cousin Becky asked her to attend a camping trip in the woods.
<b>Consistent Elaboration</b>	Jamie really wanted to go to a country where he could speak the language. Luckily, he was able to choose a trip to China.	Cathine loved the wilderness. She appreciated the nature around her, from the chirping birds to the gentle forest breeze.
<b>Inconsistent Elaboration</b>	Jamie didn't want to study abroad anywhere he didn't know the language. He knew Spanish and French, which opened up a few opportunities.	Catherine despised the wilderness. The insects and reptiles creeped her out, and she felt disgusting without a shower.
<b>Causal Elaboration</b>	Jamie didn't want to study abroad anywhere he didn't know the language. He knew Spanish and French, which opened up a few opportunities. That semester, Jamie started to learn Chinese, and	Catherine despised the wilderness. The insects and reptiles creeped her out, and she felt disgusting without a shower. That night, however, she watched the sunset, which was so beautiful that it changed

	after a year, he felt ready to go to China.	Catherine's opinion of nature.
<b>Filler (All)</b>	After settling on his destination, Jamie prepared himself for the trip. First, the security line took two hours. Then, the flight was quite a bit longer than he had anticipated.	Becky had been one of Catherine's closest relatives when they were children. It had been a long time since they had been together. Because of this, Catherine was excited and happy.
<b>Target Sentences (All)</b>	During the time he visited in <b>China</b> , he saw cities such as like Beijing and Shanghai.	Catherine had a great time <b>hiking</b> . The trip was a great way to relax.
<b>Comprehension Question</b>	Did Jamie travel to Beijing?	Did Catherine lose her job?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>25 ("wedding")</b>	<b>26 ("Biologist")</b>
<b>Introduction (All)</b>	Linda was very excited to attend the wedding of her best friend Celia. The wedding was to be held at a rebuilt barn about two hours away from Linda's house.	Crystal, an experienced biologist, was preparing for a trip at sea. This was the first time she would be doing research in the field.
<b>Consistent Elaboration</b>	Linda was a very competent driver, and was always happy to take car trips. Also, she was a very punctual person to begin with.	Crystal studied small bacteria, but she was excited to swim with the fish they lived among. She had become a biologist originally because she loved animals so much.
<b>Inconsistent Elaboration</b>	Linda was not a good driver, and always ended up lost and late. Her boss, as a joke, began pushing back her start	Crystal studied small bacteria found at sea, but did not want to swim with the other sea life in the ocean. She largely

	time.	stayed in the lab staring into a microscope.
<b>Causal Elaboration</b>	Linda was not a good driver, and always ended up lost and late. Her boss, as a joke, began pushing back her start time. Because she didn't want to be late to the wedding, she practiced driving there twice beforehand and became very familiar with the road.	Crystal studied small bacteria found at sea, but did not want to swim with the other sea life in the ocean. She largely stayed in the lab staring into a microscope. After some self-evaluation, however, Crystal decided some time in the water might be good for her.
<b>Filler (All)</b>	The day of the wedding was sunny and cool. Linda had a light lunch and finished some cleaning. Then, she got dressed and set out with a present in the car	The research ship was to be at sea for 6 months. They would stop at several ports along the way. Crystal was accompanied by a number of other scientists and engineers.
<b>Target Sentences (All)</b>	As she expected, Linda arrived at the church <b>early</b> . She spent some time in her car messing with her hair.	As soon as she could, Crystal went for a <b>swim</b> . The ocean water of the coast was resplendent in the sun.
<b>Comprehension Question</b>	Was the wedding held in a barn?	Was Crystal an engineer?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>27 ("Packing Lunch")</b>	<b>28 ("Soccer")</b>
<b>Introduction (All)</b>	Hans started his new office job two weeks ago. The job requires Hans to take a lunch break everyday at 12:00.	Terri's parents wanted her to become more active. Because her father used to play, Terri was encouraged to play soccer.

<b>Consistent Elaboration</b>	Hans loved to cook, so he greatly anticipated his lunches. He would feast on his delicious homemade fare.	Terri was actually excited to play on the soccer team. Two of her best friends played, and she was quicker than either of them.
<b>Inconsistent Elaboration</b>	Hans didn't look forward to lunch. He didn't cook, and didn't feel like walking to get something.	Terri was scared to play on the soccer team. She didn't like practicing and spent most of the time standing off to the side of the field.
<b>Causal Elaboration</b>	Hans didn't look forward to lunch. He didn't cook, and didn't feel like walking to get something. Because eating out became too expensive, Hans gave in and decided to start cooking his own lunches.	Terri was scared to play on the soccer team. She didn't like practicing and spent most of the time standing off to the side of the field. After attending a soccer clinic, however, Terri felt more confident in her improved skills.
<b>Filler (All)</b>	His office had 13 other people working in it. They usually went out to eat in small groups. Because he was new, Hans initially kept to himself.	Terri's parents drove her to her first game. It was a chilly October day. The school fields gradually appeared on the right of the car.
<b>Target Sentences (All)</b>	As soon as they left, Hans dug into some of his <b>cooking</b> . He had made a new chicken salad recipe.	Terri excitedly ran out to the <b>field</b> . She couldn't wait for the game to start.
<b>Comprehension Question</b>	Was Hans new at his job?	Did Terri's mother play soccer?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>29 ("Games")</b>	<b>30 ("Sushi")</b>
<b>Introduction (All)</b>	Jason's roommate in	Garet recently moved to

	his apartment had the newest video game console and games. It was a sleek-looking black box with complicated, wireless controllers.	New York City from his small town in Ohio. One of the first things that surprised him was the great variety of food that was available everywhere.
<b>Consistent Elaboration</b>	Jason loved playing videogames. He found it hard to put the controller down and go to bed at night.	Garet especially enjoyed the many different types of sushi. He liked watching them roll the fish and vegetables inside the rice and seaweed.
<b>Inconsistent Elaboration</b>	Jason didn't really like playing videogames. He made a schedule with his roommate so he could watch sports when he wanted.	As tolerant of food as he was, Garet was disgusted by the notion of sushi. He had never tried it, but the idea of raw fish made him sick to his stomach.
<b>Causal Elaboration</b>	Jason didn't really like playing videogames. He made a schedule with his roommate so he could watch sports when he wanted. Despite this, Jason's roommate convinced him to give a few of his videogames another shot, which ended in Jason really enjoying them.	As tolerant of food as he was, Garet was disgusted by the notion of sushi. He had never tried it, but the idea of raw fish made him sick to his stomach. Once Garet's dad forced him to try sushi, however, it became his new favorite food.
<b>Filler (All)</b>	Jason worked in town at an accounting firm. He still hadn't purchased a car. The city ran several buses that he was able to take downtown.	Garet lived in the lower east side of Manhattan. He enjoyed the multitude of stores and restaurants within walking distance of his apartment. Having so

		many options appealed to him.
<b>Target Sentences (All)</b>	During the first week in the new apartment, Jason stayed up late playing <b>videogames</b> . He barely made it to work on time.	At least three days a week Gareth stopped for <b>sushi</b> . Lately he had a taste for eel.
<b>Comprehension Question</b>	Did Jason's roommate have a video game consol?	Did Gareth live in Los Angeles?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>33 ("Pens")</b>	<b>34 ("Sunburn")</b>
<b>Introduction (All)</b>	Kara liked spending time in her classes. She preferred to sample broadly from the offerings at her school. This semester, she was taking her first course on Russian.	Zeke was preparing for all the fun activities he was going to do this summer. They included hiking, swimming, biking and plenty of sports.
<b>Consistent Elaboration</b>	Because she picked up the Russian language quickly, Kara used pens on assignments and tests.	Zeke was always sure to put sunscreen on. Healthy skin was important to Zeke and he did not like to get sunburned.
<b>Inconsistent Elaboration</b>	Kara rarely used a pen to complete her Russian assignments and tests. This would result in an unreadable mess.	Zeke never wore sunscreen. He did not like how it felt on his skin and he thought it smelled weird.
<b>Causal Elaboration</b>	Kara rarely used a pen to complete her Russian assignments and tests. This would result in an unreadable mess. One day, however, Kara decided that challenging	Zeke never wore sunscreen. He did not like how it felt on his skin and he thought it smelled weird. All it took, however, was one horrific case of sunburn



	herself to use a pen might force her to actually learn the language.	to convince Zeke to change his ways.
<b>Filler (All)</b>	Kara had made a number of new friends this semester. Often, they would meet before class to compare notes. Meeting people had been easier than she had expected.	One hot morning in August, Zeke rode his bike over to his friend Andy's house. Andy had slept in, so Zeke had to wake him up. This was a regular occurrence.
<b>Target Sentences (All)</b>	On her final Kara used her favorite <b>pen</b> . To her surprise, she rarely had to correct an answer.	They decided to swim, so Zeke put on <b>sunscreen</b> . Andy's pool was big and in-ground.
<b>Comprehension Question</b>	Was Kara taking a class on Russian?	Did Zeke plan his winter activities?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>35 ("Dodgeball")</b>	<b>36 ("Gym")</b>
<b>Introduction (All)</b>	Every Tuesday Cassie had gym class. She could participate in all sorts of activities like capture the flag and kickball. Last week Cassie's class introduced dodgeball.	Randy was getting older. He knew his body would start to reflect this, so Randy started looking for ways to stay healthy.
<b>Consistent Elaboration</b>	Cassie was one of the better students at dodgeball and was always first picked. Her throws were very accurate and she always caught the most balls in the game.	Since he wanted to stay strong Randy started going to the gym on a regular basis. He worked every muscle group.
<b>Inconsistent Elaboration</b>	Cassie was never a fan of dodgeball. She was definitely not one of the first picks. Cassie mostly	Randy tried to do everything he could except going to the gym. He started eating better

	stayed off to the side trying not to get hit rather than playing.	and going on walks.
<b>Causal Elaboration</b>	Cassie was never a fan of dodgeball. She was definitely not one of the first picks. Cassie mostly stayed off to the side trying not to get hit rather than playing. Once Cassie's teacher told her she would lose points if she did not participate more, she ended up actually enjoying herself.	Randy tried to do everything he could except going to the gym. He started eating better and going on walks. One day his wife commented on how unhealthy he looked, which was all the motivation he needed to start going to the gym.
<b>Filler (All)</b>	Cassie went to a large school with students from several different counties. Because of this, there were four separate gym sections. Each section held almost 100 students.	Of course, being healthy is difficult. Randy has his moments of slipping just like everyone else. He was particularly fond of sneaking off for ice cream.
<b>Target Sentences (All)</b>	Every Tuesday, Cassie tried to play <b>dodgeball</b> . It was her favorite exercise.	More frequently, Randy went to the <b>gym</b> . He was starting to really enjoy himself.
<b>Comprehension Question</b>	Did Cassie go to a large school?	Was Randy young?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>37 ("Gardening")</b>	<b>38 ("Website")</b>
<b>Introduction (All)</b>	Jasmine's favorite time of the year is Spring. She loves the smell in the air as the earth thaws, and the feel of the warming morning sun.	Cody was a prolific author who published dozens of books and other writings. He was known for not only writing a lot, but writing in a number of different

		styles.
<b>Consistent Elaboration</b>	Jasmine was excited to start on her garden. She bought seeds, a trowel and a watering can.	Cody also created a website for himself. He chose a dark blue background to match the gloomy mood of his detective novels.
<b>Inconsistent Elaboration</b>	As much as Jasmine liked to watch things grow, she hated gardening. After ten minutes she was covered with sweat and dirt.	Cody knew absolutely nothing about computers or personal websites. He felt those were tacky for truly accomplished authors.
<b>Causal Elaboration</b>	As much as Jasmine liked to watch things grow, she hated gardening. After ten minutes she was covered with sweat and dirt. Despite how much she hated the process, no one could deny that Jasmine's garden always looked great.	Cody knew absolutely nothing about computers or personal websites. He felt those were tacky for truly accomplished authors. Nevertheless, he realized that online marketing is growing by the second, and he ended up making a website.
<b>Filler (All)</b>	Jasmine's neighbor, Ben, was a widower who would often ask her over for tea in the afternoon. Ben would discuss current events, generally disagreeing with them. Jasmine would nod and smile.	Cody was as well-known for his short stories as his longer novels. He won the O'Henry Prize for short fiction four times. He liked the constraints placed on him by short writings.
<b>Target Sentences (All)</b>	Jasmine was proud of her <b>garden</b> , and often showed it off to Ben.	Cody thought his fiction was a perfect focus for his <b>website</b> . He often posted unpublished work.
<b>Comprehension Question</b>	Is Spring Jasmine's favorite time of year?	Was Cody a new author?

