

GOING BEYOND THE TEXT: THE INFERENCING PROCESSES OF SKILLED READERS
IN L1 AND L2 ACROSS READING TASKS

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Abstract

This small exploratory study investigated the inferencing processes of skilled first language (L1) and second language (L2) readers for two academic tasks. The goal was to examine possible effects of language and task, or reading purpose, on the frequency and distribution of inferences. Participants ($n = 10$) were native speakers of German enrolled at a large university in Hessen, Germany in a B.Ed. program. Participants read two expository texts (one written in German and the other written in English) in two task conditions: summary and position-paper. Think-aloud protocols while reading and stimulated recall immediately after reading were recorded, transcribed, coded, and the results were compared quantitatively and qualitatively across tasks and languages. The statistical analyses indicated that there were task effects on inferencing processes, and that they were stronger in L2. When reading for a summary purpose, inferencing processes differed across languages which was not the case for the position-paper task. Readers' inferencing processes differed significantly across tasks in L2, but not in L1. The results suggest that skilled readers strategically inference based on academic task demands, but that transfer of strategic inferencing skills from L1 to L2 is not complete even with advanced L2 readers. Findings raise questions about the explicit instruction of strategic inferencing for academic tasks in L2 reading classrooms.

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CHAPTER 1: INTRODUCTION

The purpose of this study was to investigate the inferencing processes of skilled adult readers in their first and second language (L1 and L2) across two reading tasks. Academic tasks that require students to write, usually require students to read texts before they write. This is one of the reasons why high-stakes language proficiency assessments, such as TOEFL and the exams aligned with the Common European Framework of Reference (CEFR), now include ‘integrated writing tasks’ that require test-takers to read an article and use its content in a written summary task (Cohen & Upton, 2006; Rosenfeld, Leung & Oltman, 2001). Interestingly, these summary tasks do not often include analysis of or critical reflection on the content of readings; they typically focus on reporting the main ideas and key support from the text (Khalifa & Weir, 2009). Nonetheless, when these students enter postsecondary institutions, they are often expected to analyze, assess, and synthesize information from multiple texts into one essay (Grabe, 2009; Macknish, 2011; Meyer Sterzik & Fraser, 2012). These are often very difficult tasks for students in L1 and L2.

Written texts are the mode through which much knowledge is shared and gained in academic environments. “Independent reading accounts for as much as 85% of learning in college” (Bosley, 2008, p. 285) and is, thus, one of the most important skills for postsecondary success in L1 and L2 environments (Schmitt, Jiang, & Grabe, 2011). In spite of this, “a recent study by the Educational Testing Service (ETS) reported that nearly half of all potential college students, those who took the ACT test in 2004, were not prepared for college-level reading” (Bosley, 2008, p. 285). Further, many first year college students are also underprepared for the academic demands of college (Fischer & Hoth, 2010), but those that successfully complete an academic upgrading course prior to enrollment are far less likely to dropout or fail within the first year of fulltime studies (Fisher &

Engemann, 2009). Fisher and Hoth (2010) reported that under-preparedness in higher-order thinking skills is a major contributor to college attrition because many first and second year students are unable to synthesize or analyze information; they are unable to effectively engage with texts. Cohen and Upton (2006) cautioned that many academic tasks can also cause problems for non-native speakers (NNSs). With a better understanding of the cognitive inference processes that skilled post-secondary readers engage in while reading in L1 and L2 for specific academic tasks, reading teachers may be better able to foster appropriate and effective inferencing behaviours.

Grabe and Stoller (2002) define reading as “the ability to draw meaning from the printed page and interpret this information appropriately” (p. 9). The authors contend that such a definition is insufficient because of its simplicity; it does not explain different reading purposes, the different skills and knowledge, and the cognitive processes involved, or the differences in L1 and L2 read. Reading requires decoding linguistic information such as graphemic-phonemic relationships (Grabe, 2009; Smith, 2004; Koda, 2005); additionally, knowledge of morphemes, words, syntax, and semantics are all important to reading comprehension (Alderson, 2000; Grabe, 2009; Grabe & Stoller, 2002; Koda, 2005; Smith, 2004). Further, Carrell and Grabe (2002) asserted that readers “engage[] in processing at the phonological, morphological, syntactic, semantic, and discourse levels, as well as engage[] in goal setting, text summary building, [and] interpretive elaborating” (p. 234). Moreover, when one looks at comprehending discourse (more than one meaning unit, or proposition, in succession), relationships among the propositions in the text must be made through an inferencing process (Grabe, 2009; Grabe & Stoller, 2002; Kintsch, 1986, 1998; Koda, 2005; Myers & O’Brien, 1998).

Local comprehension is a literal understanding of details within a short text such as a sentence or two, or a short segment of a longer text such as a paragraph within an essay. Global comprehension, on the other hand, refers to the reader comprehending not only the specific pieces of information, but their relationship to one another across a text that is longer than a paragraph. Essentially, local and global comprehension differentiate between understanding the parts versus the whole, respectively. Further to the local and global distinctions, researchers generally agree that readers construct mental representations of texts in their memory, and there are multiple levels of these representations (Horiba, 2013; Kintsch, 1998). In Kintsch's (1998) Construction-Integration Model, text processing has two main processes: construction and integration. In construction, the reader attaches each proposition to the prior propositions, and categorizes the text into a hierarchical structure (Kintsch, 1998). The result is a textbase representation or understanding. If successful, the author's intended meaning is understood, and Kintsch (1986, 1998) associates this level of comprehension with remembering a text. The reader is able to accurately report the content of a text in a summary type assignment, but does not go 'beyond the text'. Kintsch further contends that skilled readers are able to attain another level of comprehension by integrating textual content with their existing knowledge, and he describes this as a situational representation and is associated with text interpretation and learning.

Inferences are required for a literal understanding of a text as well as for interpreting, analysing, and assessing the information at both local and global levels (Chikalanga, 1992; Grabe, 2009; Graesser & Kreuz, 1993; Graesser, Singer & Trabasso, 1994; Kintsch, 1998; Koda, 2005; McKoon & Ratcliff, 1992; Suh & Trabasso, 1993; van den Broek et al., 1993, 1994; Zwaan & Singer, 2003). There is also consensus as to what an inference is: information that is activated from the reader's memory and tested on, or applied to a text but is not explicitly stated in the text

(Cromley & Azevedo, 2007; Grabe, 2009; Koda, 2005; McKoon & Ratcliff, 1992; van den Broek, 1994). The literature generally distinguishes between two kinds of inferences: bridging and elaborative. Bridging inferences occur online, or during reading, to assist in the establishment of local coherence by linking the current proposition to the previous textual information either semantically or causally (Geva, 1992; Koda, 2005; Zwaan & Singer, 2003). The application of elaborative inferences has not been directly tied to reading comprehension at the local level in the research; hence, they are not necessarily required for literal, or textbase, levels of text comprehension with short texts (Zwaan & Singer, 2003).

While elaborative inferences may not be required for local coherence building, they may be applied strategically depending on reading purpose (Horiba, 1996, 2000, 2002, 2013; van den Broek et al, 2001; Yoshida, 2012), and they are required for global coherence and the integration of the textual information into the reader's knowledge for a situational representation (Kintsch, 1986, 1998; Koda, 2005; Zwaan & Singer, 2003). "Ideas that are strongly implied by a discourse context but do not bear on coherence are called *elaborative inferences*" (Zwaan & Singer, 2003, p. 104, italics in original). Elaborative inferences require the application of the reader's knowledge to textual information; prior textual information is applied for elaborative inferences only if it is the integration of several pieces of information from across a longer text (Koda, 2005; Narvaez et al., 1999; Zwaan & Singer, 2003). Most texts in academia are long and many of the assignments require students to do more with a text than write a summary; therefore, many academic tasks require elaborative inferences.

Inferences are required for reading comprehension at both local and global levels (Chikalanga, 1992; Grabe, 2009; Graesser & Kreuz, 1993; Graesser et al., 1994; Kintsch, 1998;

Koda, 2005; McKoon Ratcliff, 1992; Suh & Trabasso, 1993; Tarchi, 2010; Zwaan & Singer, 2003; van den Broek, et al., 1993). What are inferences, where do they come from, and when do readers use them? These questions have intrigued researchers for decades. Unfortunately, there has been very little consistency in taxonomies, definitions, and methodologies (Graesser et al., 1994; van den Broek et al., 1993; Zwaan & Singer, 2003). There is a large body of L1 inferencing research spanning 30-plus years that has focused on memory processes, activation processes, literal comprehension, interpretive reading, inference taxonomies, and the effects of a variety of variables. In addition, the majority of our L1 inferencing knowledge is based upon narrative texts. Narrative and expository texts differ, and Narvaez et al. (1999) posited that the inferencing processes of readers are affected by text type. Additionally, little L2 inferencing research has been conducted with long expository texts as the majority has focused on inferences for local coherence and literal comprehension. Further, a limited number of researchers in both L1 and L2 has included task as a factor affecting inferencing processes, and even fewer have looked at how specific tasks affect inference processes. Although many researchers mention that their studies are limited to narrative texts and that task type or reading purpose may affect inferencing processes, there is a lack of inferencing research with expository texts in both L1 and L2.