Comprehension Question Answer	Yes	No
<b>BLOCK</b>	<b>39 ("Two Jobs")</b>	<b>40 ("New Car")</b>
<b>Introduction (All)</b>	Rachel was starting to get behind on her bills. Her one job alone wasn't enough, so she started thinking about what she could do to make more money.	Brandon's car was reaching the end of its days. It didn't pass the last inspection, so he needed to get a new one as soon as possible.
<b>Consistent Elaboration</b>	Rachel was surprised at how much extra time she had during the week. She decided to get a second job as a waitress to help pay her bills.	In order to save money Brandon opted to buy a used car. He went to the dealer looking for a fairly decent replacement for around \$3,000.
<b>Inconsistent Elaboration</b>	Rachel thought about getting a second job to make extra money. Unfortunately Rachel didn't have enough time in her schedule.	Brandon did not want a used car. He wanted a brand new car in bright red with a sunroof and a leather interior.
<b>Causal Elaboration</b>	Rachel thought about getting a second job to make extra money. Unfortunately Rachel didn't have enough time in her schedule. One day she didn't have enough money to pay her phone bill, so she decided she had to make time for a second job.	Brandon did not want a used car. He wanted a brand new car in bright red with a sunroof and a leather interior. Brandon quickly realized that a new car would be way to much money so he settled on buying a used car.
<b>Filler (All)</b>	Rachel had moved to the city a year ago. She was from a small town, and considered herself happy in either place. Wherever she lived,	Brandon's friend drove with him across town to the dealership. It was on a busy street lined with restaurants. The dealership sat smack in

	there she was.	the middle of the block.
<b>Target Sentences (All)</b>	Soon, Rachel had a second <b>job</b> . She worked an Italian restaurant in midtown.	He finally decided on something <b>used</b> , picking it because it fit his price range.
<b>Comprehension Question</b>	Did Rachel live in the city?	Did Brandon buy a new truck?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>41 ("Studying")</b>	<b>42 ("Chess")</b>
<b>Introduction (All)</b>	Candice was a freshman in college. She received relatively good grades in high school. However, she didn't receive any special scholarships.	Eilene was looking for a club to join at school. She was interested in many things already, but also wanted to try something new.
<b>Consistent Elaboration</b>	Candice made studying her number one priority. After class she would go back to her dorm room and do all the reading and homework for her next class.	Eilene joined the chess club even though she had never really played before. She ended up being a very good player and within a few practices she was one of the best.
<b>Inconsistent Elaboration</b>	Candice thought that she would be able to get by if she only skimmed her assigned chapters. She felt that she was smart enough, so she didn't study much.	When Eilene joined the chess club, she was amazed at how difficult it was. Eilene was so bad at chess that she considered quitting and joining another club.
<b>Causal Elaboration</b>	Candice thought that she would be able to get by if she only skimmed her assigned chapters. She felt that she was smart enough, so she didn't study much. After getting C's in all her classes, Candice learned	When Eilene joined the chess club, she was amazed at how difficult it was. Eilene was so bad at chess that she considered quitting and joining another club. Eilene started meeting with a chess veteran

	that if she wanted to get good grades, she'd have to work for it.	weekly, and, before long, she was just as good as the other members.
<b>Filler (All)</b>	Candice really liked the school she was at. It was in a city, but the campus featured a main quad. The quad was surrounded by small, beautiful buildings.	Eilene liked having a full schedule. To keep her energy up, she made sure to bring a snack to her club meetings. Lately, she liked granola bars.
<b>Target Sentences (All)</b>	Everyday Candice spent two hours <b>studying</b> , and spent even more time if she had a test coming up.	Last weekend there was a chess competition at the school and Eilene <b>won</b> . She got a 300-dollar prize!
<b>Comprehension Question</b>	Was Candice's school in the city?	Did Eilene like to be bored?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>43 ("Bus")</b>	<b>44 ("Sorority")</b>
<b>Introduction (All)</b>	Harold just got a new job in the city. The office wasn't too far away from his apartment, so Harold was considering alternative forms of transportation besides a car.	Jackie was thinking about pledging a sorority. She was hesitant at first, but she decided to try it out because it was a great way to meet new people.
<b>Consistent Elaboration</b>	The bus came to mind most readily for Harold. He did not mind riding it at all. There were strangers on the bus, but they did not bother him because he would listen to his MP3 player.	Jackie had a great time and got along with all of the sorority sisters. Everyone was so nice and welcoming and she felt like she fit right in.
<b>Inconsistent Elaboration</b>	Harold knew straight away that the bus was not an option. The bus	Jackie's first day at the sorority was a disaster. Many of the sisters told

	<p>was very cramped for him and he always felt he was riding with the strangest people. Instead, he liked riding his bike to work.</p>	<p>her that she wouldn't fit in and they made fun of her clothes.</p>
<b>Causal Elaboration</b>	<p>Harold knew straight away that the bus was not an option. The bus was very cramped for him and he always felt he was riding with the strangest people. Instead, he liked riding his bike to work. Soon, Harold realized that riding his bike would take too long, so he had no choice but to take the bus.</p>	<p>Jackie's first day at the sorority was a disaster. Many of the sisters told her that she wouldn't fit in and they made fun of her clothes. However, her attitude about the sorority softened after spending time with two of the sisters.</p>
<b>Filler (All)</b>	<p>His job usually offered a reasonable schedule. He could usually sleep until 8am. This morning, he had to get to his office earlier than usual.</p>	<p>Jackie was walking along one Friday and stopped by a bulletin board. There was a flyer for a concert she had tickets to that night. Beside this was a notice for a party at a sorority.</p>
<b>Target Sentences (All)</b>	<p>Harold spent about half an hour waiting for the <b>bus</b>, and didn't have enough time to finish his work.</p>	<p>Jackie's decision was easy; she would go to the <b>party</b>, and cancel the reservation of ticket to the concert.</p>
<b>Comprehension Question</b>	<p>Did Harold take a bus?</p>	<p>Was Jackie in High School?</p>
<b>Comprehension Question Answer</b>	<p>Yes</p>	<p>No</p>
<b>BLOCK</b>	<p><b>45 ("Rollercoaster")</b></p>	<p><b>46 ("Dancing")</b></p>
<b>Introduction (All)</b>	<p>Christian had been to amusement parks before.</p>	<p>Amilee never danced before, but decided to</p>

	He liked to look at the masses of people moving around. Last weekend, Christian went to the amusement park with his friends.	start learning after she watched a professional performance. She signed up for a dancing class the next day.
<b>Consistent Elaboration</b>	Christian didn't want his friends to regard him as coward, so he decided to try out the rollercoaster. He ended up loving it and couldn't wait for the next one.	It turned out that Amilee had a natural talent for dancing. She was good at getting the moves and memorizing the steps.
<b>Inconsistent Elaboration</b>	Christian was terrified of high speeds and heights, so he didn't accompany his friends on certain rides. While they rode the highest rollercoaster, Christian played on his phone.	It turned out that Amilee found dancing very difficult. She was frustrated because her form was poor and she kept forgetting the moves.
<b>Causal Elaboration</b>	Christian was terrified of high speeds and heights, so he didn't accompany his friends on certain rides. While they rode the highest rollercoaster, Christian played on his phone. Christian's friends teased him about refusing to ride, so he gave the rollercoaster a shot, and ended up having a great time.	It turned out that Amilee found dancing very difficult. She was frustrated because her form was poor and she kept forgetting the moves. Once Amilee found a dance instructor that offered to help her with private lessons, however, she started to get the hang of it.
<b>Filler (All)</b>	Christian and his friends made sure to eat funnel cakes and corn dogs for lunch. After lunch they played a few carnival games. Christian	For the end of semester recital, the whole school was invited. The recital was advertised across campus. The dancers wore their finest



	excelled at darts.	costumes.
<b>Target Sentences (All)</b>	The highlight of Christian's day was the <b>rollercoaster</b> . He rode it ten more times before he left.	The class instructor decided that Amilee would be the <b>lead</b> . Amilee received many flowers from her friend and family.
<b>Comprehension Question</b>	Was Christian with his friends?	Was Amilee an experienced dancer?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>47 ("Notetaking")</b>	<b>48 ("Tantrums")</b>
<b>Introduction (All)</b>	Wayne had just started his first year of college. In high school he got good grades. He planned to pursue a major in political science.	Sally was an only child. Because of this, her parents were inclined to attend to her. If Sally wanted a new toy or a new pretty dress, her parents usually gave it to her.
<b>Consistent Elaboration</b>	Wayne always took very detailed and well organized notes. He studied for hours every night, not just before tests.	When her parents occasionally told her, "no," Sally always threw tantrums until her parents gave in. This usually worked, especially in public places.
<b>Inconsistent Elaboration</b>	Wayne never took notes during lectures. He was confident that he would be able to get good grades by just going to class.	When her parents occasionally told her, "no," Sally never threw any tantrums. She was always very polite in public places.
<b>Causal Elaboration</b>	Wayne never took notes during lectures. He was confident that he would be able to get good grades by just going to class. Because he got a	When her parents occasionally told her, "no," Sally never threw any tantrums. She was always very polite in public places. However,

	C- on his first exam, however, Wayne decided it was time to start taking notes.	as Sally approached her teen years, she began to develop a temper.
<b>Filler (All)</b>	Wayne really enjoyed college and his newfound freedom. He made a lot of new friends. He often spent weekends completely out of his dorm room.	One day, Sally was at the grocery store with her parents. She asked her parents for chocolate covered marshmallows. Her parents said "no".
<b>Target Sentences (All)</b>	When Wayne's parents saw his final grades they were very <b>proud</b> . Wayne's hard work had paid off.	As usual, Sally had a <b>tantrum</b> . Her parents were embarrassed and finished their shopping quickly.
<b>Comprehension Question</b>	Was Wayne in college?	Was Sally a teenager?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>49 ("Trick or Treats")</b>	<b>50 ("Donating")</b>
<b>Introduction (All)</b>	Gerard had lived in the same neighborhood all his life. It was the kind of neighborhood where everyone took house decorating for the holidays very seriously.	Grace just went shopping for high school. She was looking through her room deciding what things she was going to keep and what things she was going to donate or throw away.
<b>Consistent Elaboration</b>	Every year during Halloween, Gerard carved jack-o-lanterns that he put all around his yard. He crafted fake ghosts and spiders and hung them from the trees. His house was always spooky.	Grace wasn't attached to her things, so there were only a few items besides clothes and keepsakes that she wanted. She decided to donate all her childhood toys.
<b>Inconsistent Elaboration</b>	Every year during Halloween, Gerard neglected to put up	Grace had a sentimental attachment to many of her things, and not just

	decorations. He did not enjoy making jack-o-lanterns and didn't think all the effort put into making his house spooky-looking was worth it.	her clothing. In particular, her childhood toys were very important to her.
<b>Causal Elaboration</b>	Every year during Halloween, Gerard neglected to put up decorations. He did not enjoy making jack-o-lanterns and didn't think all the effort put into making his house spooky-looking was worth it. After years of his neighbors criticizing him, however, Gerard decided this was the year to start decorating.	Grace had a sentimental attachment to many of her things, and not just her clothing. In particular, her childhood toys were very important to her. It occurred to Grace that by giving her toys away, she would be giving another child the same wonderful memories that she had.
<b>Filler (All)</b>	This year, Gerard had traveled three days before Halloween and wasn't able to come back until Halloween evening. He had a new client who lived a few states away. So, Gerard had to stay fly.	Grace was glad she had some more grown up outfits to wear. The last thing she wanted was to look like her little sister and her friends. They seemed like little children to Grace.
<b>Target Sentences (All)</b>	Therefore, one week from Halloween, he decided to <b>decorate</b> , and get everything ready.	Grace rode with her mother to the donation center with a bag of <b>toys</b> . All told the trip took about two hours and Grace felt even older.
<b>Comprehension Question</b>	Did Gerard have to travel during Halloween?	Did Grace go shopping for toys?
<b>Comprehension Question</b>	Yes	No

Answer		
BLOCK	51 ("Smartphone")	52 ("Drying dishes")
<b>Introduction (All)</b>	Olaf was raised in the days before mobile phones. As the years went by, more and more people started getting cell phones, and eventually it became necessary for Olaf to get a phone, too.	Like most other children, Shelly had a number of chores to do around the house. Every week she had to take out the trash. She also had to feed the dog and wash the dishes after dinner.
<b>Consistent Elaboration</b>	Olaf wanted to purchase a smartphone to use. While it was more expensive, he could surf the internet wherever he wanted and play games any time he was bored.	When Shelly washed the dishes, she was sure to clean every dish thoroughly. After all the dishes were clean, she would dry them with a towel.
<b>Inconsistent Elaboration</b>	Olaf decided that he would be content with a simple cell phone. It was cheaper, and all he really needed to do was make the occasional phone call.	When Shelly washed the dishes, she was very sloppy. She would always leave bits of food on them and stack the plates, still dirty, next to the sink.
<b>Causal Elaboration</b>	Olaf decided that he would be content with a simple cell phone. It was cheaper, and all he really needed to do was make the occasional phone call. Once his friend showed him all the awesome things one can do with a smartphone, however, Olaf was enthralled with the devices.	When Shelly washed the dishes, she was very sloppy. She would always leave bits of food on them and stack the plates, still dirty, next to the sink. Noticing this, Shelly's father lectured her on the dangers of bacteria and the necessity of cleaning the dishes sufficiently.
<b>Filler (All)</b>	Olaf went to the cell phone store. He was told	One night, Shelly and her family had steak and

	there were several types of phones on sale. He could see dozens of phones along two of the stores walls.	mashed potatoes for dinner. They ate for what seemed like hours. When everyone was finally finished, Shelly headed into the kitchen.
<b>Target Sentences (All)</b>	Considering his needs, Olaf decided on a <b>smartphone</b> , and also got a new number.	She washed the dishes until they were <b>spotless</b> , then she dried them and stacked them neatly in the cupboard.
<b>Comprehension Question</b>	Was Olaf a young child?	Did Shelly live with her boyfriend?
<b>Comprehension Question Answer</b>	No	No
<b>BLOCK</b>	<b>53 ("Haircut")</b>	<b>54 ("Coffee")</b>
<b>Introduction (All)</b>	Royce had the curliest hair anyone had ever seen. Straightening it was impossible. Royce liked his hair because it made him feel unique.	Janet was definitely not a morning person. No matter how many hours of sleep she got, she was cranky every morning.
<b>Consistent Elaboration</b>	Every once in a while his hair would get too long and Royce would have to cut it. He liked getting his hair cut because getting haircuts kept his hair looking stylish.	Janet drank a lot of coffee. The caffeine helped her stay energized all day. She preferred to drink it without cream or sugar, so that she would get the best taste.
<b>Inconsistent Elaboration</b>	Royce hated getting haircuts. He wanted to let his hair grow as long as it could as a statement. His last haircut was three years ago and it was getting long.	Janet considered drinking coffee, but she thought it tasted awful. She could really use the caffeine boost to get her through her day, so she relied on energy drinks instead.
<b>Causal Elaboration</b>	Royce hated getting haircuts. He wanted to	Janet considered drinking coffee, but she

	let his hair grow as long as it could as a statement. His last haircut was three years ago and it was getting long. Royce's girlfriend, fed up with his loose hairs being left all over the furniture, begged him to get a haircut.	thought it tasted awful. She could really use the caffeine boost to get her through her day, so she relied on energy drinks instead. Once Janet's mom suggested she add cream and sugar to her coffee, however, she began to love the taste.
<b>Filler (All)</b>	One day, Royce was walking down Main street looking for something to eat. He noticed a new barber had moved in across from the diner. He thought for a moment.	Janet worked as a sales associate at a department store. Mostly she answered phones and rang people up. Occasionally a guy would flirt with her.
<b>Target Sentences (All)</b>	Royce got a <b>haircut</b> , because he thought it emphasized his strong jawline.	Everyday, Janet drank four cups of <b>coffee</b> , making the work day a lot more bearable.
<b>Comprehension Question</b>	Did Royce have curly hair?	Did Janet work at a convenience store?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>55 ("Motorcycle")</b>	<b>56 ("Bike Helmets")</b>
<b>Introduction (All)</b>	Cassandra always drove her car with the windows down. She loved the smell of fresh air and the feeling of the wind in her hair. She decided she wanted to buy a new vehicle so that she could enjoy the outside more while she drove.	Leeroy's parents got him a new bike for his birthday and Leeroy wanted to ride it right away. All of his friends already had bikes without training wheels.
<b>Consistent Elaboration</b>	Cassandra knew that a	Leeroy always listened

	motorcycle would be perfect. It gave her the ultimate amount of wind in her hair and sun on her skin. Plus, it was much cheaper than a car.	to his parents when they told him to wear his helmet. It was very important to Leeroy that he was safe in the case of an accident.
<b>Inconsistent Elaboration</b>	Cassandra wasn't sure what she wanted to drive. She knew she liked to feel safe on the road. Big trucks freaked her out when they passed her.	Like his friends, Leeroy never wore his helmet when he rode his bike. He thought the helmet was stupid and made him look like a dork.
<b>Causal Elaboration</b>	Cassandra wasn't sure what she wanted to drive. She knew she liked to feel safe on the road. Big trucks freaked her out when they passed her. Upon realizing how expensive a reliable, safe car was, however, Cassandra turned her attention toward motorcycles.	Like his friends, Leeroy never wore his helmet when he rode his bike. He thought the helmet was stupid and made him look like a dork. Once one of his friends wrecked and badly injured his head, however, Leeroy and all his buddies changed their minds about helmets.
<b>Filler (All)</b>	Cassandra checked her bank account to be sure she could afford it. It looked like she definitely had enough money for something new. She took a trip into the city on the weekend.	Leeroy loved his new bike. He even bought fancy back pegs for it. One day, Leeroy's friends invited him to ride bikes at the park.
<b>Target Sentences (All)</b>	Cassandra bought herself a black <b>motorcycle</b> , and soon became an everyday rider.	Leeroy rode up to his friends wearing a <b>helmet</b> , knowing it would keep him safe as he rode around.

<b>Comprehension Question</b>	Did Cassandra drive?	Did Leeroy's parents buy him a car?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>57 ("Dollhouse")</b>	<b>58 ("Comic Books")</b>
<b>Introduction (All)</b>	Christmas time was fast approaching and Megan just finished her wish list to send to Santa Claus. She addressed the letter to the North Pole and put a stamp on it.	Some people collect seashells or stamps, but Josiah had never really collected anything. Josiah's friend told him that starting a collection would be a fun hobby. Because it was his friend, Josiah agreed.
<b>Consistent Elaboration</b>	On the top of her list was a pony. Megan wanted a pony so bad, getting anything else for Christmas would be a terrible let-down.	Josiah knew right away that comic books were what he wanted to collect. He enjoyed the stories and artwork, but also the history of the characters.
<b>Inconsistent Elaboration</b>	On the top of her list was a new dollhouse. Megan wanted a dollhouse so bad, getting anything else for Christmas would be a terrible let-down.	Josiah knew right away that baseball cards were what he wanted to collect. He enjoyed looking at the pictures and stats of the players.
<b>Causal Elaboration</b>	On the top of her list was a new dollhouse. Megan wanted a dollhouse so bad, getting anything else for Christmas would be a terrible let-down. That was, at least, until her friends told her that dollhouses are lame and for little girls.	Josiah knew right away that baseball cards were what he wanted to collect. He enjoyed looking at the pictures and stats of the players. Because Josiah was a big fan of superheroes, he decided to start collecting comic books as well.
<b>Filler (All)</b>	On Christmas eve,	Josiah often went to flea



	Megan and her parents made sugar cookies. They sat around the Christmas tree and sang Christmas carols together. Soon, it was time for bed.	markets and yard sales. He always found tons of cool, old stuff. Every once in a while, he found the perfect addition to his collection.
<b>Target Sentences (All)</b>	When Megan got a dollhouse she was <b>furious</b> . What was Santa thinking?	One Sunday, Josiah bought dozens of <b>comics</b> . He bought so many he had to hide them from his mom.
<b>Comprehension Question</b>	Did Megan get a dollhouse for Christmas?	Did Josiah's brother get him into collecting things?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>59 ("Fishing")</b>	<b>60 ("Political Science")</b>
<b>Introduction (All)</b>	Sandy was looking for things to do. Without any homework, she had so much time on her hands. One day, Sandy's uncle invited her to go fishing with him.	Caroline was excited to start college. She got into the school that she wanted but needed to decide on what she wanted to study.
<b>Consistent Elaboration</b>	Although she had never been fishing before, Sandy was very excited. She caught three fish in the first hour. Sandy was having so much fun.	Caroline's parents encouraged her to do anything she wanted, as long as it would make her happy. Caroline had her mind set on becoming a engineer, so she took science and math classes for her first semester.
<b>Inconsistent Elaboration</b>	Sandy was unsure whether she had ever done anything more boring in her entire life. She sat there for three	Caroline's parents encouraged her to do anything she wanted, as long as it would make her happy. Caroline

	hours without even a nibble. She hated fishing.	loved debating and was going to be a great lawyer one day, so she took political science classes her first semester.
<b>Causal Elaboration</b>	Sandy was unsure whether she had ever done anything more boring in her entire life. She sat there for three hours without even a nibble. She hated fishing. After her uncle suggested that she use live bait instead of lures, however, Sandy had great success.	Caroline's parents encouraged her to do anything she wanted, as long as it would make her happy. Caroline loved debating and was going to be a great lawyer one day, so she took political science classes her first semester. After many bad grades and a loss of interest, Caroline soon decided to switch her major to engineering.
<b>Filler (All)</b>	At the end of the day, Sandy helped her uncle carry the gear back to the car. On the ride home, Sandy slept. She woke as they pulled into her driveway.	Caroline loved her classes. Her professors were brilliant and she was learning so much. Her classmates also were a source of support and knowledge.
<b>Target Sentences (All)</b>	Sandy couldn't wait for the next time she <b>fished</b> . Going to the creek would be great fun.	After graduating she was offered a job as an <b>engineer</b> . All her hard work paid off.
<b>Comprehension Question</b>	Did Sandy's Uncle take her fishing?	Did Caroline's Grandfather pay her tuition?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>61 ("Recycling")</b>	<b>62 ("Basketball")</b>
<b>Introduction (All)</b>	Clive was the person	Dennis was in middle

	that all his friends went to when they wanted to have a party. He just knew how to make sure everyone was having a fun time. Because he helped plan the parties, he felt like he had to help clean up afterward as well.	school and wanted to join a sports team. Basketball and soccer were both very popular sports at his school. Dennis had never played either. He decided to try-out for both teams and see which one he was better at.
<b>Consistent Elaboration</b>	When cleaning up, Clive recycled everything he could. He would recycle even the smallest piece of confetti and the caps to glass bottles.	Dennis was pretty natural at soccer. In fact, his speed made him a formidable opponent even before he really knew anything.
<b>Inconsistent Elaboration</b>	When cleaning up, Clive was notorious for throwing away everthing. He tossed all the decorations,and even glass bottles and aluminum cans.	Dennis was pretty natural at basketball. In fact, his height made him a formidable opponent even before he really knew anything.
<b>Causal Elaboration</b>	When cleaning up, Clive was notorious for throwing away everthing. He tossed all the decorations,and even glass bottles and aluminum cans. This changed when Clive threw away a plastic bottle, and the sanitation worker asked him why he didn't love the earth.	Dennis was pretty natural at basketball. In fact, his height made him a formidable opponent even before he really knew anything. Nevertheless, his coach rarely took him off the bench, and his friends suggested he focus his attention on soccer instead.
<b>Filler (All)</b>	One day, Clive was planning a house-warming party for his friend. His friend had	Both teams practiced on Monday and Wednesday afternoons after school. Dennis planned to do his

	just bought his first house. Clive called the caterer and set up decorations.	homework once he got home after practice. He would then practice more.
<b>Target Sentences (All)</b>	When Clive was cleaning up, he threw all the plastic cups into the <b>recycling</b> . Cleaning up today took longer than usual	When the try-out results were posted, Dennis earned a chance to play <b>soccer</b> . He was very nervous to play in an actual game.
<b>Comprehension Question</b>	Did Clive like parties?	Did Dennis hate sports?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>63 ("E-mail")</b>	<b>64 ("Iced Tea")</b>
<b>Introduction (All)</b>	Like many older people, Irving was becoming increasingly aware of new technology. Nowadays, everybody was able to use new ways to communicate.	Cory was always thirsty. Maybe it was in her blood, maybe it was her home in Atlanta, but she always needed a drink nearby. Of course, there were some that she drank much more than others.
<b>Consistent Elaboration</b>	Irving was glad to embrace the 21st century and started utilizing e-mail on a regular basis. Irving used to write letters, but this way was very easy and much more convenient.	Cory's favorite drink has been iced tea for as long as she can remember. It had to be sweetened of course, else Cory wouldn't like it. She liked three spoonfuls of sugar.
<b>Inconsistent Elaboration</b>	Irving really hated technology, especially e-mailing. He preferred to write letters to his friends, and that would never change. Writing was relaxing for him and he thought it was much more personal.	Cory's favorite drink has been iced tea for as long as she can remember. It had to be unsweetened of course, or else Cory wouldn't like it. Cory really couldn't handle the sugar.