The reading purpose affects the cognitive processes employed by the reader (Carver, 1997; Cohen & Upton, 2006; Horiba, 1996, 2000, 2002, 2013; Horiba & Fukaya, 2015; Kintsch, 1986, 1998; Koda, 2005; Grabe, 2009; Rosenfeld, Leung & Oltman, 2001; van den Broek et al., 2001; Yoshida, 2012). Specific to this thesis, it is probable that the reading task or purpose “affects the inference process during reading” (Noordman, Vonk & Kempff, 1992, p. 587) and “depend on the reader’s goals” (Narvaez et al., 1999, p. 493). How learners store, organize, represent, interpret and learn information from texts has yet to be defined with complete agreement in the literature (Horiba,

2013; Horiba & Fukaya, 2015; Nassaji, 2007). Further, how L2 readers differ from or are similar to L1 readers is even less clear (Horiba, 2000, 2013; Nassaji, 2007).

Reading requires making inferences, but if the inferencing processes differ between literal and interpretive reading, the assumptions made about a student's reading abilities or proficiency based on reading for a summary task cannot necessarily be applied to reading for tasks that require the reader to go 'beyond the text' and elaboratively inference. Elaborative inferences can foster learning (Horiba, 1996; Kintsch, 1986, 1998) and are necessary for successful completion of academic tasks that require critical reading to synthesise, analyse, and integrate information within and among texts (Horiba, 2002; Kintsch, 1998; Koda, 2005; Zwaan & Singer, 2003). However, some types of elaboration, such as applying background knowledge, embellishing or extending textual information, and applying textual information to novel situations, can be challenging for readers (Durgunoğlu & Jehng, 1991).

1.1 Importance of Study

Research suggests that there are different types of elaborative inferences, and they may be affected by reading purpose (Cohen & Upton, 2006; Durgunoğlu & Jehng, 1991; Horiba, 2013). Khalifa and Weir (2009) argue that there is a need in the field to clearly define and verify the cognitive processes during reading specific to reading purpose. Horiba (2013) and Horiba and Fukaya (2015) contend that this relationship is still not well defined and much more research is needed. As per Yoshida (2012), "[i]f we are to identify how particular processing tasks induce certain processing operations and thereby influence comprehension, we must carry out more careful analyses... investigating...particular tasks" (p. 19). Much more is known about the inferences

required to create a literal understanding of a text than is known about the inferences involved in an interpretive level of comprehension.

A variety of academic tasks have been categorized and include summary, information synthesis, critical analysis, and personal response (Rosenfeld et. al, 2001). For these tasks, the text is reconstructed in the reader's memory but not stored as purely linguistic information (Kintsch, 1986.), and how the information is reconstructed is often task dependent (Horiba, 2013; Kintsch, 1998). However, fluent and skilled L1 reading does not necessarily transfer to L2 reading (Clarke, 1980; Heeney, 2005; Koda, 2005; Macaro & Erler, 2008; Shih, 1992). For example, L2 readers may not have automated lower-level processing skills such as decoding which cause issues at the local level (Horiba, 2000; Pretorius, 2005; Yoshida, 2012); thus, tasks that require global comprehension, assessment, analysis, or integration of content may be especially difficult. English for Academic Purposes (EAP) students often complain that applying what they read to academic tasks is one of the most difficult tasks for them (Fraser, 1989), and elaborative inferences are required for these types of tasks (Grabe, 2009; Horiba, 2002; Kintsch, 1998; Koda, 2005; Zwaan & Singer, 2003).

Given our limited knowledge of the inferencing processes of skilled, adult readers in both L1 and L2 with expository texts, and as it is accepted that inferences are generated while reading and task is a factor affecting reading, this study is framed by three research questions:

1. Do the inferences generated by skilled, adult readers differ between a summary task and a position-paper task in L1?

- a) If so, in what way(s)?

2. Do the inferences generated by skilled, adult readers differ between a summary task and a position-paper in L2?

a) if so, how?

3. Do the inferences generated by skilled, adult readers in L1 differ from the inferences generated in L2?

a) In a summary task?

i) if so, how?

b) In a position-paper task?

i) if so, how?

In order to answer the research questions, a small exploratory study was undertaken with a group of skilled adult readers in their L1 (German) and L2 (English) at a large university in Germany. Participants read two texts, one in German and one in English, and were given a reading purpose based on an academic writing task. To access the normally hidden inferencing processes that are required to investigate the research questions, Think-Aloud Protocols (TAs) are one of the most appropriate methods (Horiba, 2000, 2013; van den Broek, 1994; Yoshida, 2012). Many second language acquisition (SLA) researchers have employed Think-Aloud protocols in order to access the cognitive processes involved in reading and writing (Barkaoui, 2015; Bowles, 2010; Cohen & Upton, 2006; Gass & Mackey, 2000; Hu & Nassaji, 2012; van den Broek et al., 2001; Yoshida, 2008). TAs require participants to verbalize what they are thinking and may be concurrent or retrospective (Bowles, 2010; Ericsson, 2002; Gass & Mackey, 2000). Concurrent TAs require the

participant to verbalize while completing a task; whereas, retrospective TAs occur after task completion and participants are asked to recall and then verbalize what they were thinking during task completion (Bowles, 2010; Ericsson, 2002). TAs were the major source of data for this study, and both concurrent and retrospective TAs were used for data collection.

The results of the proposed research may lead to a better understanding of which inferences skilled, adult readers in L1 and L2 make while reading academic texts for specific academic tasks. Knowledge of the inferencing processes engaged in by readers may inform EAP pedagogy. For instance, if the inferences generated in the L1 are transferred to the L2, reading instructors need not focus as much on inferencing processes as much as other reading skills in the classroom. If, however, they do not transfer or there is a loss, teachers should then include some focus on instructing inferences in class. Furthermore, if the inferencing processes engaged in are in fact task specific, then reading instructors may want to teach strategic inferences in task-specific contexts. Moreover, assessing student reading may become more task specific, thus, possibly increasing validity in classroom based reading assessments. Additionally, understanding which inferences are task specific may offer teachers insights into student 'errors' such as reading for a summary task when asked to read for an analysis task. This may improve feedback to students and improve their reading proficiency.

While this may not affect large-scale assessments, a better understanding of what teachers are assessing leads to higher construct-validity. The English medium academy is no longer the domain of NSs; the number of NNSs at post-secondary institutions around the world studying in English is increasing. As such, EAP programs are also increasing. In high-stakes contexts such as EAP programs, large scale proficiency assessments, and postsecondary studies, knowledge of the

linguistic requirements of the target context is imperative for the development of valid and reliable course outcomes and assessments (Bachman & Palmer, 2010). Further, the more informed language and EAP instructors are in said requirements, the more informed their pedagogy will be. Decades of bridging inference research have positively influenced reading instruction for local comprehension; so too can elaborative inferencing research positively influence reading instruction for global and interpretive levels of comprehension as required for successful completion of post-secondary studies. As Meyer Sterzik and Fraser (2012) and Macknish (2011) have argued, interpretive, or critical, reading strategies can be taught.

1.2 Dissertation Outline

Chapter Two presents a review of the research relevant to the current study. It begins with a discussion of three perspectives of reading comprehension that are most appropriate to academic contexts, and then presents and explains an integration of the perspectives that frame the current study. Section two presents a brief history of the current views in reading comprehension research that reading is an interactive process in which readers interact with texts. Three of the most influential theories of reading processes, or discourse processing, are discussed next and their relevance to the current study is explained. Following that, there is a discussion of inferences in reading, pertinent studies from both L1 and L2 researchers, and a description of the major inference categorisations from L1 cognitive psychology research with narrative texts that have influenced inference categories for expository texts and reading purposes. Chapter Three, describes the methodology and participants' demographics and context, the materials used in the study, and data collection and data analysis procedures. The results of the data analysis are presented in Chapter

Four. Chapter Five includes a discussion of the study results, pedagogical and assessment implications, and recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Major Perspectives Framing Reading Research

Reading, although an invisible process, is anything but simple. Multiple linguistic and cognitive skills, strategies and processes are engaged in concurrently by readers. Further, there are also external factors such as reading purpose and text type that can affect reading processes both positively and negatively in L1 and L2. Reading is a complex skill in any language; when reading in a second language, though, the process and its components are even more complex (Grabe, 2009; Koda, 2007). Further, the interactions between the components and the degrees to which the components affect L2 reading comprehension are not well understood. Although a single model of reading has yet to be agreed upon (Perfetti & Stafura, 2014) there is agreement as to the components involved in the process (Carrell, 1983; Lorch, 1998). Background knowledge, memory, language proficiency, reading purpose, and inferencing ability are key components of reading comprehension (Albrecht & Meyers, 1998; Cook, Halleran & O'Brian, 1998; Eskey, 2002; Grabe, 2009; Gerrig & McKoon, 1998; Kintsch, 1986, 1998; Koda, 2007; Lorch, 1998; Perfetti & Stafura, 2014; Sanford & Garrod, 1998; McKoon & Ratcliff, 1998; Myers & O'Brien, 1998; Yoshida, 2012). What is currently debated is the way(s) in which these components are accessed and when, where, and how they are applied (Cook et al., 1998; Graessar, Singer & Trabasso, 1994; Lorch, 1998; Perfetti & Stafura, 2014) and how reading purpose affects cognitive processes during reading (Horiba, 2000, 2013; Yoshida, 2012). There are many frameworks of reading comprehension (Perfetti & Stafura, 2014), and Cohen and Upton (2006) and Enright et al. (2000) detail a framework of three perspectives specific to academic contexts which is highly applicable to this research: the Processing Perspective, the Task Perspective, and the Reader Purpose Perspective.