<b>Causal Elaboration</b>	Irving really hated technology, especially e-mailing. He preferred to write letters to his friends, and that would never change. Writing was relaxing for him and he thought it was much more personal. This changed when the price of stamps went up, discouraging Irving from writing letters.	Cory's favorite drink has been iced tea for as long as she can remember. It had to be unsweetened of course, or else Cory wouldn't like it. Cory really couldn't handle the sugar. Cory eventually learned that artificial sweeteners didn't negatively affect her like sugar did.
<b>Filler (All)</b>	Every morning at 7am, Irving would make some toast and eggs. Once he was finished with breakfast, he would sit on his porch and watch birds for a while. He had some bluejays that chased littler birds away.	All her friends knew her favorite drink. One day Cory went to visit one of her old friends, and they talked a lot with each other. Her friend stood up and went into her kitchen.
<b>Target Sentences (All)</b>	Then, he would spend an hour writing <b>emails</b> , and hoping he would hear from one of his friends.	Her friend prepared Cory some tea that was <b>sweet</b> , and carried it out into the living room.
<b>Comprehension Question</b>	Was Irving an older man?	Was Cory always hungry?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>65 ("Airplanes")</b>	<b>66 ("Tips")</b>
<b>Introduction (All)</b>	Joann loved to travel. She had been to almost every state in the United States. She collected trinkets from everywhere she visited.	Richard had made plans to take his girlfriend out to dinner at a fancy restaurant. He knew the food would be delicious, but also very expensive.
<b>Consistent Elaboration</b>	Whenever Joann had to travel long distances, she	Richard was a gentlemen, and always

	would fly in an airplane. Joann loved flying because it was really fast and convenient. She liked being able to relax and watch the view from the plane window.	paid above average tips when he went to a restaurant. He knew that waitressing was a hard job.
<b>Inconsistent Elaboration</b>	For as much as she traveled, Joann never flew on an airplane. She was absolutely terrified of flying and always took a bus or a train instead. She was convinced that planes were flying death traps.	Richard was not a nice man, and never tipped, even if the server did an amazing job. He always argued with management when the tip was included.
<b>Causal Elaboration</b>	For as much as she traveled, Joann never flew on an airplane. She was absolutely terrified of flying and always took a bus or a train instead. She was convinced that planes were flying death traps. Joann would only consider flying if her destination was so far away that it was the only practical option.	Richard was not a nice man, and never tipped, even if the server did an amazing job. He always argued with management when the tip was included. But after his girlfriend told him that it embarrassed her when he didn't tip, he had to change his ways to cheer her up.
<b>Filler (All)</b>	One day, Joann's sister called her with excitement. She was getting married in Niagara Falls. Joann was so happy for her sister.	At the restaurant, Richard ordered a big, juicy steak. His girlfriend order a lobster salad. At the end of their dinner, the waiter brought them the bill.
<b>Target Sentences (All)</b>	Joann immediately bought a ticket for a <b>plane</b> . She also started looking for the perfect	As they left, Richard dropped a large <b>tip</b> . It was the best meal they had ever had.

	wedding gift.	
<b>Comprehension Question</b>	Was Joann's sister getting married at Niagara Falls?	Did Richard eat scallops for dinner?
<b>Comprehension Question Answer</b>	Yes	No
<b>BLOCK</b>	<b>67 ("Meditation")</b>	<b>68 ("Cards")</b>
<b>Introduction (All)</b>	Gus read many things about meditation. He read that in addition to helping one control stress, it also helps one cultivate a loving and compassionate mindset.	Stephanie was always on the lookout for fun games and activities to do. She liked to play video games, read books and do sudoku puzzles.
<b>Consistent Elaboration</b>	Gus started meditating about five years ago. It helped him get ready for the day and deal with the stresses of everyday life.	One of Stephanie's favorite activities was playing cards. She was good at a number of card games including bridge and loved to teach people new ways to play.
<b>Inconsistent Elaboration</b>	Although Gus was aware of the benefits of meditation, he didn't have the attention to dedicate. Every time he tried, his mind would wander.	Out of all the things Stephanie liked, playing cards was not one of them. For whatever reason, card games seemed immensely boring to her and she didn't think they were worth doing.
<b>Causal Elaboration</b>	Although Gus was aware of the benefits of meditation, he didn't have the attention to dedicate. Every time he tried, his mind would wander. One day on the way to work, however, an exotically dressed	Out of all the things Stephanie liked, playing cards was not one of them. For whatever reason, card games seemed immensely boring to her and she didn't think they were worth doing. Once she

	guru helped Gus tremendously by saying, "live life as if you were free."	finally paid attention to a game of poker her friends were playing, however, Stephanie became enthralled with card games.
<b>Filler (All)</b>	Gus went to work around ten, but he got up early to have coffee and feed his cat. His cat, Rufus, had been with him for eight years. He quickly ate his food.	On Saturday morning, Stephanie visited a friend's new house. It was just around the corner from her apartment. Quite a few friends and acquaintances were over there, sitting around a table.
<b>Target Sentences (All)</b>	Every day after feeding Rufus Gus would <b>meditate</b> , and it left him feeling clear and energized.	Without hesitation Stephanie started playing <b>cards</b> . She spent the rest of the day doing so with her friends.
<b>Comprehension Question</b>	Does Gus have a dog?	Did Stephanie have lots of friends?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>69 ("Cash")</b>	<b>70 ("Photography")</b>
<b>Introduction (All)</b>	Dale enjoyed living in the modern age of technological advancement. Things like electronic bus passes and debit cards impressed him, with their complicated ways of transferring information.	Ben went to the art museum for a field trip in one of his classes. There were many different types of galleries in the museum. Ben went off with his friends to explore.
<b>Consistent Elaboration</b>	Although Dale liked having a debit card, he never left the house without cash.	Soon Ben found himself in the photography wing. Ben had always appreciated



	<p>Sometimes Dale wanted to buy something that only cost a few dollars, and did not like to use his cards for such everyday purchases.</p>	<p>photography as a unique style of art. He found representations of reality striking.</p>
<p><b>Inconsistent Elaboration</b></p>	<p>Dale never bothered to bring cash with him anymore. Every store he went to accepted his debit card and he never cared about paying a few cents extra if his purchase was under a minimum amount.</p>	<p>Ben found the photography wing boring. To him, photography didn't require as much skill as other forms of art, like sculpture or painting. Indeed, he was captivated by abstract paintings.</p>
<p><b>Causal Elaboration</b></p>	<p>Dale never bothered to bring cash with him anymore. Every store he went to accepted his debit card and he never cared about paying a few cents extra if his purchase was under a minimum amount. After coming across more and more stores that did not accept cards, though, Dale was forced to start carrying cash.</p>	<p>Ben found the photography wing boring. To him, photography didn't require as much skill as other forms of art, like sculpture or painting. Indeed, he was captivated by abstract paintings. Upon listening to his friends' insight, however, Ben was impressed with the emotion these photographs invoked and decided to revisit the photography wing.</p>
<p><b>Filler (All)</b></p>	<p>One day, Dale was out in search of a birthday present for a friend. He found a rare DVD his friend had been looking for at an independent video store near his</p>	<p>Ben and his friends spent almost the rest the day in the exhibition. The overhead speakers announced closing in a half hour. They barely had time to go to the</p>

	house. The store had been around for years and was quite a find.	giftshop.
<b>Target Sentences (All)</b>	He searched his wallet and found his <b>cash</b> , and handed it over to the store owner.	After the visit, Ben decided to take a class in <b>photography</b> . He hoped to display his photographs in a professional gallery one day.
<b>Comprehension Question</b>	Did Dale hate computers?	Did Ben go to the museum with his class?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>71 ("Class")</b>	<b>72 ("Soap Operas")</b>
<b>Introduction (All)</b>	Sherry studied civil engineering in university. Like a good student, she attended all of her classes. Even though she was an engineer, she had to take some general courses.	Chase watched a great deal of television. He was a regular viewer of dozens of programs. Chase was a fan of action shows, comedies, and many other genres.
<b>Consistent Elaboration</b>	Sherry decided to take a course in Psychology to fill her general education requirement. She was very interested in the course and listened attentively every day.	Out of all the different genres of T.V. shows Chase watched, he enjoyed soap operas the most. The emotions of the characters moved him in ways that other shows just could not.
<b>Inconsistent Elaboration</b>	Sherry avoided having to take a Psychology class by signing up for an astronomy course. Astronomy had to be the much more interesting subject.	Though Chase enjoyed a wide variety of television shows, he would never watch soap operas. He disliked how fake they seemed because of the unrealistic plots and the crazy over-acting that

		took place.
<b>Causal Elaboration</b>	<p>Sherry avoided having to take a Psychology class by signing up for an astronomy course. Astronomy had to be the much more interesting subject. To Sherry's surprise, Astronomy did not interest her whatsoever, prompting her to drop the class and pick up Psychology instead.</p>	<p>Though Chase enjoyed a wide variety of television shows, he would never watch soap operas. He disliked how fake they seemed because of the unrealistic plots and the crazy over-acting that took place. Chase's perspective changed when the soap opera his mom was watching made him laugh hysterically.</p>
<b>Filler (All)</b>	<p>Most of Sherry's courses took place two or three times a week. About half of these required extensive reading. However, the other half focused on writing and programming.</p>	<p>Since some of his friends also liked watching TV, they all usually spent Friday watching shows. This Friday, when he arrived they were watching TV as usual. Chase sat on the couch.</p>
<b>Target Sentences (All)</b>	<p>When she saw her friends, Sherry would excitedly tell them about <b>Psychology</b>, and would recommend readings to them.</p>	<p>Chase was excited to watch the newest <b>soap opera</b>, and reached over to grab the remote.</p>
<b>Comprehension Question</b>	Was Sherry a pre-schooler?	Does Chase like TV?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>73 ("Veterinarian")</b>	<b>74 ("Planner")</b>
<b>Introduction (All)</b>	<p>Josie loved animals. She would take any chance she could get to house-sit for her friends so she could play with their pets. Her favorite</p>	<p>Like many other people in the modern world, Carlos led a hectic life. Between classes, a job, a girlfriend, and all other aspects of life, Carlos</p>

	channel to watch was Animal Planet.	was constantly pulled in multiple directions.
<b>Consistent Elaboration</b>	There were many professions that dealt with animals, like dog-grooming or wildlife rescue. More than anything else however, Josie wanted to be a veterinarian.	Because Carlos was so busy, he used a monthly planner. He had a poor memory, so he made sure to write everything down in order to keep track of his schedule.
<b>Inconsistent Elaboration</b>	Although Josie loved animals, there was no way she could ever be a veterinarian. Josie knew that seeing sick animals made her feel terrible.	Carlos didn't use a planner. He didn't write anything down because he had a good memory. He would just commit things to mind and not forget.
<b>Causal Elaboration</b>	Although Josie loved animals, there was no way she could ever be a veterinarian. Josie knew that seeing sick animals made her feel terrible. After some deep thought, however, Josie decided she could not handle the idea of not doing her part to help.	Carlos didn't use a planner. He didn't write anything down because he had a good memory. He would just commit things to mind and not forget. Carlos changed his ways, however, when he forgot to turn in an assignment and pick up his girlfriend in the same day.
<b>Filler (All)</b>	Josie was a great student in high school. In fact, she finished near the top of her class. Her guidance counselor assured her she could get into any program she wanted.	Carlos recently volunteered to be on the student council in his school. This required him to meet several times a month to discuss issues pertaining to student life. He met many fellow students this way.
<b>Target Sentences (All)</b>	Josie applied to a program for	Carlos put all of these new meetings into his

	<b>veterinarians</b> , and was thrilled when she was accepted.	<b>planner</b> , which was very helpful for keeping track of time.
<b>Comprehension Question</b>	Was Josie interesting in becoming a realtor?	Was Carlos a member of student council?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>75 ("Alarm Clock")</b>	<b>76 ("Vacuuming")</b>
<b>Introduction (All)</b>	Throughout high school, Lizzy would often sleep in late. She did all her homework and so she still did well in school, despite this. However, Lizzy had just begun college, and the classes were much harder.	Miguel didn't have to do many chores as a child. His mother and father usually split the chores between themselves because they wanted Miguel to focus on his studies.
<b>Consistent Elaboration</b>	Even though she hated alarm clocks, Lizzy needed one to wake up every morning. She set her alarm to go off at 8 o'clock, two hours before her first class.	The only chore that Miguel regularly had to do was vacuum the floors. About once a week he would vacuum all the floors in the house.
<b>Inconsistent Elaboration</b>	Lizzy was fortunate that she didn't need to be rudely awakened by an alarm clock. She was able to wake two hours before her first class because her internal clock was so regular.	Since Miguel's mother never taught him how to do any chores, he didn't know how to clean. Miguel didn't even know how to properly vacuum.
<b>Causal Elaboration</b>	Lizzy was fortunate that she didn't need to be rudely awakened by an alarm clock. She was able to wake two hours before her first class because her internal clock was so regular.	Since Miguel's mother never taught him how to do any chores, he didn't know how to clean. Miguel didn't even know how to properly vacuum. After Miguel covered the floor in crumbs,

	Lizzy realized how falsely confident she was when she slept in and missed her class one morning.	however, he forced himself to learn how to vacuum and was surprised by how easy it was.
<b>Filler (All)</b>	Midway into the semester, the weather began to turn, and winter was right around the corner. The temperature began dipping below freezing. Lizzy reminded herself to dress in layers.	Miguel really enjoyed living on his own. He appreciated the freedom that college offered him. He kept in touch with his parents by calling them about once a week.
<b>Target Sentences (All)</b>	Early Monday morning Lizzy was woken by her <b>alarm</b> , but really didn't want to go out into the cold.	Miguel made it part of his routine at school to <b>vacuum</b> . His room was surprisingly clean.
<b>Comprehension Question</b>	Was is spring at Lizzy's school?	Did Miguel like living on his own?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>77 ("teethbrushing")</b>	<b>78 ("poetry")</b>
<b>Introduction (All)</b>	Sydney grew up in a single parent home, with a father who had two full-time jobs. Because of this she took care of herself a lot of the time. This included cooking for herself, and driving herself to school in the morning.	Jamal loved to write fiction stories. His favorite thing to do was sit under a tree during the summer and write adventures for his characters.
<b>Consistent Elaboration</b>	Sydney took great pride in her personal hygiene, and would use fancy soaps and toothpaste. She wanted everyone to know she was clean and	Although Jamal wrote fiction, he was also heavily invested in poetry. Jamal felt that poetry allowed him to make certain creative

	healthy.	decisions that wouldn't work in a novel.
<b>Inconsistent Elaboration</b>	Sydney wasn't great at personal hygiene. Although her father would buy soaps and toothpaste, Sydney often forgot to do simple things like brushing her teeth.	Jamal never really experimented with poetry of any kind. He always considered it a sappy and unappealing style fit for hippies and romantics, and was happy to work on novels.
<b>Causal Elaboration</b>	Sydney wasn't great at personal hygiene. Although her father would buy soaps and toothpaste, Sydney often forgot to do simple things like brushing her teeth. However, Sydney changed her mind after several bad trips to the dentist.	Jamal never really experimented with poetry of any kind. He always considered it a sappy and unappealing style fit for hippies and romantics, and was happy to work on novels. Jamal changed his mind when his friend asked him to read his poetry and he realized how good it was.
<b>Filler (All)</b>	Sydney felt like she did a pretty good job taking care of herself. She had become a decent cook, and had about twenty recipes. Also, she was good at waking up on her own.	The school Jamal attended was known for its creative arts department. Writing, in particular, was well represented in the curriculum. There were numerous classes offered each semester.
<b>Target Sentences (All)</b>	The first thing Sydney did each morning was clean her <b>teeth</b> , even if she was running late class.	Without hesitation, Jamal signed up for a class on <b>poetry</b> , feeling it he would enjoy it.
<b>Comprehension Question</b>	Did Sydney's mother have two jobs?	Was Jamal a writer?

Comprehension Question Answer	No	Yes
<b>BLOCK</b>	<b>79 ("Goldfish")</b>	<b>80 ("Baseball")</b>
<b>Introduction (All)</b>	Natalie loved to go to the fair. Every year she would go with her mom, dad and sister. Her favorite thing to do was ride the rides, but there were also hundreds of animals to look at and dozens of games to play.	Jordan loved playing outside with his friends. When he was little, games like tag were sufficient to keep Jordan's attention. As he got older however Jordan's friends started playing team sports.
<b>Consistent Elaboration</b>	At the ring toss game Natalie saw that the prize was a goldfish. Natalie's brother begged their mom to play, and she told Natalie that she could play too. Natalie won a goldfish on her first try.	Jordan told his mom he wanted to play baseball, as a number of his friends had joined the team. He needed a glove, however, so his mom took him out a bought him a fancy new one.
<b>Inconsistent Elaboration</b>	While they were at the fair, Natalie and her brother saw a ring toss game. The prize was a goldfish, and both the kids played a few games. Unfortunately, neither child was able to win.	Jordan told his mom he wanted to play baseball, as a number of his friends had joined the team. He needed a glove, however, and his mom decided it was too expensive to buy him one.
<b>Causal Elaboration</b>	While they were at the fair, Natalie and her brother saw a ring toss game. The prize was a goldfish, and both the kids played a few games. Unfortunately, neither child was able to win. Seeing the disappointment in	Jordan told his mom he wanted to play baseball, as a number of his friends had joined the team. He needed a glove, however, and his mom decided it was too expensive to buy him one. Jordan really wanted to play baseball,



	Natalie's face, the worker told her she was the 1,000th contestant and gave her a goldfish as a special prize.	so he organized a lemonade stand and used the money he made to buy a glove.
<b>Filler (All)</b>	Natalie and her family stayed at the fair late. They wandered taking in the sights, sounds, and smells of the event. She knew that she would be tired the next day, but didn't care.	Jordan spent most of his time playing outside with his friends. They would meet at the park at the end of the road. Sometimes dozens of kids would be there.
<b>Target Sentences (All)</b>	The next morning, Natalie couldn't wait to see her prize <b>goldfish</b> , and to feed him his breakfast.	Jordan would come home from school and grab his <b>glove</b> , and rush out the door to meet his friends.
<b>Comprehension Question</b>	Did Natalie buy a goldfish?	Did Jordan like sports?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>81 ("Volunteering")</b>	<b>82 ( Peggy's Exercise)</b>
<b>Introduction (All)</b>	Alexandra was a member of many different institutions and organizations on her college campus. She went to many clubs and had a lot of classes, so it was hard for her to fit new things into her schedule.	Peggy had gained 40 pounds during her pregnancy. She was currently in a new set of clothes because all of her pre-pregnancy things are too small.
<b>Consistent Elaboration</b>	One of the many activities Alexandra participated in was volunteering at the soup kitchen. She thought it was very important to give back to society and	Peggy's son, Chris, who was now two-years-old and could walk, is active and runs around while Peggy does her sit-ups. In fact, his activity makes her want to get

	aid those who are in need.	back into shape.
<b>Inconsistent Elaboration</b>	Alexandra was so busy that thinking of another activity to do would be too overwhelming, even if it was volunteering. She simply did not have the time needed to help the needy.	Peggy's son, Chris, who was now two-years-old and could walk, is active and runs around while Peggy watched her sit-coms. In fact, his activity makes her want to get back into bed.
<b>Causal Elaboration</b>	Alexandra was so busy that thinking of another activity to do would be too overwhelming, even if it was volunteering. She simply did not have the time needed to help the needy. This changed when Alexandra saw a homeless man sitting in the cold, inspiring her to make time to help the homeless.	Peggy's son, Chris, who was now two-years-old and could walk, is active and runs around while Peggy watched her sit-coms. In fact, his activity makes her want to get back into bed. Noticing how lazy she had become, Peggy decided she needed to start working out before it was too late.
<b>Filler (All)</b>	On most days, Alexandra could be found in the library. The library was the oldest building on campus, and the least comfortable. Alexandra would run from the library to her next scheduled event.	One day while in the living room the telephone began to ring. Peggy hurried into the kitchen to pick up the phone. Peggy picked up the telephone and sat down on a chair.
<b>Target Sentences (All)</b>	For example, Alexandra spent two hours every Tuesday evening <b>volunteering</b> , and kept doing so for several years.	Peggy's legs were sore from the <b>exercise</b> . She bent over to pick Chris up and put her in her lap.
<b>Comprehension Question</b>	Was Alexandra lazy?	Did Peggy have a small child?

Comprehension Question Answer	No	Yes
<b>BLOCK</b>	<b>83 ( Anne and her Horses )</b>	<b>84 ( Claire and Jared's New House)</b>
<b>Introduction (All)</b>	Anne's family had owned horses ever since she was a little girl. Each day Anne would ride her horse in one of the many nearby pastures.	Claire and Jared were ready to buy their first house. Finally, it was the day to meet the realtor to sign all the paperwork.
<b>Consistent Elaboration</b>	Midnight, Anne's horse, was a strong young stallion. He was being trained for racing and was getting stronger as each day passed. Anne could sense the strength of the powerful horse as it carried her weight with ease.	The house they decided to buy was a lovely cottage out in the countryside. Both Claire and Jared grew up in small towns and wanted to raise a family in a similar place.
<b>Inconsistent Elaboration</b>	Midnight, Anne's horse, was a tired old mare. She was too old to perform any strenuous tasks and was unable to jump for even short distances. Anne could sense the fatigue of the frail horse as it strained to carry her weight.	The house they decided to buy was a lovely loft in the city center. Both Claire and Jared grew up in cities and wanted to raise a family in a similar place.
<b>Causal Elaboration</b>	Midnight, Anne's horse, was a tired old mare. She was too old to perform any strenuous tasks and was unable to jump for even short distances. Anne could sense the fatigue of the frail horse as it	The house they decided to buy was a lovely loft in the city center. Both Claire and Jared grew up in cities and wanted to raise a family in a similar place. After a shooting occurred down the street from the loft, however,

	strained to carry her weight. Despite her frail condition, however, Midnight could always display some agility if it was absolutely necessary.	they decided the city wasn't safe enough for a child.
<b>Filler (All)</b>	Today, as Anne was riding, she was distracted by a sound. She looked to where the sound came from and saw her father on a tractor. Because of this, she didn't notice the large ditch immediately in front of her.	Claire and Jared had met in college. Soon after they graduated, they both found employment nearby. They had lived in a small apartment for several years.
<b>Target Sentences (All)</b>	At the ditch the horse <b>jumped</b> , and landed safely on the other side.	They were excited for the big move to the <b>countryside</b> , and quickly packed their belongings.
<b>Comprehension Question</b>	Did Anne own sheep?	Did Claire and Jacob just buy a new home?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>85 ( Robin house-sits)</b>	<b>86 ( Smith's World Travels)</b>
<b>Introduction (All)</b>	Robin loved to spend time at the ocean watching the waves crash against the rocks. She enjoyed the sun and the cool breeze that came off the water.	The Smiths' loved to travel to odd locations around the world. They enjoyed spending time together away from work and school.
<b>Consistent Elaboration</b>	Robin was a strong swimmer and worked every summer as a lifeguard. She had always preferred swimming in the ocean	On their most recent trip, they went on a tour of a tropical rainforest. A heavy mist seemed to rest on the ferns and moss of the

	to lying on the beach, and she really enjoyed swimming through the waves.	muddy forest floor.
<b>Inconsistent Elaboration</b>	However, Robin was a poor swimmer and had avoided the water ever since grade school. She had always preferred staying on the shore to swimming in the water, because the waves always frightened her.	On their most recent trip, they went on a tour of a desert region. A strong wind and strands of stinging pellets of sand brushed against everything.
<b>Causal Elaboration</b>	However, Robin was a poor swimmer and had avoided the water ever since grade school. She had always preferred staying on the shore to swimming in the water, because the waves always frightened her. One day, Robin had to run into the ocean after a beachball, and she was shocked by how fun the waves were.	On their most recent trip, they went on a tour of a desert region. A strong wind and strands of stinging pellets of sand brushed against everything. Unfortunately, the desert climate was too much for the Smiths, so they went to a tropical rainforest for the latter portion of the week.
<b>Filler (All)</b>	This week Robin was house-sitting for a friend. It was a small cottage along a private beach. When she woke up in the morning, she immediately smelled the fresh air.	The Smiths often invited friends over to look at their pictures. Mr. Smith had a slide show of their recent trip ready to go. Mrs. Smith passed out refreshments.
<b>Target Sentences (All)</b>	The first thing she did was go for a nice <b>swim</b> , and had breakfast afterwards.	The first picture overlooked a vast <b>forest</b> . The vista was breathtaking to behold.
<b>Comprehension Question</b>	Was Robin house-sitting	Did the Smiths like to

	for her parents?	travel?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>87 ( Donna’s Birthday)</b>	<b>88 ( Craig Tries a New Sport)</b>
<b>Introduction (All)</b>	Donna’s friends wanted to do something special for her birthday. To celebrate, they decided to treat her to dinner. They went to a new restaurant in the downtown area.	Craig really enjoyed outdoor activities. He was an athletic person and participated in many sports.
<b>Consistent Elaboration</b>	Their hostess at the Italian restaurant greeted her guests and walked them to their table. Donna noticed a chef in the kitchen spinning dough high in the air.	He loved the warm spring weather and the hot days of summer. Because he couldn’t stand the cold weather, he spent his winter vacations in the tropics. Each year he tried a new warm-weather sport.
<b>Inconsistent Elaboration</b>	Their hostess at the Italian restaurant greeted her guests and walked them to their table. Donna noticed a chef in the kitchen throwing knives high in the air as he cut up shrimp.	He loved the winter and he found the cold brisk weather refreshing. In fact, he was planning on spending his vacation in the mountains. Each winter he tried a new cold-weather sport.
<b>Causal Elaboration</b>	Their hostess at the Italian restaurant greeted her guests and walked them to their table. Donna noticed a chef in the kitchen throwing knives high in the air as he cut up	He loved the winter and he found the cold brisk weather refreshing. In fact, he was planning on spending his vacation in the mountains. Each winter he tried a new cold-weather sport.

	shrimp. Donna hated shrimp, so she knew for sure that she wouldn't be ordering any.	Although Craig preferred the winter, he still loved the many sports that the summer had to offer.
<b>Filler (All)</b>	As Donna sat down, all of her friends wished her a happy birthday. Their waitress came to take their dinner orders and then left. They were happy to spend some time together.	Craig was an air-traffic controller at the airport in Boston. Because his job was very demanding, his boss scheduled a short vacation every few months. He just came back from his last trip.
<b>Target Sentences (All)</b>	Soon the waitress set down a giant <b>pizza</b> . It looked like it could serve 20 people.	On this last trip Craig learned how to <b>surf</b> . He came back and bragged about it for weeks.
<b>Comprehension Question</b>	Did Donna just get a new job?	Did Craig go on many trips?
<b>Comprehension Question Answer</b>	No	Yes
<b>BLOCK</b>	<b>89 ( Jack's Camping Trip)</b>	<b>90 ( Jody's Time to Retire)</b>
<b>Introduction (All)</b>	Every year Jack would take a vacation away from the stress of work. On his last vacation he went whitewater rafting. This year he had planned to go camping and hiking by himself.	Jody had been a doctor for a long time, and has always worked hard. She was turning 70 in the fall, which would also be her 25th year at the hospital.
<b>Consistent Elaboration</b>	Jack enjoyed spending time outdoors and loved to hunt and fish. For years Jack has been an officer of his local hunting club. He has been a staunch advocate of the National Rifle Association.	Jody decided that it would be best if she retired. She could no longer see very well and often made errors in judgment. She was looking forward to the retirement.