The Processing Perspective includes individual differences between poor and strong readers and the factors that contribute to reading comprehension (Enright et al., 2000). From this perspective, it is argued that the best way to understand reading abilities is to study individual readers and note differences between strong and weak readers (Enright et al., 2000). Factors that affect reading include speed and automaticity of decoding, level of thoroughness and accuracy of word recognition, and level of fluency in syntactic parsing and proposition integration, working memory processing efficiency, inferencing abilities, strategic competence and monitoring, and accuracy in creating a mental representation of the text structure and hierarchy (Enright et al., 2000). Most of these factors have been demonstrated to affect L2 readers (Koda, 2005). Essentially, from the processing perspective, linguistic knowledge and cognitive skills are the driving force behind reading comprehension (Enright et al. 2000).

From the Task Perspective, an explanation of reading comprehension is possible through a definition of skills that good readers possess (Enright et al., 2000). Defining those skills can be accomplished through researching what skilled readers do when they successfully accomplish specific tasks, and this is best accomplished through authentic tasks in authentic contexts (Enright et al., 2000). Key factors involved in this perspective are frequency and use of specific lexical items, complexity of the syntax, length and amount of information, and the time required or allotted to complete the task (Enright et al., 2000). This perspective is not dependent on cognitive processing theories, which may be problematic since much of the current research is processing-based (Enright et al., 2000). However, it is possible to account and control for processing and linguistic variables during tasks and measurements in tasks and research. Lastly, defining the strategies employed by skilled readers would allow for them to be taught to less skilled readers to improve their reading comprehension (Enright et al., 2000).

Finally, the Reader Purpose Perspective “describes reading in terms of the coordinated application of knowledge and processes to a text or texts in the service of a goal or purpose” (Cohen & Upton, 2006, p.1). The emphasis is on reading as an individual, cognitive process that is affected by not only the reader’s knowledge and skills, but also by task characteristics (Cohen & Upton, 2006). Further, individual differences in linguistic and background knowledge can account for reading comprehension variations (Cohen & Upton, 2006; Enright et al., 2000). Other individual variables such as cognitive processing ability, strategy use, affect, L1, text type, and task or purpose all interact and directly influence a reader’s performance while reading for a specific goal or purpose (Cohen & Upton, 2006). This perspective distinguishes purposes for reading (e.g.: reading to learn, reading for the main idea, and reading to find specific information) as factors that affect reading processes (Enright et al., 2000).

The perspective adopted in this paper and used to frame the current study is a combination of the Task Perspective and the Reader Purpose Perspective, and will be referred to as the *Reader’s Task Perspective*. It is largely in sync with the Reader Purpose Perspective in that reading is viewed as an individual cognitive process in which many cognitive actions occur simultaneously while reading and the processes are most likely task dependent. Furthermore, the view will be taken that multiple internal and external variables such as language proficiency and background knowledge affect reading comprehension and that these can and must be controlled for as much as possible in reading research. The *Reader’s Task Perspective* also includes the Task Perspective view that authentic materials and tasks are imperative to any reading comprehension research. In order to define what skilled readers do when successfully accomplishing academic reading tasks, but the research materials need to be as authentic as possible in order for the data to have evidence of validity. Once skilled readers’ cognitive processes have been identified and defined through

research with authentic materials and tasks, they can be taught to less skilled readers to improve reading comprehension. The literature review that follows is focused on theories and studies that explain or inform the major focuses in the *Reader's Task Perspective*.

2.2 L1 and L2 Discourse Processing and Reading Comprehension

It is accepted that reading is a complex, interactive process that is not yet fully understood in L1 learners, let alone adult L2 learners (Grabe, 2009; Koda, 2005; Nassaji, 2007). Historically, reading theories were very linear, or 'bottom-up models', and focused on phonological, lexical, and syntactic information, or they were 'top-down models' and based mainly on reader expectations and knowledge (Rumelhart, 1977). Rumelhart (1977, 1980) convincingly argued that bottom-up models fail to adequately explain the effects of surrounding letters, syntax, semantics, and context, and many researchers have consistently found that a reader's background knowledge affects reading comprehension (Grabe, 2009; Koda, 2005; Nassaji, 2007).

Current theories of discourse processing, therefore, include both linguistic and world knowledge. To illustrate, in their proposed 'Reading Systems Framework', Perfetti and Stafura (2014) make three central claims about reading based on decades of reading comprehension research:

1. Three classes of knowledge sources are used in reading: linguistic knowledge, orthographic knowledge, and general knowledge (knowledge about the world, including knowledge of text forms, e.g. text genres).
2. The processes of reading-decoding, word identification, meaning retrieval, constituent building (sentence parsing), inferencing, and comprehension monitoring- use these knowledge sources in both constrained ways (e.g., decoding uses orthographic and phonological knowledge but not general knowledge) and in interactive ways (e.g., inferences use general knowledge and propositional meaning extracted from sentences).
3. These Processes take place within a cognitive system that has pathways between perceptual and long-term memory systems and limited processing resources (p.25).

The 'Reading Systems Framework' has been proposed as a general framework of reading comprehension and cognitive processing and includes "knowledge sources, basic cognitive and language processes, and the interactions among them" as the key components (Perfetti & Stafura, 2014, p. 24; see Figure 1). As can be seen in Figure 1, there are many components involved in reading, and their interactions are imperative to comprehension. The Reading Systems Framework is intended to be used to create hypotheses about readers' comprehension problems. To illustrate, the model allows one to identify weaknesses in one, or more, of the components, and then carry out careful experimentation to specify which area(s) are problematic, either knowledge or processes. This investigative process works best with lower level processing issues such as phonological awareness because more specific hypotheses can be made through a series of experiments including subsystems of the phonological component. The investigative process mentioned above does not function well with higher level processes because the input required for higher level processes tends to be more complex; thus, it is more difficult to control for some of the lower level components (Perfetti & Stafura, 2014). However, the framework can be used to identify 'pressure points' in reading comprehension and reading research. Although proposed to describe L1 reading, the components Perfetti and Stafura (2014) describe are applicable to L2 reading as well. While there are differences in L2 reading as compared to L1 reading, the components remain the same.

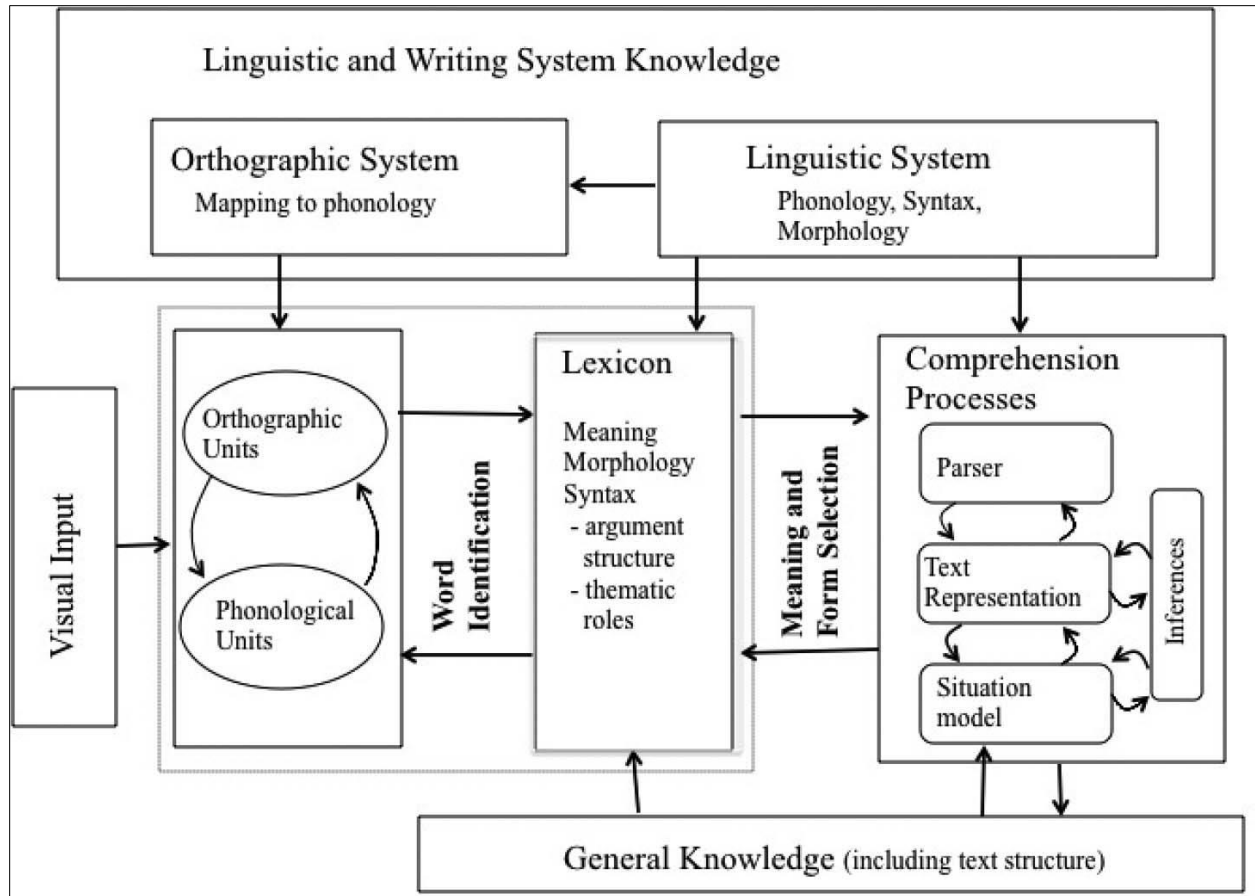


Figure 1: The Reading Systems Framework (taken from Perfetti & Stafura, 2014, p. 24).