<b>Inconsistent Elaboration</b>	Jack enjoyed spending time outdoors and also loved wildlife. He strongly opposed the killing of animals for sport. Last Spring he organized a protest against the National Rifle Association.	State law mandated that doctors over seventy must retire. Jody didn't want to retire yet, so she fought this decision. She took her case far, but she lost the final battle.
<b>Causal Elaboration</b>	Jack enjoyed spending time outdoors and also loved wildlife. He strongly opposed the killing of animals for sport. Last Spring he organized a protest against the National Rifle Association. Being open-minded, however, Jack attended a wildlife presentation on the over-population and starvation of deer in areas with no hunting.	State law mandated that doctors over seventy must retire. Jody didn't want to retire yet, so she fought this decision. She took her case far, but she lost the final battle. After being upset for a while, Jody accepted defeat and acquired an optimistic mindset about the idea of relaxing from now on.
<b>Filler (All)</b>	Jack drove his jeep up to the mountains and then hiked to his campsite. After setting up camp, Jack started a camp fire. He felt tired and decided to go to sleep early.	Jody had quite a bit to gather together from her office. She wanted to make sure not to lose any photos of her children she may have brought in. She had used this desk for a few years.
<b>Target Sentences (All)</b>	The next morning Jack took out his <b>rifle</b> . He set off down a trail he knew was often full of wildlife.	Jody's impending retirement made her feel <b>happy</b> . She was looking forward to enjoying a quiet life.
<b>Comprehension Question</b>	Was Jack a skateboarder?	Did Jody work at a hospital?



Comprehension Question		
Answer	No	Yes

**APPENDIX B. REFERENTIAL STIMULI**

Table 7. All Text Passages – Study 2.

<b>Item</b>	<b>Cond</b>	<b>Passage</b>
1	Cons	The boy looked up at a plane. The wings of the plane were smooth.
1	Inco	The boy looked up at a plane. The flight of the plane was smooth.
2	Cons	The biologist put an ant under the microscope. The tiny insect was easy to follow.
2	Inco	The biologist put an ant under the microscope. The black insect was easy to follow.
3	Cons	The sweet fruit tasted amazing.
3	Inco	The hungry runner grabbed an apple. The red fruit tasted amazing.
4	Cons	The boy let go of the balloon's string. It floated into the sky.
4	Inco	The boy let go of the balloon's string. It popped in the sky.
5	Cons	The movers saw the piano in the corner of the room. The weight of the piano was substantial.
5	Inco	The movers saw the piano in the corner of the room. The sound of the piano was beautiful.
6	Cons	The girl looked up at the banner her co-workers made for her birthday. The paper banner was 10 feet long.
6	Inco	The girl looked up at the banner her co-workers made for her birthday. The message was 10 feet long.
7	Cons	The shopper saw the antique basket on the shelf. The wicker basket was a hundred years old.
7	Inco	The shopper saw the antique basket on the shelf. The handle was a hundred years old.
8	Cons	The basketball team ran to the bench. The long bench was quickly filled.
8	Inco	The basketball team ran to the bench. The wood bench was quickly filled.
9	Cons	The boy examined the bee in his bottle of coke. The clear bottle seemed like a microscope.
9	Inco	The boy examined the bee in his bottle of coke. The glass

		seemed like a microscope.
10	Cons	The woman wore her scarf outside. The wool scarf insulates heat well and keeps her warm.
10	Inco	The woman wore her scarf outside. The long scarf insulates heat well and keeps her warm.
11	Cons	There were a lot of leftover bricks in the yard. The red bricks were used to build a house.
11	Inco	There were a lot of leftover bricks in the yard. The hard bricks were used to build a house.
12	Cons	The man grabbed a broom to retrieve his phone from under the couch. The long broom allowed him to get it.
12	Inco	The man grabbed a broom to retrieve his phone from under the couch. The wooden broom allowed him to get it.
13	Cons	The candle had been lit for an hour. The wax had begun to melt.
13	Inco	The candle had been lit for an hour. The bright candles had begun to melt.
14	Cons	The cat was lingering in the kitchen. It ate a piece of cheese.
14	Inco	The cat was lingering in the kitchen. Its fur was shed on the cheese.
15	Cons	The cherry topped the sundae. The red cherry was atop the whipped cream.
15	Inco	The cherry topped the sundae. The sweet cherry was atop the whipped cream.
16	Cons	The clock was mounted on the wall. It ticks every second.
16	Inco	The clock was mounted on the wall. The hands moved every second.
17	Cons	The student moved his clothes into the dorm closet. The small closet could barely hold all his clothes.
17	Inco	The student moved his clothes into the dorm closet. The doors could barely hold all his clothes.
18	Cons	The designer coat is flashy. The buttons are large and black.
18	Inco	The designer coat is flashy. The warm coat is large and black.
19	Cons	The coin was very hot. The metal coin was heated up by the sun.
19	Inco	The coin was very hot. The round coin was heated up by

		the sun.
20	Cons	The girl left the comb outside. The plastic had melted.
20	Inco	The girl left the comb outside. The teeth had melted.
21	Cons	The cottage is located in a popular ski resort. A small cottage is ideal in the crowded area.
21	Inco	The cottage is located in a popular ski resort. The wood cottage is ideal in the crowded area.
22	Cons	The boy dropped the remote on the couch. The soft couch is ideal to relax and watch T.V. on.
22	Inco	The boy dropped the remote on the couch. The cushions are ideal to relax and watch T.V. on.
23	Cons	The cupboard is old and worn down. The wooden cupboard has termites and is fragile.
23	Inco	The cupboard is old and worn down. The shelves have termites and are fragile.
24	Cons	Desks can be hazarous at times. A wooden desk can give you splinters.
24	Inco	Desks can be hazarous at times. The flat surface can give you splinters.
25	Cons	The little girl takes good care of her doll. Her hair gets brushed every morning.
25	Inco	The little girl takes good care of her doll. The porcelain doll gets brushed every morning.
26	Cons	Doorknobs come in many shapes. The round doorknob is very common.
26	Inco	Doorknobs come in many shapes. The metal doorknob is very common.
27	Cons	The boy tried to pet the seagull. It flew away and escaped.
27	Inco	The boy tried to pet the seagull. Its wings spread open and escaped.
28	Cons	The girl wore her new shoes to prom. The high-heels hurt her feet after awhile.
28	Inco	The girl wore her new shoes to prom. The leather hurt her feet after awhile.
29	Cons	The girl did her make-up by the dresser. The mirror on her dresser helped her see what she was doing.
29	Inco	The girl did her make-up by the dresser. The wooden dresser helped her see what she was doing.
30	Cons	The construction workers began working with the drill

		early. The loud drill woke up half the neighborhood.
30	Inco	The construction workers began working with the drill early. The electric drill woke up half the neighborhood.
31	Cons	The teacher found an old ruler in her desk. The units on the side were fading.
31	Inco	The teacher found an old ruler in her desk. The wooden ruler was fading.
32	Cons	The boy found a damaged fork in the trash. The prongs were twisted and bent.
32	Inco	The boy found a damaged fork in the trash. The silver was twisted and bent.
33	Cons	The boy bought popsicles and stored them in the freezer. The cold freezer froze the popsicles.
33	Inco	The boy bought popsicles and stored them in the freezer. The large freezer froze the popsicles.
34	Cons	The man bought some new socks. The holes in his socks gave his toes a nice breeze.
34	Inco	The man bought some new socks. The cotton in his socks gave his toes a nice breeze.
35	Cons	The woman's husband is a limo driver who uses gloves. The leather gloves she bought help him grip the wheel better.
35	Inco	The woman's husband is a limo driver who uses gloves. The wool gloves she bought help him grip the wheel better.
36	Cons	The baby loves all kinds of grapes. The juicy grape burst when she took a bite.
36	Inco	The baby loves all kinds of grapes. The green grape burst when she took a bite.
37	Cons	The man took his damaged guitar to the music shop. The strings on his guitar need to be repaired.
37	Inco	The man took his damaged guitar to the music shop. The wood on his guitar needs to be repaired.
38	Cons	The boy's mother wants a hamster that does not shed hair. The fur on the hamster is short and does not shed.
38	Inco	The boy's mother wants a hamster that does not shed hair. The small hamster is short and does not shed.
39	Cons	The boy's mother told him to wear a helmet. His hard helmet protected him from a concussion when he fell.
39	Inco	The boy's mother told him to wear a helmet. The plastic

		helmet protected him from a concussion when he fell.
40	Cons	The little boy narrowly missed running into a hook in the kitchen. A sharp hook cut his hand when he ran by the bathroom.
40	Inco	The little boy narrowly missed running into a hook in the kitchen. The metal hook cut his hand when he ran by the bathroom.
41	Cons	The squirrel was searching for food. It ate nuts under the shade of a large tree.
41	Inco	The squirrel was searching for food. It climbed under the shade of a large tree.
42	Cons	The truck was driving through the desert. The wheels were full of sand.
42	Inco	The truck was driving through the desert. The large truck was full of sand.
43	Cons	The boy wore his new jeans to chemistry lab. His blue jeans were stained by the acid.
43	Inco	The boy wore his new jeans to chemistry lab. The pockets were stained by the acid.
44	Cons	The wheel rolled off the car. The round wheel kept rolling into oncoming traffic.
44	Inco	The wheel rolled off the car. The rubber tire kept rolling into oncoming traffic.
45	Cons	The mother gave the baby a lemon to try. The sour lemon made the baby pucker.
45	Inco	The mother gave the baby a lemon to try. The yellow lemon made the baby pucker.
46	Cons	The man ordered an iceberg lettuce salad for lunch. The crunchy lettuce was delicious and fresh in the salad.
46	Inco	The man ordered an iceberg lettuce salad for lunch. The green lettuce was delicious and fresh in the salad.
47	Cons	Marbles can be dangerous if inhaled. The small marble lodged itself in the dog's nostril.
47	Inco	Marbles can be dangerous if inhaled. The round marble lodged itself in the dog's nostril.
48	Cons	The students looked at the menu at the restaurant. The prices on the menu indicated the restaurant was too expensive.
48	Inco	The students looked at the menu at the restaurant. The paper menu indicated the restaurant was too expensive.

49	Cons	The girl bought a soft new shirt. The cotton shirt is her new favorite.
49	Inco	The girl bought a soft new shirt. The sleeves were really cute.
50	Cons	The woman just put her coffee mug in the microwave. The ceramic mug was very hot when she took it out.
50	Inco	The woman just put her coffee mug in the microwave. The handle was very hot when she took it out.
51	Cons	The little girl found a mushroom in the backyard. The poisonous mushroom was thrown away immediately by her mother.
51	Inco	The little girl found a mushroom in the backyard. The brown mushroom was thrown away immediately by her mother.
52	Cons	The man set his napkin down by the candle. The paper napkin nearly caught on fire.
52	Inco	The man set his napkin down by the candle. The white napkin nearly caught on fire.
53	Cons	The woman wore her expensive necklace outside. The golden necklace was shining in the sun.
53	Inco	The woman wore her expensive necklace outside. The silver necklace was shining in the sun.
54	Cons	The man had onion soup for dinner. The smell of the soup disgusted his date.
54	Inco	The man had onion soup for dinner. The layers of the onion disgusted his date.
55	Cons	Kids must be careful when playing around an oven. The hot oven can easily burn children.
55	Inco	Kids must be careful when playing around an oven. The racks in the oven can easily burn children.
56	Cons	The boy quickly put his pants on. The zipper was open because he forgot to close it.
56	Inco	The boy quickly put his pants on. The buttons were open because he forgot to close them.
57	Cons	The man ordered extra peas on his salad. The green peas were a nice addition to the salad.
57	Inco	The man ordered extra peas on his salad. The nutritious peas were a nice addition to the salad.
58	Cons	The man just bought an expensive new pen. The ink flowed nicely onto the page.

58	Inco	The man just bought an expensive new pen. The plastic pen flowed nicely onto the page.
59	Cons	The man forget he left a pin on his chair. The sharp pin stabbed him when he sat down.
59	Inco	The man forget he left a pin on his chair. The metal pin stabbed him when he sat down.
60	Cons	The man ate a pickle for lunch. The crunchy pickle made a snapping sound when he took a bite.
60	Inco	The man ate a pickle for lunch. The green pickle made a snapping sound when he took a bite.



**APPENDIX C. NELSON-DENNY COMPREHENSION TEST (COVER AND EXAMPLE PAGE)**

**Comprehension**

**Nelson-Denny Reading Test  
Form E**

Read completely through a passage, then answer the questions following that passage. You may look back at the material you have read, but do not puzzle too long over any one question. When you have completed the questions for one passage, go immediately to the next one. Continue working until you are told to stop. You will have 15 minutes to work. If you do not have time to complete all the questions, leave the remaining ones blank.

**DO NOT WRITE ON THIS TEST**

## PASSAGE ONE

A few had been wise enough to see a fine poet in Browning, and Elizabeth Barrett was one of them. The young man with the lemon-colored gloves and long dark hair and high-strung, restless manner who had visited her in 1846 had been moved to write to her because she had praised his poetry. She found the man even more to her liking than the verse, and it was not so very long—only the time between May, 1845, and September, 1846—before Robert Browning had stolen the poetess from the dour father who guarded her like a dragon (never wanting her to marry any man), and taken her with him to Italy and a new life.