In the literature, descriptions of L2 reading processes have been separated into two categories: decoding and whole-text (Grabe & Stoller, 2002; Macaro & Erler, 2008). Decoding is described as the identification or translation of linguistic units (words and/or propositions); whereas, whole text reading includes putting those units together to build a mental representation of the entire text (Fraser, 2004; Grabe & Stoller, 2002; Kintsch, 1998; Macaro & Erler, 2008). These definitions are very much componential in that they attempt to describe only the components and actions involved in reading comprehension (Urquhart & Weir, 1998). Process models, on the other hand, have attempted to describe not only the components but their interactions during reading (Grabe & Stoller, 2002; Kintsch, 1998; Macaro & Erler, 2008; Urquhart & Weir, 1998).

Process models began with the bottom-up approach (Urquhart & Weir, 1998), which has been described by Grabe and Stoller (2002) as lower-level processes that include linguistic decoding. Kintsch (1998) believes that this linguistic decoding is the construction of a text-based understanding, and Bernhardt (1991) refers to this process of linguistic decoding as text-driven reading. This process requires the reader to recognize letters and their spelling patterns in order to identify words (Bernhardt, 1991; Heeney, 2005; Kintsch, 1998; Macaro & Erler, 2008). Once words are recognized and encoded, they must be categorized into their longer units, or propositions, to create meaning (Bernhardt, 1991; Heeney, 2005; Kintsch, 1998; Koda, 2005; Macaro & Erler, 2008). In fluent readers, the decoding process is automatic, and the readers focus on 84% of the content, or meaning carrying, words in a text, and 17% of the function, or grammatical, words (Bernhardt, 1991, p. 73). While decoding, fluent readers remember the prior propositions and cognitively ‘attach’ them to the new propositions to create a mental representation of the author’s meaning (Kintsch, 1998; Koda, 2005; Macaro & Erler, 2008; Urquhart & Weir, 1998). L2 readers, however, may not decode words as automatically, tend to be slower because of unfamiliarity with proposition structures and patterns, and their L1 may actually interfere with the decoding process (Bernhardt, 1991; Fraser, 2004; Heeney, 2005).

Although Fraser (2004) states that fluent readers need to give little attention to the mechanics of decoding while reading, this skill alone is not enough for reading comprehension (Grabe & Stoller, 2002; Heeney, 2005; Kintsch, 1998; Koda, 2005; Urquhart & Weir, 1998). Top-down processing is also required; it includes prior knowledge application, hypothesis making and verification, questioning, purpose definition, and inferencing (Macaro & Erler, 2008; Urquhart & Weir, 1998). Bernhardt (1991), Heeney (2005), Kintsch (1998), and Koda (2005) all contend that the reader must be able to integrate and apply background knowledge to the text in order to

appropriately interpret a text. The integration of the text-based understanding with the reader's knowledge is described by Bernhardt (1991) as knowledge-driven reading, by Koda (2005) as reading between and beyond lines, and by Kintsch (1998) as creating a situation-based representation of the text. Koda (2005) posited that text comprehension goes “beyond adequate language processing skills” and the reader is required to be able to “envision real-world situations inferred from the text statements” (p. 127).

The knowledge used in this process comes directly from the reader and can be local, domain, or culture specific (Bernhardt, 1991). These knowledge areas can cause L2 readers to again be limited (Bernhardt, 1991), or to misinterpret the text (Koda, 2005) because of a lack of experience or knowledge around the social groups, institutions, and cultures that the text refers to (Bernhardt, 1991; Heeney, 2005). Higher level processing (Grabe & Stoller, 2002), or the creation of a situational representation (Kintsch, 1998), cannot be achieved without a textbase understanding (Kintsch, 1998; Koda, 2005). As can be seen in Figure 1, a reader's general knowledge, including text knowledge, is imperative to all three levels of text comprehension, and of particular importance to this study, a reader's general knowledge is required for the two levels of text comprehension that include inferences (Perfetti & Stafura, 2014). Background knowledge, or general knowledge, directly affects reading comprehension and inferencing processes (Perfetti & Stafura, 2014).

2.2.1 Schema Theory in L1 and L2 Reading Comprehension

In the 1970s, schema theory, a theory of how knowledge is represented in long-term memory, was first applied to reading comprehension as the interaction of the reader's background, or prior knowledge, with the text in relation to comprehension (Grabe, 2009; Rumelhart, 1977, 1980). For example, inferring why a character pinched their nose when walking into a horse stall

will be much easier for a reader who has been in, or mucked-out, a horse stall. A reader who has not been on a farm, nor mucked-out a horse stall, would most likely infer that it smelled badly, but they would not necessarily be able to attribute the smell to its origin.

Schemata are hypothesized to be “[t]he fundamental elements upon which all information processing depends. Schemata are employed in the process of interpreting sensory data (both linguistic and non-linguistic), in retrieving information from memory, in organizing actions, in determining goals and sub-goals, in allocating resources and generally in guiding the flow of the processing system” (Rumelhart, 1980, p. 4). Two types of schemata are generally discussed in the literature: formal and content. Although there is some variation in the literature of the definitions of the two types of schemata, in this paper, formal schema will be used to characterize a person’s linguistic knowledge from morphemes to rhetorical text structure in any and all languages that they ‘know’ at any proficiency level. Content schema includes what a person knows about the world in general as well as in specialized areas such as professional topics. Based on schema theory, recent cognitive processing theories have integrated bottom-up and top-down processing models and state that listeners and readers combine world and linguistic background knowledge to create mental representations of a text (Flowerdew & Miller, 2005; Hulstijn, 2003; Kintsch, 1986, 1998; Lynch & Mendelsohn, 2002; Perfetti & Stafura, 2014; van Dijk & Kintsch, 1983).

World knowledge schemata influence comprehension in two ways; first, by restricting the interpretation of the text which enhances comprehension (Buck, 2001). Second, scripts, which are a complex type of schema, allow the learner to form expectations and inferences based on context expectations (Buck, 2001). In a similar vein, studies have demonstrated that the activation or retrieval of ‘incorrect’ schemata can adversely affect reading comprehension (Carrell & Eisterhold,

1988; Grabe, 2009; Pretorius 2005, 2006; Rumelhart, 1980). Finally, the density of a schema can affect its retrieval time. Anderson and Reder (1999) describe research related to schema theory (human associative memory theory) that demonstrates that the more information there is within a schema, the longer it can take learners to retrieve the desired piece of information. Additionally, when a piece of information is not a part of existing schema, learners can be very quick to reject it. Further, readers are able to achieve a richer level of text comprehension than simply a literal understanding of an author's meaning (Durgunoğlu & Jehng, 1991; Kintsch, 1988, 1998; Perfetti & Stafura, 2014) which “[can] be explained by an interactive combination of top-down (knowledge driven) and bottom-up (word-based) processes” (Perfetti & Stafura, 2014, p. 23). However, the application of schemata to a text can both foster and impede reading comprehension.

Johnson (1982) found that cultural background knowledge had a larger effect on reading comprehension at the textbase level than focused vocabulary exposure. The advanced EAP participants in this study represented 23 nationalities that do not celebrate Halloween which was the topic of the expository text. The text, which was written to include low-frequency words, consisted of a familiar section based on what students had studied in class and an unfamiliar section based on the historical past of Halloween. The results revealed that background knowledge had a greater effect on textbase comprehension than exposure to new vocabulary; the students recalled significantly more information from the familiar section of the text than from the unfamiliar section. While vocabulary had some effects on comprehension at the word and sentence level, its effects were not as strong as the effects of background knowledge.

Carrell (1983) looked at the role of background knowledge in both L1 and L2 readers at a textbase level of comprehension using propositional recall. For the purposes of her study, she

categorized background knowledge into three components with a continuum: content familiarity and unfamiliarity, context given or unknown, and lexical items clear or unclear. Participants were college level native speakers (NSs) and intermediate and advanced non-native speakers (NNSs) who were given texts from each of the three categories to read and recall. The results revealed large differences between NSs and NNSs. NSs used all three types of background knowledge equally to facilitate textbase comprehension; both bottom-up and top-down processing were used. However, NNSs, both intermediate and advanced, relied heavily on content familiarity; it was the only significant variable in their textbase recall. Further, only the NSs showed a positive correlation with their assessment of ease or difficulty to a text and their level of recall (Carrell, 1983). One similarity did arise from Carrell's (1983) study, however; both NSs and NNSs remembered the unfamiliar text better than they remembered the familiar text. Perhaps this is due to the implementation of strategies such as elaborative inferencing, but Carrell did not investigate this potentially inferential oddity.

In a similar study, Carrell (1987) investigated the effects and possible interactions of content schemata and formal schemata in L2 learners for textbase comprehension. She defined content schemata as "knowledge relative to the content domain of the text" and formal schemata as "knowledge relative to the formal, rhetorical organizational structures of different types of texts" (p. 461). The participants were EAP students of Catholic or Muslim faiths, and the religions were the topics of the texts. Both texts were also written in a known rhetorical format which followed conventions of narratives and also in an 'unknown' format which was organized non-chronologically. The results of the study showed that when L2 learners read a familiar topic in a familiar rhetorical pattern, they comprehended it better than when it was an unfamiliar topic in an unfamiliar rhetorical pattern. However, when learners were given either an unfamiliar topic or an unfamiliar rhetorical pattern, content knowledge affected literal comprehension to a greater degree

than formal schemata; unfamiliar content had more detrimental effects on textbase comprehension than unfamiliar organizational structure.

Chen and Donin (1997) studied graduate science students to assess the effects of language proficiency and domain-specific knowledge, or content schemata, on reading comprehension of academic texts in L1 as compared to L2. Two knowledge domains were selected: biology and engineering. The biology group was the high background knowledge group and the engineers were the low background knowledge group. All of the participants were native Mandarin speakers studying in English in universities in Montreal. The participants were divided into two levels of proficiency that were subdivided into two groups: more proficient (high-intermediate to high) and less proficient (low-intermediate to intermediate) based on a standardized proficiency assessment. The study assessed lexical resolution and propositional recall. The results demonstrated that the effects of the two variables differed in regard to the levels of discourse processing. First, language proficiency regularly affected lower-level processing such as reading time and lexical information; all of the subjects read more slowly in the L2 than the L1 regardless of background knowledge. However, language proficiency did not affect semantic and textbase levels of comprehension. Background knowledge, on the other hand, affected semantic and global comprehension, but it had very little effect on lexical and syntactic processing. Lower proficiency readers with higher levels of background knowledge not only read as quickly as the high proficiency, low knowledge readers, they also remembered more propositions. A final, interesting finding of this study was that the participants' propositional recall did not change whether reporting in their L1 or L2.

Chu, Swaffar, and Charney (2002) conducted a study that also focused on reading in L1 and L2. The study assessed the effects of rhetorical patterns, or formal schemata, on the reading

comprehension of expository texts of Chinese EFL post-secondary students at the freshman and senior years of study in Taiwan. Four English expository texts were produced in both the conventional Chinese and English rhetorical patterns, and participants read one text from each pattern. Participants completed both immediate and delayed recall tasks based on propositional recall. The participants recalled significantly more propositions from the more familiar, Chinese rhetorically structured texts than they did of the more unfamiliar English rhetorically structured texts. The readers did not notice the rhetorical differences in the texts; therefore, the authors suggested that metacognitive awareness of rhetorical pattern distance could enhance reading comprehension as there was a “negative transfer of L1 rhetorical convention” that “seemed to affect reading recall in the L2 to a similarly significant degree regardless of the participants’ distinctly different developmental stages” (pp. 529-30). The application of formal schemata to a text affects L2 readers’ ability to create a literal understanding of a text.

Schemata affect reading comprehension in L1 readers (Carrell, 1983; Chen & Donin, 1987) as well as L2 readers (Carrell, 1983, 1987; Chen & Donin, 1987; Chu et al., 2002; Johnson, 1982) and this effect can be positive or negative. An appropriate schema can positively influence comprehension (Carrell, 1983), a lack of schemata can negatively affect comprehension (Carrell, 1983, 1987; Chen & Donin, 1987), and the transfer of incorrect schemata can also negatively affect reading comprehension (Chu et al., 2002). However, schemata are not the only component or variable that affects reading comprehension. Reading comprehension is the result of a multitude of concurrent cognitive actions, or processes, that a reader employs while reading, and as detailed in Figure 1, inferences are a major component in reading comprehension processes. A simple definition of inferencing is the application of a reader’s knowledge to a text to ascertain connections among textual content that are not explicitly stated in the text. Because of the complex cognitive

processing that occurs when one reads, many theories and frameworks of reading have been labelled models of discourse processing. There are three dominant theories of discourse processing in the literature that are of particular relevance to this research: memory-based models, Kintsch's (1988, 1998) Construction-Integration model, and Carver's (1997) Rauding Theory.

2.2.2 Memory-based Models of Reading Comprehension

Discourse processing requires memory to apply prior propositional content to new propositional content in order for comprehension to occur (Lorch, 1998). Gerrig and McKoon (1998) state that "the central claim of the memory-based approach is that each new piece of linguistic information is understood in terms of the information that it evokes from memory" (p. 69). It is agreed that the memory processes involved in reading can be divided into two major components: working memory and long term memory. Working memory (WM) is the first stage of memory and is limited in amount of space: 2 propositions (Foltz, 2003), time: generally 1-2 seconds (Grabe, 2009; Zwaan & Singer, 2003), and capacity to perform multiple, simultaneous processes (Koda, 2005; Grabe, 2009). Working memory can, however, hold more propositions if the reader requires it for the purpose of the reading, but it is not infinite (Grabe, 2009; Kintsch, 1998; Zwaan & Singer, 2003). It is also generally agreed that the propositions within working memory must be conceptualized in order to be transferred to long term memory; readers tend to remember concepts as opposed to the exact lexical terms (Bransford, 1983; Bransford & Franks, 1972; Franks & Bransford, 1972; Grabe, 2009; Kintsch, 1998; Trabasso & Magliano, 1996). However, if the pragmatic meaning of a proposition is highly interactive, such as a play on words or a pun, the focus of the reader is on the lexical items; thus, the reader tends to store the linguistic information verbatim in their memory (Zwaan & Singer, 2003).

“Long-term memory (LTM) is everything a person knows and remembers: episodic memory, semantic memory, as well as declarative and procedural knowledge” (Kintsch, 1998, p. 217). In order to retrieve information from LTM when one reads, a cue in the text activates a retrieval mechanism in WM; the retrieval structure then searches LTM via schemata structures to access the information from LTM (Kintsch, 1998). Schemata, organizational structure of memory content, must be dense to foster quick and accurate retrieval (Kintsch, 1998). The only way a schema becomes dense is with a “[s]uitable knowledge base...[because a person] has reached a high level of expertise in a special expert domain, or in everyday life situations where everyone is an expert” (Kintsch, 1998, p. 221). Without a dense schema, inappropriate information from memory may be retrieved which affects reading comprehension (Kintsch, 1998).

The information evoked from memory that fosters reading comprehension in memory-based (MB) models of reading is prior textual information and existing linguistic knowledge (Albrecht & Myers, 1998; Cook et al., 1998; Gerrig & McKoon, 1998; Lorch, 1998; McKoon & Ratcliff, 1998; Myers & O’Brien, 1998; Sanford & Garrod, 1998). There is very little mention of the reader’s content schemata, or world knowledge, in the memory-based perspective. It is predominantly a ‘bottom-up’ view (Lorch, 1998) in that it focuses on the reader applying schemata to infer relationships across propositions for local coherence. Inferences are defined by McKoon and Ratcliff (1992) as “any piece of information that is not explicitly stated in a text” (p. 440). For example, in this perspective, the relationship between a pronoun and its referent is an inference made by the reader. This is an example of an automatic inference because it is part of the reader’s “well-known information from general knowledge” combined with “explicit information from the text being read” (p. 441).

The general knowledge that McKoon and Ratcliff (1992) referred to includes the reader's world and linguistic knowledge; that is similar to Perfetti and Stafura's (2014) description of general knowledge in The Reading Systems Framework, as well as the prior textual information that the reader has retained in working memory. For example, learners were able to quickly identify a subject when it was referred to again with the same modifier that had been used before. According to MB approaches, this is because the information is readily available in memory because it has been encoded as such (McKoon & Ratcliff, 1992). However, Gerrig and McKoon (1998) mention that world knowledge assists the reader in forming a mental picture of the textual information. The focus of most MB models, however, is how the relevant background information *from the text* is accessed (Cook et al., 1998; Lorch, 1998).

In MB approaches, text comprehension is considered “in the absence of specific goals and strategies” from the reader (McKoon & Ratcliff, 1992) with the view of reading as inferentially limited during ‘normal’ reading circumstances (van den Broek et al., 1993). MB researchers focus on automatic, effortless, and instant inferences that occur during readings tasks, which do not foster conscious or strategic inferencing, for local comprehension (van den Broek et al., 1993). This is evidenced through research methods that limit conscious inferencing opportunities by “employ[ing] rapid presentation rates, require[ing] quick responses to criterial tasks, and often...use brief texts” (van den Broek et al., 1993, p. 176). Thus, studies with an MB perspective tend to be concerned with the inferences made online for local coherence (van den Broek et al., 1993) and a literal understanding of the text. Further, MB researchers state that readers do not elaboratively or strategically inference unless there is a comprehension issue at the local level or because of a reader goal; the MB model does not include inferences for global coherence (McKoon & Ratcliff, 1992)

There is consensus among MB researchers that something in a text can trigger a searching mechanism within memory (Lorch, 1998). Information from the text, as explicit information in working memory or as implicit information stored in long-term memory, is accessed via a linguistic cue (Albrecht & Myers, 1998; Cook et al., 1998; Sanford & Garrod, 1998). The difference between the two places of accessible information is only retrieval time; implicit information takes a little longer to access (Albrecht & Myers, 1998; Cook et al., 1998; Sanford & Garrod, 1998). MB researchers concur that the retrieval process is ‘dumb’ in that all information that is related to the linguistic cue will be accessed whether or not it is necessary; this has been called a ‘resonance’ process (Albrecht & Myers, 1998; Cook et al., 1998; Gerrig & McKoon, 1998; Lorch, 1998; McKoon & Ratcliff, 1998; Myers & O’Brien, 1998; Sanford & Garrod, 1998) and the Fan Effect (Anderson & Reder, 1999). The premise of the Fan Effect is that the more information that is related to a specific concept within a text, the longer it can take to retrieve the desired piece of information as every piece, relevant or not, is activated (Anderson & Reder, 1999).