One morning, soon after their marriage, Elizabeth Browning thrust a manuscript into her husband's pocket, and then ran upstairs in a swift confusion to her room. It was a sonnet sequence on their love written during the time of their courtship and love letters. Mrs. Browning never intended these poems to be published, but her poet-husband promptly declared that they must be. He suggested calling them *Sonnets from the Portuguese*—a title which might hide the fact that they were personal. They were in his mind "the finest sonnets written in our language since Shakespeare's."

Browning's opinion of *Sonnets from the Portuguese* was hardly more flattering to his wife than his opinion of most of her poetry. He thought her a better poet than he was, and the world at that time agreed with him. He called her his "moon of poets," as she considered him her sun.

She was a pure singer with a lovely lyrical tenderness, the best poet of her sex since Sappho. Her *Sonnets*, in their autobiographical candor, in their fine restraint and fullness, reveal a woman's secret soul as had no other poetry in our literature up to that time. Her lyrical mastery shines in many passages of her writings.

Italy was a kind of promised land for Elizabeth Browning. Living in Florence or in little villages in the summers, she drank in the sun of the south and warmth of her husband's love, and blossomed in a life of precarious happiness for fifteen years. In Italy she found friends, most of them cultured Americans. Hawthorne saw the Brownings there; the New England thinker and essayist Margaret Fuller visited them. The painter Story came, and the young sculptress Harriet Hosmer. One caller records that Robert Browning was "simple, natural, and playful," and that Mrs. Browning was all "genius and sensibility."

Daytimes Browning walked forth with Elizabeth's little dog Flush, but he seldom could be lured from his home evenings. One privileged intruder, coming frequently at night to join the poets over hot chestnuts and mulled wine, found talk good and laughter plentiful. During the third year of their stay in Italy, a son, Robert Weidemann Browning, was born.

But through this happy life a strain of dark foreboding began to creep. Elizabeth Browning's father died unrelenting in his disapproval of her marriage, refusing to see her or to allow any of his family to see her. A dearly loved sister died and left three children all younger than her own boy. She drooped and pined a little and Browning shielded her from ordinary visitors. She had a sudden and alarming attack of sickness but was not considered in any danger. One night, soon after, she awoke from a troubled sleep and, apparently with no idea that she was about to leave him, spoke in the tenderest fashion of her love for him, and in his arms, her head dropped as though in a faint, but it was the end.

Profound and lasting was Browning's grief. "Looking back," he said, "I see that we have been all the time walking over a torrent on a straw."

1. Flush was the name of Brownings'
  - A. cat.
  - B. dog.
  - C. canary.
  - D. turtle.
  - E. thrush.
2. At night the Brownings often enjoyed
  - A. hot chestnuts.
  - B. a tart with clotted cream.
  - C. strawberries and cream.
  - D. café au lait.
  - E. cheese soufflé.
3. The Brownings saw
  - A. Coleridge.
  - B. Byron.
  - C. Walt Whitman.
  - D. Poe.
  - E. Hawthorne.
4. Browning wrote to Miss Barrett because she had
  - A. invited him to visit.
  - B. written him for advice.
  - C. praised his poetry.
  - D. sent him one of her own poems.
  - E. sent a friend to meet him.
5. The authors of this passage placed most attention on the Brownings'
  - A. literary efforts.
  - B. personal relationship.
  - C. social contacts.
  - D. problems.
  - E. early meeting.
6. What best describes the Brownings' early days abroad?
  - A. Travel
  - B. Relaxation
  - C. Creative activity
  - D. Intellectual stimulation
  - E. Happiness
7. You would assume that Browning
  - A. found it easy to see Elizabeth.
  - B. carefully avoided Mr. Barrett.
  - C. begged Mr. Barrett's consent to marry.
  - D. understood Mr. Barrett
  - E. got Elizabeth to ask her father's consent.
8. In the "torrent on a straw" quotation, the word *straw* probably refers to
  - A. the frailty of life.
  - B. weakness of character.
  - C. sorrow.
  - D. happiness.
  - E. the fleeting nature of fame.

# APPENDIX D. NELSON-DENNY VOCABULARY TEST (COVER AND EXAMPLE PAGE)

## VOCABULARY TEST

### DIRECTIONS FOR PARTICIPANTS

- A. Do not turn this page of the test booklet until directed to do so.
- B. Do not make marks of any kind on this test booklet.
- C. The Vocabulary Test, containing 100 items, is timed separately from the Comprehension Test. Work only on the Vocabulary Test during the seven and a half minutes allowed for it. Do not go on to the Comprehension Test until told to do so.
- D. To make sure you know how to take the test, complete the three practice exercises below

### Practice Exercises

1. **A chef works with:** A. bricks B. music C. clothes D. food E. statues .....1.

Which word best completes the opening statement? Yes, **food** is the best answer. Look at the first practice exercise answer row on the answer sheet to see how you are to mark your answer.

2. **To repair is to:** A. destroy B. finish C. fix D. work E. show .....2.

Mark the space for the answer you think is correct. You should have marked space **C**, since **fix** is the correct answer.

3. **Mathematics refers to:** A. letters B. numbers C. machines D. plants E. stars .....3.

What is the letter of the best answer? Mark the space lettered the same as the answer you think is correct. You should have marked space **B**, **numbers**, that is the correct answer.

- E. Wait for the signal to turn this page.
- F. Now listen carefully to the examiner for further instructions.

MAKE NO MARKS ON THIS TEST BOOKLET

VOCABULARY TEST

1. **Plump hands are:** A. thin B. strong C. shapely D. chubby E. small .....1.
2. **If you object, you:** A. oppose B. approve C. throw out D. offer E. observe .....2.
3. **To get forgiveness is to get:** A. praised B. blamed C. scolded D. pardoned E. helped .....3.
4. **To probe is to:** A. search B. protect C. cure D. reason E. prevent .....4.
5. **Conning means:** A. caring B. tricking C. collecting D. helping E. writing .....5.
6. **To maltreat is to:** A. curse B. prescribe C. abuse D. pretend illness E. operate .....6.
7. **A brochure is a:** A. letter B. broken piece C. dialect D. sharp rod E. pamphlet .....7.
8. **To launch is to:** A. praise B. snack C. rinse D. anchor E. start .....8.
9. **Unique means:** A. good B. solid C. complete D. widely used E. one and only .....9.
10. **Corridors are:** A. passageways B. tunnels C. openings D. chambers E. glimpses .....10.
11. **A current trend is:** A. past B. expected C. decreasing D. present E. future .....11.
12. **Grotesque shoes are:** A. for dancing B. large C. ugly D. pointed E. strong .....12.
13. **The art of governing refers to:** A. ruling B. obeying C. taxing D. growing E. pleasing .....13.
14. **A metamorphosis is a:** A. severe phobia B. shock C. change D. photograph E. stark image .....14.
15. **To venture is to:** A. open B. watch C. write D. risk E. profit .....15.
16. **Economic aid refers to:** A. money B. information C. education D. farming E. culture .....16.
17. **To shuttle is to go:** A. up B. away C. back and forth D. aside E. astray .....17.
18. **Nonentity:** A. not existing B. entire C. nonsense D. nucleus E. abnormal .....18.
19. **A trifle is a:** A. small article B. stone C. grant D. gift E. little trick .....19.
20. **To negotiate terms is to:** A. summarize B. break off C. ignore D. sign E. arrange .....20.
21. **To presume is to:** A. start B. presuppose C. request D. suggest E. repeat .....21.
22. **Misconstrued means:** A. misspelled B. misinterpreted C. misled D. hopeless E. bent .....22.
23. **Devastatingly means:** A. hopefully B. helplessly C. rightly D. destructively E. largely .....23.

APPENDIX E. TOWRE EXAMINATION BOOK (CONTAINS WORDS AND NON-WORDS)

**TOWRE**

Profile/Examiner  
Record Booklet

Form A

**Test of Word Reading Efficiency**

**Section I. Identifying Information**

Name \_\_\_\_\_ Female  Male  Grade \_\_\_\_\_  
 Year \_\_\_\_\_ Month \_\_\_\_\_ Day \_\_\_\_\_ School \_\_\_\_\_  
 Date Tested \_\_\_\_\_ Examiner's Name \_\_\_\_\_  
 Date of Birth \_\_\_\_\_ Examiner's Title \_\_\_\_\_  
 Age \_\_\_\_\_

**Section II. TOWRE Scores**

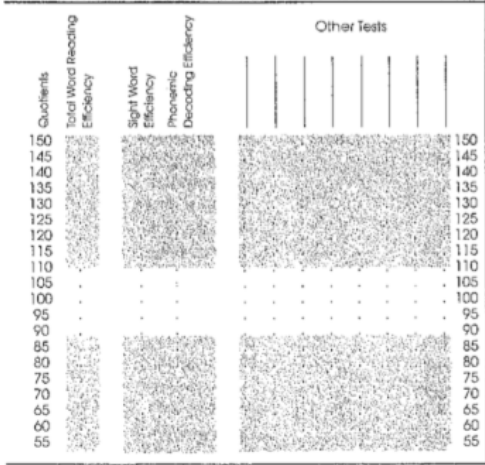
**Section III. Other Test Scores**

Subtest	Raw Score	Age Equiv.	Grade Equiv.	%ile	Standard Score
I. Sight Word Efficiency	___	___	___	___	<input type="text"/>
II. Phonemic Decoding Efficiency	___	___	___	___	<input type="text"/>
Sum of Standard Scores					<input type="text"/>
Total Word Reading Efficiency Standard Score					<input type="text"/>
Total Word Reading Efficiency Percentile					<input type="text"/>
Standard Scores based on	<input type="checkbox"/> age				
	<input type="checkbox"/> grade				

Test Name	Date	Standard Score	TOWRE Equiv.
1. _____			
2. _____			
3. _____			
4. _____			
5. _____			
6. _____			
7. _____			
8. _____			

**Section IV. Profile of Scores**

**Section V. Interpretation and Recommendations**



\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

© 1999 by PRO-ED, Inc.  
11 12 13 14 15 09 08 07

Additional copies of this form (#8922) may be purchased from  
 PRO-ED, 8700 Shoal Creek Blvd., Austin, TX 78757-6897  
 800/897-3202, Fax 800/397-7633  
 Order online at <http://www.proedinc.com>

## Subtest I Sight Word Efficiency

**MATERIALS:** Stopwatch, Forms A and B Sight Word Efficiency Reading Cards

**CEILING:** Administer all items

**SCORING:** Mark all the words the examinee reads incorrectly and draw a line after the last word read. The examinee's raw score is the total number of words correctly read within 45 seconds. If the examinee finishes all the words before the time is up, note the time required to read all of the words. If the examinee skips a word, simply count it as an error. If he or she hesitates for more than 3 seconds on a word and is instructed to go to the next word, mark the word as incorrect.

**PRACTICE:** Present the Practice Words on the Form B card. Say, "I want you to read some lists of words as fast as you can. Let's start with this practice list. Begin at the top, and read down the list as fast as you can. If you come to a word you cannot read, just skip it and go to the next word. Use your finger to help you keep your place if you want to." Have the examinee read the words. If the examinee skips around a lot, ask him or her to read the words from top to bottom, without jumping around.

**NOTE:** If you are giving Form A immediately after Form B, omit the practice instructions and proceed to Form A by saying, "Now we will do it one more time. Remember to read the words as fast as you can without making errors. Skip any words you cannot read."

**PRACTICE WORDS:** on, my, bee, old, warm, bone, most, spell

**TEST:** (Give the following instructions using Form B to demonstrate.) Say, "Okay, now you will read some longer lists of words. The words start out pretty easy, but they get harder as you go along. Read as many words as fast as you can until I tell you to stop. Begin here (point to the upper left corner on Form B) and read down this list (draw finger down the list) before you start on the next list (point to top of second column). Read the words in order, but if you come to one you can't read, skip it and go to the next one. Use your finger to keep your place if you want to, and if you skip more than one word, point to the word you are reading next. Do you understand? Okay, you will begin as soon as I turn over the card."

Quickly turn over the Form A card and start timing as soon as the examinee says the first word. As he or she is reading, mark any words that are misread or skipped. After 45 seconds, tell the examinee to stop, and note the last word read. If the examinee finishes all the words before the time is up, note the time required to read all the words. If, before the time is up, the examinee indicates that he or she cannot read any more words, ask the examinee to look over the whole list to see if there are any more words he or she can read. If the examinee then indicates he or she can read no more words, stop testing.