The strength of the cue, or its level of overlap with prior propositions, will also affect retrieval time and information activation. For example, Cook et al. (1998) conducted several studies in which a character was described as having a particular characteristic, such as passivism. Later in the story, the character would enrol in an activity that matched, was neutral to, or contradicted the previously described characteristic, such as enrolling in boxing classes (Cook et al., 1998). The authors argued that in models that focus on specific discourse markers, as opposed to their theory of featural overlap, the inconsistent scenarios would not cause comprehension breakdown. Their results showed that reading time did, in fact, slow in the contradicting scenarios. These results were duplicated in all four of their experiments.

Albrecht and Myers (1998) furthered this theory when they demonstrated that without overlap to an original goal statement, readers did not notice an inconsistency; without a cue of some sort, prior propositions are not accessed from memory. Myers and O'Brien (1998) explained that the strength of the cue for reactivation of relevant background knowledge is influenced by featural overlap, antecedent elaboration, distractor effects, referential distance, and world-knowledge resonance; each will affect reactivation time. Gerrig and McKoon (1998) concurred and demonstrated that when the character being referenced is an 'outsider', or not necessary to comprehend the scenario or from a much prior episode in the text, reactivation took a little longer, but it did occur. Clearly, textual features cause reactivation of prior-read textual content from memory, even when the distance is greater than working memory would allow for; hence, long-term memory must also be searched by the reader.

MB researchers further argue that propositions, although the smallest unit of meaning that can be verified, are not necessary for knowledge activation; sub-propositions can cause the reactivation (Lorch, 1998). Albrecht and Myers (1998) showed that when a noun was modified, and the modification was included in the cue sentence, readers reactivated the original scenario or goal associated with the noun. Sanford and Garrod (1998) went further and incorporated content schema into the theoretical framework by explaining that information in a text is translated into a mental representation of a scenario within memory, and that referent representations assist in the reactivation of background knowledge. To illustrate, when readers were given the sentences "John was on his way to school. He was worried about the maths lesson" (p. 167), in recall tests, John was described as a "schoolboy" (p. 167) even though that had not been explicitly stated, and he could just as easily have been the teacher. This is the only reference to content schema in the MB approach.

Very few MB studies have been conducted with L2 readers, but memory also affects L2 discourse processing and comprehension. Unlike the MB researchers who focused on what information was retained in memory while reading, Payne, Kalibatseva and Jungers (2009) included working memory capacity of L2 readers as an independent variable in their study of the interactions of several factors in L2 reading. They asked the question, “Does domain experience compensate for working memory capacity in second language reading comprehension?” (p. 119). As the authors are from psychology and neuroscience faculties, their definition of domain experience is not content knowledge but exposure to the target language or a weak measure of L2 proficiency. The authors describe three possible models of correlational relationships between working memory capacity (WMC), L1 proficiency, and L2 exposure time:

1. the “Knowledge is Power” model: with a certain level of exposure to and experience with the target language, differences in WMC and L1 proficiency can be eliminated as factors in L2 reading comprehension.
2. the “Independent Influences” model: that WMC and exposure are independent variables that both affect L2 reading comprehension but do not interact.
3. the “Rich get Richer” model: the WMC limitations cannot be compensated for with L2 exposure; thus, learners with higher WMC and exposure time will become the most proficient L2 readers.

The participants were given an English (L1) reading proficiency test, a WMC test, and a Spanish (L2) reading proficiency test (Payne et al., 2009). When all three variables were included in regression analyses, L1 reading comprehension ability significantly predicted L2 reading comprehension; WMC gave no further indication beyond what it predicted for L1 reading

comprehension, and exposure time independently influenced L2 reading comprehension. The authors concluded “that reading abilities in a foreign language are influenced independently by cognitive ability and experience with language, and that working memory has an indirect relationship with L2 comprehension” (p. 123). The authors concluded that WMC was indirectly related to L2 reading because WMC was mediated by L1 reading level, and there were no differences in comprehension from L1 and L2 related to WMC. That said, L1 reading proficiency and exposure to the target language, or language proficiency, directly affected reading comprehension.

According to MB models, only when the automatically retrieved information is insufficient for comprehension because of a lack of local or global coherence is a directed mental search of the reader’s content schema employed (Cook et al., 1998; Lorch, 1998; Myers & O’Brien, 1998). Therefore, ‘top-down’ influences are generally not considered in literal comprehension in this approach (Lorch, 1998). MB researchers recognize that elaborative and strategic inferences can occur, but they are not included in MB models as they do not attempt to explain comprehension beyond local coherence and a literal level of comprehension. MB researchers have demonstrated that bridging inferences are required for reading comprehension at local levels (Perfetti & Stafura, 2014), and their studies informed the descriptions and definitions of the inferences that are generated by readers while reading narrative texts. However, many academic tasks require more. Readers can go ‘beyond the text’ and read for global coherence and an interpretive level of comprehension. Kintsch (1986, 1998) concurred and included multiple levels of text comprehension in his Construction-Integration model of discourse processing.

2.2.3 The Construction Integration Model

Kintsch's (1986, 1998) model of discourse processing provides a current and useful framework for understanding the cognitive processes involved in several levels of reading comprehension (Horiba, 2000, 2002; Meyer Sterzik & Fraser, 2012; Nassaji, 2007; Perfetti & Stafura, 2014; Yoshida, 2012; Zwaan & Singer, 2003). Kintsch (1986, 1998) differentiates between understanding and learning from texts with three levels of mental representations: parsing, textbase, and situational. At the parsing level, readers are concerned with clauses and sentences which they understand; this is the process of decoding the text using only the linguistic features of the text and the reader's knowledge of linguistic information (Kintsch, 1986). At the parsing level, no inferences are generated (Kintsch, 1998); it is a "shallow" representation with no "referential specification for each noun" (Graesser et al., 1994, p. 373). As inferences are not generated during parsing, this level of comprehension is not relevant to the current study.

Comprehension, in Kintsch's (1998) model has two main processes: construction and integration. In construction, the reader decodes the letters and words into micro-propositions and propositions, activates prior knowledge, attaches each proposition to prior propositions, and mentally categorizes the text into a hierarchical structure. The textbase representation focuses on propositions and their organization into micro and macro structures within the reader's memory. The textbase level includes the application of the reader's formal schemata of rhetorical structure to organize the propositions. The result is a textbase representation or understanding. If successful, the author's intended meaning is understood, and Kintsch (1986, 1998) associates this comprehension process with remembering a text. This textbase is a literal understanding of the text; it does not include analysis, assessment, nor application of the content to novel situations. The reader is able to

accurately report the content of a text in a summary type assignment, but does not go beyond the text.

Kintsch (1986, 1998) further contends that skilled readers are able to attain a deeper level of comprehension by integrating the content with their existing knowledge. This integration of the textbase with the reader's knowledge is described by Kintsch (1998) as a situational representation and is associated with text interpretation and learning. A situation model of a text is a mental representation of the situation described by a text (Kintsch, 1986). For example, if reading a text that describes a country, the situation model is the mental map, or picture, of the country that the reader creates. A textbase is required to construct a situation model of a text, but a textbase does not guarantee that a reader will create a situation model of a text (Kintsch, 1986, 1998). It is also possible that an inaccurate textbase could be used to create a situation model, but the accuracy and quality of the situation model may, thus, be questionable.

Kintsch (1986) illustrates the differences between textbase and situation model representations with four experiments, one with children given easily and difficultly worded problems, and three with college students with survey and route style maps. The findings demonstrated that there were no significant differences in the recall of easily and difficultly worded arithmetic problems for the children that did not solve the problems; however, those that solved the problems, or created a situation model of the word problems, remembered significantly more easy problems than difficult problems. Kintsch (1986, 1998) asserts that this is because the children were able to create a situation model because they understood how to use the linguistic information in the simpler worded problems to create a situation model; whereas, with the more difficultly worded problems, they were unsure how to solve them, so they were unable to create an effective situation

model. This demonstrates that having to solve a problem requires the reader to reconstruct the linguistic information into a mental situation, thereby, modifying the linguistic information which fosters retention (Kintsch, 1986).

College students showed similar results with textbase and situation models of text representation (Kintsch, 1986). Participants were given one of two styles of text, and both styles of text were coherent, but one was more so; it was recalled at a significantly higher rate than the other. As has been demonstrated by much research, text coherence matters in constructing a textbase representation (Grabe, 2009; Kintsch, 1986; Koda, 2005). In regard to learning from a text, however, coherence did not have an effect, but the type of mental representation did. Recall output amounts were almost exactly the same for the two groups, but those that created situation models of the text by drawing a map were far more successful in their content recall (Kintsch, 1986). The textbase group largely reproduced the original text with only 24% of their output not matching the original text. Kintsch labeled the non-matching output as inferences and elaborations. In that portion of their recall, 79% of the inferences and elaborations made were wrong. The situational group reproduced fewer words from the original text, but their elaborations and inferences (35%) were correct 82% of the time. Kintsch (1986) concluded that reading to remember and reading to learn are based on different cognitive processes.

Kintsch's (1998) model is of relevance to this study as his framework is used to distinguish the levels of comprehension required for the tasks discussed in the relevant studies as well as the current study. However, a classification of how different reading purposes interact with cognitive processing is needed for the discussion of the literature because there are multiple research focuses and purposes, and not all studies have been framed with reading purpose specifically. Carver

(1997) provides a framework that can consistently be applied to many reading studies and, as described in the following section, proposed a theory describing the specific cognitive processes required for different reading purposes.

2.2.4 The Rauding Theory of Reading Processes

The reason why a text is being read affects the cognitive processes employed by the reader (Carver, 1997; Cohen & Upton, 2006; Grabe, 2009; Horiba, 1996, 2000, 2002, 2013; Horiba & Fukaya, 2015; Kintsch, 1986, 1998; Koda, 2005; Rosenfeld et al., 2001; van den Broek et al., 2001; Yoshida, 2012). Carver (1997) provides a theoretically based classification of how reading purpose and reading rate interact with cognitive processing (Fraser, 2007; see Table 2.1) based on a large body of research in L1 reading comprehension research. He posited that there are five types of reading that vary by purpose and cognitive processing complexity in L1 college-level readers (Carver, 1997). The least complex and fastest type of reading is scanning and involves only lexical access as can be seen in Table 2.1; each subsequent type becomes slower in terms of number of words per minute (wpm) as the cognitive processing components increase. Of particular relevance to this study are the types of reading and their processing components.

Scanning and skimming are the fastest types of reading and utilize the fewest cognitive components, and are “reading to find information” in the reader purpose perspective. Scanning is searching for a specific, discreet piece of information, such as a date, and does not require the reader to comprehend the surrounding text, per se, but only to find the piece of information; thus, lexical access is the main process engaged for this type of reading. Skimming involves lexical access and semantic encoding, or remembering the meaning of words in a text, as the reader attempts to get the

gist of phrases or clauses or short sections of text, and in the reader purpose perspective is subsumed under the same category as scanning (Enright et al., 2000).

Table 2. 1: Carver's Rauding Theory (Based on Carver, 1997).

Reading Type	Rate (wpm)	Cognitive Processing Components
Scanning	600	Lexical Access
Skimming	450	&* Semantic Encoding
Rauding	300	&& Sentence Integration
Learning	200	&&& Idea Remembering
Memorizing	138	**** Fact Rehearsing

* & denotes inclusion of the previously mentioned component(s)

Rauding, or “reading for basic comprehension” occurs under normal, reading for pleasure situations such as when reading the newspaper or a novel. It is more cognitively demanding and requires lexical access, semantic encoding, and proposition integration (Carver, 1997). The reader attempts to comprehend the main theme or ideas of the text, and integrates the meanings of multiple sentences. (Enright et al., 2000).

Learning, or “reading to learn” in the reader purpose perspective, is more cognitively demanding and requires lexical access, semantic encoding, sentence integration, and idea remembering (Carver, 1997). Readers must connect and integrate the textual information from across the entire text (Enright et al., 2000) as they also attempt to integrate the content within their existing knowledge. Learning from a text often causes the reader to turn linguistic information into concepts or ideas and attach prior textual information to current textual information (Carver, 1997; Enright et al., 2000).

The last type of reading in Carver's model is memorizing. This is the most complex of the reading purposes and includes five cognitive processes. This type of reading often occurs with

college students studying for exams, especially those that are not open-book and the students must ‘know’ all of the information. Although this is a common type of academic reading, it is not relevant to the current study as participants did not complete tasks that fostered nor required remembering or memorizing textual content in detail; they knew that they would have access to the texts in order to complete the tasks (see Chapter 3).

Kintsch (1986, 1998) and Carver (1997) argued that reading purpose affects cognitive processing, and both L1 and L2 researchers have included task, or reading purpose, as independent variables in reading research and supported these assertions, especially in regard to reading purpose affecting inferencing processes.

Narvaez et al. (1999) included reading purpose and text type as independent variables in their study of undergraduate students studying in their L1 English who were enrolled in psychology courses. Participants were randomly assigned to either a ‘reading to study’ purpose or a ‘reading for pleasure’ purpose. They read two narrative texts with 116 clauses each, and two expository texts with 81 and 82 clauses each. Participants read the texts while thinking aloud and the data were recorded, transcribed, and analyzed for instances of inferences. The inference categories included repetitions, coherence breaks from the text and schemata, evaluations, associations, explanations, and predictions. Comprehension was assessed via oral propositional recall; all of the participants were able to accurately and completely comprehend the texts. The results revealed that text type affected reading rates: expository texts were read slower, at Carver’s (1997) Learning rate, than narrative texts which were read at Carver’s (1997) Rauding rate. Additionally, although not statistically significant, readers reported more inferences in the study condition than in the entertainment purpose, and that finding was more pronounced with the expository texts than the

narrative text. There were no differences in comprehension based on reading purpose or text. Further, participants reported more instances of inferences of background knowledge-based coherence breaks, repetitions, and evaluations when reading for a study purpose than for an entertainment purpose. Text type and task affected inferential processes; therefore, the authors concluded that inferencing processes must be, at least partially, strategic and under readers' control.

Horiba (2000) investigated the effects of language proficiency, text type, and task with L1 and L2 readers. There were two texts, one narrative and one expository, and readers were instructed to read 'freely' for enjoyment or 'for coherence' for a summary task. Data were think aloud protocols that were analyzed for two levels of cognitive processing: lower-level which included bottom-up strategies, and higher-level processes which included inferences, strategic monitoring behaviours, and emotional reactions to textual content. The data showed that when reading in L1, expository texts evoked different cognitive processes than when reading narratives. Readers generated more inferences based on prior textual content and their background knowledge when reading essays and made more predictions when reading narratives. The reading for coherence purpose also affected inference processes in L1 as readers reported more inferences based on prior textual content, made more comments on text structure, and reported fewer associations to general knowledge than they reported in the read freely condition. L2 readers, however, demonstrated much smaller differences in cognitive processing when reading expository and narrative texts, but they did report more predictions and comments on text structure when reading essays. Task did not affect their cognitive processing of the text, but recall in L2 was as high as in L1 when reading for coherence. Horiba (2000) concluded that L1 and L2 readers strategically employ differing cognitive processes, including inferences, based on text-type and task, and the strategic processes differ across languages.

Yoshida (2012) included L2 proficiency as an independent variable in reading comprehension, but she investigated how text type (narrative, expository) and task (outline, comprehension questions, and reading only) affected comprehension. All three groups were EFL university students who were asked to complete immediate and delayed summary tasks after reading. There were no significant task effects on recall, suggesting that participants read the texts similarly for all three tasks. However, the narrative texts were remembered better than the expository texts, and this difference increased from immediate to delayed recall. These differences in narrative versus expository comprehension in Yoshida's results, may be explained by textual features and levels of familiarity. Based on the findings of previous research, Narvaez et al. (1999) explained that readers' inference processes with narrative texts differ from expository texts in at least six ways:

- (a) Narrative texts may elicit more interest, promoting more explanations and predictions than do expository texts
- (b) narrative texts may promote increased inferencing, resulting, for example, in readers making nine times as many inferences during narrative texts as they made during expository texts
- (c) readers have early and extensive practice making inferences while reading narrative texts, because they are used when learning to read and because everyday life is structured much like a story
- (d) the structure of expository texts is more variable than that of narrative texts
- (e) narrative texts may activate schema and script structures that support inference generation
- (f) narrative texts may rely more on familiar forms of causality than do expository texts, thus, promoting more explanations and more predictive inferences (p. 493).

Horiba and Fukaya (2015) looked at the effects of reading purpose, topic familiarity, and L1 and L2 proficiency and their effects on remembering and learning, specifically vocabulary acquisition, from a text. The participants were 145 postsecondary students whose L1 was Japanese and L2 was English. They were divided into two groups: high topic familiarity (nursing students),

and low topic familiarity (non-nursing students), and they all read a short, narrative English text that described a patient's experience with nurses in a healthcare situation. The reading purpose defined for the participants was specifically language of recall: one group was told before they read that they would later recall in L1 (L1-L1), another in L2 (L2-L2), and a third in L1 which was changed to L2 prior to the recall test (L1-L2). Recall was assessed based on number of propositions recalled in a post-reading writing task. Language proficiency affected content recall overall; topic familiarity enhanced comprehension of details within the text; L1-L1 reading purpose had higher content recall, and L2-L2 purpose assisted in incidental vocabulary acquisition (Horiba & Fukaya, 2015). The findings suggest that reading purpose based on language of recall "affects resource allocation during text processing" (Horiba & Fukaya, 2015, abstract).