- |          |            |               |                  |
|----------|------------|---------------|------------------|
| 1. is    | 27. work   | 53. crowd     | 79. uniform      |
| 2. up    | 28. jump   | 54. better    | 80. necessary    |
| 3. cat   | 29. part   | 55. inside    | 81. problems     |
| 4. red   | 30. fast   | 56. plane     | 82. absentee     |
| 5. me    | 31. fine   | 57. pretty    | 83. advertise    |
| 6. to    | 32. milk   | 58. famous    | 84. pleasant     |
| 7. no    | 33. back   | 59. children  | 85. property     |
| 8. we    | 34. lost   | 60. without   | 86. distress     |
| 9. he    | 35. find   | 61. finally   | 87. information  |
| 10. the  | 36. paper  | 62. strange   | 88. recession    |
| 11. and  | 37. open   | 63. budget    | 89. understand   |
| 12. yes  | 38. kind   | 64. repress   | 90. emphasis     |
| 13. of   | 39. able   | 65. contain   | 91. confident    |
| 14. him  | 40. shoes  | 66. justice   | 92. intuition    |
| 15. as   | 41. money  | 67. morning   | 93. boisterous   |
| 16. book | 42. great  | 68. resolve   | 94. plausible    |
| 17. was  | 43. father | 69. describe  | 95. courageous   |
| 18. help | 44. river  | 70. garment   | 96. alienate     |
| 19. then | 45. space  | 71. business  | 97. extinguish   |
| 20. time | 46. short  | 72. qualify   | 98. prairie      |
| 21. wood | 47. left   | 73. potent    | 99. limousine    |
| 22. let  | 48. people | 74. collapse  | 100. valentine   |
| 23. men  | 49. almost | 75. elements  | 101. detective   |
| 24. baby | 50. waves  | 76. pioneer   | 102. recently    |
| 25. new  | 51. child  | 77. remember  | 103. instruction |
| 26. stop | 52. strong | 78. dangerous | 104. transient   |

Number of words read correctly

If examinee finishes list before 45 seconds, note time to finish

## Subtest II Phonemic Decoding Efficiency

**MATERIALS:** Stopwatch, Forms A and B Phonemic Decoding Efficiency Reading Cards

**CEILING:** Administer all items

**SCORING:** Mark all the nonwords the examinee reads incorrectly on each form and draw a line after the examinee's last nonword. The examinee's raw score is the total number of nonwords read correctly within 45 seconds. If the examinee skips a nonword, simply count it as an error. If the examinee hesitates for more than 3 seconds on a nonword, mark it as incorrect and point to the next item and say, "Go on." Some items have more than one correct pronunciation for the vowel. Score the item correct if the examinee gives any of the correct pronunciations. Alternative correct pronunciations are indicated with real word examples, with the vowel in question underlined>. For words with more than two syllables, alternative pronunciations are given separately for each syllable.

**PRACTICE:** Present the Practice items on the Form A card. Say, "Now I want you to read some words that are not real words. Just tell me how they sound. I want you to read them as fast as you can. Let's start with this practice list. Begin at the top, and read down the list as fast as you can. If you come to a made-up word you cannot read, just skip it and go to the next word. Use your finger to keep your place if you want to." Have the examinee read the nonwords. If the examinee skips around a lot, ask him or her to read the words from top to bottom, without jumping around. If the examinee tries to substitute real words for the nonwords, remind him or her that these are made-up words, not real words, and the goal is to try to say how they sound.

**NOTE:** If you are giving Form A immediately after Form B, skip the practice instructions and proceed by saying, "Now we will do it one more time. Remember to read the nonwords as fast as you can without making errors. Skip any nonwords you cannot read."

**PRACTICE WORDS:** ba (bat, fate, pizza), um (umpire), fos (fossil), gan (gander), rup (rupture), nasp (cisp), luddy (muddy), dord (ford).

**DIRECTIONS:** (Give the following instructions using Form B to demonstrate.) Say, "Now you will read some longer lists of nonwords. The words start out pretty easy, but they get harder as you go along. Just read as many of these nonwords as fast as you can until I tell you to stop. Begin up here (point to the upper left corner on Form B) and read down this list (draw finger down the list) before you start on the next list (point to top of second column). Read the words in order, but if you come to one you can't read, just skip it and go to the next one. Use your finger to keep your place if you want to, and if you skip more than one word, point to the word you are reading next. Do you understand? Okay, you will begin as soon as I turn over the card."

Quickly turn over the Form A card and start timing as soon as the examinee says the first nonword. As the examinee is reading, mark all the words that are misread or skipped. After 45 seconds, tell the examinee to stop, and note the last word read. The examinee's score is the total number of words correctly read within 45 seconds. If the examinee finishes all the nonwords before the time is up, note the time required to read all the words. If, before the time is up, the examinee indicates that he or she cannot read any more words, ask the examinee to look over the whole list to see if there are any more words he or she can read. If the examinee then indicates he or she can read no more words, stop testing.

Stimulus	Pronunciation
1. ip	(t <u>i</u> p)
2. ga	(g <u>a</u> p, g <u>a</u> te)
3. ko	(c <u>o</u> de, c <u>o</u> t)
4. to	(t <u>o</u> ck, t <u>o</u> pe)
5. om	( <u>o</u> n)
6. ig	(p <u>i</u> g)
7. ni	(n <u>i</u> p, n <u>i</u> ce)
8. pim	(h <u>i</u> m)
9. wum	(s <u>u</u> m)
10. lat	(f <u>a</u> t)
11. baf	(b <u>a</u> t)
12. din	(p <u>i</u> n)
13. nup	(c <u>u</u> p)
14. fet	(m <u>e</u> t)
15. bave	(s <u>a</u> ve)
16. pate	(f <u>a</u> te)

17. herm	(tɜ:m)
18. dless	(mɒs)
19. chur	(blɜ:
20. knap	(nɒp)
21. five	(hʌve)
22. barp	(tɜ:p)
23. stlp	(tʃp)
24. plin	(fɪn)
25. frip	(trɪp)
26. poth	(mɒθ)
27. vasp	(clɒsp)
28. meest	(fɛst)
29. shlee	(flee)
30. guddy	(mʌdɪ)
31. skree	(tree)
32. felly	(jelly)
33. clrt	(shɪrt)
34. slne	(ljne)
35. dreef	(reef)
36. praln	(pɔln)
37. zint	(ɪnt)
38. bloot	(lɒt, bɒk)
39. trisk	(brɪsk)
40. kelrn	(hɛlm)
41. strone	(stɔne)
42. lunaf	lu (tʌne, bʌn), naf (ɔter)
43. cratty	(fɒt)
44. trober	(sɒber)
45. depate	de (de, deɔk), pɒte (fɒte)
46. glant	(plɒnt)
47. sploosh	(lɒse, bɒk)
48. dreker	dre (mɒt, mɛt), ker (hɜ)
49. rittun	rit (st), lun (bʌn)
50. hedfert	hed (bɛd), fert (fɜ:n)
51. bremick	bre (tree, bɛd), mɪk (tɪk)
52. nlfpate	nɪf (snɪf), pɒte (lɒte)
53. brlnbert	brln (fɪn), bert (hɜ)
54. clabom	clɒ (clɒy, clɒp), bɒm (bɒmb)
55. drepnort	drep (pɛp), nɒrt (fɒrt)
56. shratted	(mɒtted)
57. plofent	plɒ (tɒe, mɒp), fɛnt (bɛnt)
58. smuncrit	smun (fʌn), crɪt (brɪt)
59. pelnador	peɪ (fɛll), nɒ (nɒp, nʌt, hɪp), dɒr (fɒr, fʌr)
60. fornalsk	fɒrn (bɒrn), ɒ (ɒt, ɪt, ʌp), lɒsk (tɒsk)
61. fermabalt	fɜ:m (fɪrn), ɒ (ɒt, ɪt, ʌp), bɒlt (mɒlt, bɒt)
62. crenidmoke	cre (hɜn, see), nɪd (ɪd, ʌp), mɒke (hɒpe)
63. emulbatate	e (ee, or egg), mʌl (hʌll), bɒ (bɒt, brɪt, bʌt), tɒte (ɪtɛ)

Number of words read correctly

If examinee finishes list before 45 seconds, note time to finish



## APPENDIX F. AUTHOR RECOGNITION TEST

### Author Recognition Test

Below you will see a list of 80 names. Some of the people in the list are popular writers (of books, magazine articles, and/or newspaper columns) and some are not. Please read the names and put a check mark next to the names of the individuals you know to be writers. Do not guess, but only check those who you know to be writers. Remember, some of the names are people who are not popular writers, so guessing can easily be detected.

- |  |   |  |   |
|--|---|--|---|
| <input type="checkbox"/> Gustav Mahler       | <input type="checkbox"/> Sue Grafton          | <input type="checkbox"/> V.C. Andrews        | <input type="checkbox"/> Walter E. Kurtz    |
| <input type="checkbox"/> T.S. Eliot          | <input type="checkbox"/> George Orwell        | <input type="checkbox"/> Laura Dern          | <input type="checkbox"/> Stephen Crane      |
| <input type="checkbox"/> Stephen King        | <input type="checkbox"/> Angela Lindvall      | <input type="checkbox"/> Leonid Pasternak    | <input type="checkbox"/> Ellen Tracy        |
| <input type="checkbox"/> Dan Brown           | <input type="checkbox"/> Edward Hopper        | <input type="checkbox"/> Henry David Thoreau | <input type="checkbox"/> Paul Pierce        |
| <input type="checkbox"/> J.K. Rowling        | <input type="checkbox"/> Anne Rice            | <input type="checkbox"/> Danielle Steele     | <input type="checkbox"/> Chester A. Arthur  |
| <input type="checkbox"/> Frederick Chopin    | <input type="checkbox"/> Andrew Jackson       | <input type="checkbox"/> James King          | <input type="checkbox"/> Tennessee Williams |
| <input type="checkbox"/> Thomas Friedman     | <input type="checkbox"/> John Constable       | <input type="checkbox"/> Annie Oakley        | <input type="checkbox"/> Joseph Conrad      |
| <input type="checkbox"/> Emilio Pucci        | <input type="checkbox"/> Mary Shelley         | <input type="checkbox"/> Upton Sinclair      | <input type="checkbox"/> Igor Stravinsky    |
| <input type="checkbox"/> Lewis Carroll       | <input type="checkbox"/> Gustav Klimt         | <input type="checkbox"/> Martina Hingis      | <input type="checkbox"/> Christine Lahti    |
| <input type="checkbox"/> Eriq LaSalle        | <input type="checkbox"/> Helmut Lang          | <input type="checkbox"/> David Ortiz         | <input type="checkbox"/> Ansel Adams        |
| <input type="checkbox"/> Joan Miro           | <input type="checkbox"/> Henry James          | <input type="checkbox"/> Louisa May Alcott   | <input type="checkbox"/> William Golding    |
| <input type="checkbox"/> Tom Wolfe           | <input type="checkbox"/> John Irving          | <input type="checkbox"/> Arthur C. Clarke    | <input type="checkbox"/> Leo Tolstoy        |
| <input type="checkbox"/> John Grisham        | <input type="checkbox"/> Isaac Asimov         | <input type="checkbox"/> Thomas Eakins       | <input type="checkbox"/> Aaron Burr         |
| <input type="checkbox"/> William Borah       | <input type="checkbox"/> Mary Cassatt         | <input type="checkbox"/> George Eliot        | <input type="checkbox"/> Ernest Hemingway   |
| <input type="checkbox"/> John Singer Sargent | <input type="checkbox"/> Ezra Pound           | <input type="checkbox"/> James Cagney        | <input type="checkbox"/> Amy Tan            |
| <input type="checkbox"/> Ambrose Bierce      | <input type="checkbox"/> Edgar Rice Burroughs | <input type="checkbox"/> Mike Stanton        | <input type="checkbox"/> John Updike        |
| <input type="checkbox"/> Tom Stoppard        | <input type="checkbox"/> J.M.W. Turner        | <input type="checkbox"/> Primo Levy          | <input type="checkbox"/> Nicholas Sparks    |
| <input type="checkbox"/> Mary Higgins Clark  | <input type="checkbox"/> Will Sasso           | <input type="checkbox"/> Charles Spiegel     | <input type="checkbox"/> Linda Carter       |
| <input type="checkbox"/> Mikhail Baryshnikov | <input type="checkbox"/> Thomas Mann          | <input type="checkbox"/> Vivica A. Fox       | <input type="checkbox"/> William Wallace    |
| <input type="checkbox"/> Samuel Beckett      | <input type="checkbox"/> Eli Whitney          | <input type="checkbox"/> Harriet Tubman      | <input type="checkbox"/> Richard Wright     |

## APPENDIX G. INDIVIDUAL DIFFERENCE CORRELATIONS – STUDY 1

Table 8. Reading skill by experimental effect correlations – Study 2.

	Comprehension	Vocabulary	Word Reading	Non-word Decoding	Author Recognition
<b>F196: Inco-Cons (Fz)</b>	.230 (.280)	.132 (.530)	-.155 (.460)	-.334 (.103)	.027 (.900)
<b>F304: Inco-Cons (Pz)</b>	-.321 (.126)	-.193 (.355)	.093 (.657)	.176 (.399)	-.292 (.160)
<b>F304: Caus-Cons (Pz)</b>	.270 (.202)	.343~ (.094)	.175 (.403)	.086 (.681)	.097 (.653)
<b>F640: Caus-Cons (Pz)</b>	.229 (.281)	.280 (.175)	.150 (.474)	.149 (.478)	.202 (.343)
<b>F640: Caus - Inco (Pz)</b>	.179 (.401)	.139 (.506)	.245 (.238)	-.017 (.937)	-.118 (.584)
<b>F640: Inco-Cons (F3)</b>	-.172 (.421)	-.045 .830	.026 (.902)	.336~ (.100)	-.235 (.193)

Note. The left column indicates the Temporal Factor (e.g, F196), and electrode cluster (e.g., Fz), as well as the experimental effect of interest (e.g., Inco-Cons). Cons = Consistent. Inco = Inconsistent. Caus = Causal.