Reading is a receptive skill, but it is not passive. Readers simultaneously employ multiple cognitive processes and apply information from multiple sources in memory while reading. Discourse processing and reading comprehension require the application of both bottom-up and top-down knowledge sources to attach information from the current proposition to prior propositions in order to construct mental representations of a text. MB researchers have focused on literal text comprehension with narrative texts and have demonstrated the necessity for bridging inferences (Perfetti & Stafura, 2014). While acknowledging the existence of different types of inferences and levels of reading comprehension, MB researchers, by and large, do not examine them. Kintsch's (1998) Construction-Integration model of discourse processing, however, includes and describes multiple levels of reading comprehension and suggests that the cognitive processes, including inferencing, required for literal and interpretive levels of comprehension differ. Carver (1997) provides a framework detailing that reading purposes or task also affects cognitive processes while

reading, and Narvaez et al., (1999) and Yoshida's (2012) findings support these assertions and demonstrate that text type also affects cognitive processing, including inferencing, during reading.

Many academic tasks require students to go beyond literal text comprehension, and the MB model is insufficient for describing reading tasks that include long texts, elaborative inferences, and reader goals. Most postsecondary students read expository texts, and are usually given a purpose or task; academic texts tend to be long, and more and different inferences are required for tasks that require more than literal comprehension. Therefore, the current study is framed by Kintsch's (1986, 1998) model of discourse processing and his levels of comprehension are used throughout the dissertation for consistency in discussions of literature, data, and tasks. Furthermore, in order to discuss similarities and differences across reading research that includes reading purposes, a consistent framework of reading type is helpful; Carver's (1997) Rauding theory provides such a framework for describing the types, or purposes, of reading. Specific to this paper, the reading task or purpose is expected to "affect[] the inference process during reading" (Noordman et al., 1992, p. 587) and "depend on the reader's goals" (Narvaez et al., 1999, p. 493). Multiple factors affect reading processes and comprehension; however, one cognitive skill, inferencing, not only affects reading, but it is necessary to comprehend texts at both literal and interpretive levels. Readers inference as they are reading, and schemata, text type, and task can affect inferencing processes in novice and skilled readers. In particular, inferencing processes differ when a reader attempts to create a situational model as compared to a textbase representation (Kintsch, 1986, 1998).

2.3 Inferences in L1 and L2 Reading

The application of information to a text that is not explicitly stated in the text is the process of inferencing. For example, the sentences "*Jimmy's big brother beat him up. The next day he was*

covered in bruises” are linked causally, but the sentences do not explicitly state the link (van den Broek, 1994, p. 547). In order to understand the causation, the reader must activate and apply their knowledge that bruises are caused by being hit and do not usually form immediately; they often take time to become obvious. That is the process of inferencing. The literature generally differentiates between two types of inferences: bridging and elaborative. Bridging inferences occur during reading to assist in the establishment of local coherence by linking the current clause to the previous textual information either semantically or causally (Geva, 1992; Koda, 2005; Zwaan & Singer, 2003). The background knowledge involved in bridging inferences is formal schemata which is defined in this study as linguistic knowledge including rhetorical structures, as well as content schemata which include topic and world knowledge. When readers infer the relationships among words and propositions across short texts such as sentence pairs, or short sections of a text like a single paragraph, they are reading for local coherence. Examples of bridging inferences for local coherence are anaphoric resolution and guessing unknown lexical items using the surrounding text. In the case of content schemata for bridging inferences, it is accepted that it must be automatically accessible; thus, it must be general, common knowledge (Zwaan & Singer, 2003). To specify, if a text describes the weather as humid and the character removes a jacket, the inference that the character is feeling warm or hot is considered bridging and is automatic because it is common general knowledge that when it is humid, it is generally warm outside.

Bridging inferences are required for local coherence building, but a different kind of inference is required for global coherence, or an understanding of the relationships among textual content in texts longer than a paragraph, as well as the integration of new textual information into the reader’s knowledge (Koda, 2005; Zwaan & Singer, 2003). “Ideas that are strongly implied by a discourse context but do not bear on [comprehension] are called *elaborative inferences*” (Zwaan &

Singer, 2003, p. 104, italics in original). Bridging inferences are required to understand a text, but elaborative inferences occur when the reader expands on or embellishes information in the text (Koda, 2005). For example, if reading a story in which a young boy is crying and holding an empty ice cream cone, an elaborative inference would answer the question why. Did he drop the scoop of ice cream? Did he finish it and wants more? The answers to both questions are examples of elaborative inferences because they are unnecessary to understand the story; the reader comprehends the words on the page and the ‘why’ has no bearing on text coherence. Elaborative inferences require the reader to apply their content schemata to textual information; prior textual information is applied to the text in elaborative inferencing only if it is the integration of several pieces of information across a longer text (Durgunoğlu & Jehng, 1991; Narvaez et al., 1999; Zwaan & Singer, 2003). When readers infer relationships of textual content across longer sections of a text such as across paragraphs, or if they are relating textual content to their personal knowledge, they are reading for global coherence. Much inferencing research in L1 and L2 has focused on bridging inferences for local coherence, similar to MB models, mainly with narrative texts, but there are some examples with expository texts.

2.3.1 Bridging Inferences in L1 and L2 Reading Research

Noordman, Vonk, and Kempff (1992), studied online causal inferences with expository texts that ranged from six to 10 sentences in L1 (Dutch). Reading time measures were taken of a target sentence which was presented in one of two conditions: explicit (no inference needed) or implicit (inference expected). A short post-reading verification assessment required “judg[ing] statements as either true or false with respect to the text” (p. 575). The hypothesis was that an increase in reading time for the implicit condition would evidence a causal inference online; whereas, an increase in

verification time would evidence the inference offline based on task. There were no significant reading time differences even when more reading time was given, but there were verification task differences; the implicit group took significantly longer than the explicit group. These results challenged the commonly held assertion that causal inferences are made online, or during reading. Consequently, this finding led to two further experiments that included a reading purpose. In the first experiment, participants were given the question they needed to answer before they were presented with the texts, sentence by sentence, and they were asked to answer the questions after they had read the entire text. The second experiment with a purpose used similar texts, but participants were instructed to judge whether each sentence was consistent with the previous sentences. Reading time increases for the implicit condition and no significant time increase for the verification task were the results. The authors concluded that a task or purpose “affects the inference process during reading” (p. 587). The data showed that the readers slowed from a Reading rate to a Learning rate (as per Carver, 1997) when given a specific reading purpose. This suggests that readers may have employed more online inferences when given a specific task.

Suh and Trabasso (1993) looked at L1 inferences for the cause of a character’s actions in relation to goals when the goal was reached, abandoned or continued. Participants read short narratives one sentence at a time and then verbalized what the sentence meant. The results indicated that readers used bridging inferences to explain actions and sub-goals that were directly related to a major goal, no matter the textual distance or whether local arguments or causes were available in memory. Also, L1 readers focused on sub-goals when reading about actions directly related them, and they did not often refer back to the superordinate goal online. Offline though, when asked, participants referred to both goals.

Building on prior reading comprehension and inference research, Hua and Keenan (2014) compared literal and inferential text comprehension of skilled and poor L1 readers, but controlled for memory to ascertain whether or not difficulties in inferencing could be attributed to poor memory or were caused by another cognitive deficit. The 78 participants were 8 to 18 years old, randomly selected from a sample of 1539, and equally separated into a poor or a good reader group. Participants completed a grade-appropriate section of a standardized reading comprehension assessment that included literal comprehension questions and inferential questions. The inferential questions required the integration of several pieces of textual information, or the reader was required to apply their content schemata. Given that the researchers were focused on text memory and its role in inferencing, and through analysis of the one sample inference question supplied, bridging inferences are the most likely type studied. However, it is possible that the older participants were required to integrate textual information from across paragraphs as opposed to a few sentences; thus, some of the participants may have engaged in elaborative inferencing, but Hua and Keenan (2014) did not use this distinction. Nevertheless, the results indicated that inferencing across several pieces of textual information was more difficult than literal recall for both groups, but poor comprehenders were able to infer as well as skilled readers when the information required for the inference was available in their memory. Inferencing, while difficult, occurs in both skilled and poor L1 readers, but memory affects the process. L2 research has also focused on bridging inferences, variables affecting inferencing, and their impact on textbase levels of comprehension mainly with narrative texts, but some L2 research has been conducted with expository texts.

Geva (1992) investigated L2 causal and relational inference ability for local and global coherence with expository texts using conjunctions as the focus. Her research was framed specifically with Kintsch's (1986, 1998) textbase level of comprehension and schema theory.

Participants were given texts, and their abilities to comprehend and infer logical relationships because of conjunctions were assessed intersententially, intrasententially, and at a discourse (paragraph) level. Her findings showed that as L2 proficiency increased, so too did inferencing ability at both local (inter/intra-sententially) and global levels (discourse), but the relationship was more significant at the global level of coherence. Additionally, she noted that the texts used for global coherence were of a scientific nature, so topics in which all of the participants had little or no content schemata, but the texts for local coherence were familiar topics. Geva (1992) posited that the lower inferencing ability differences for local coherence may have been more significant had the topics been unfamiliar; higher L2 proficiency may compensate for lower levels of content schemata. She concluded with the recommendation that EAP researchers include more, long expository texts in their studies and that EAP instructors include the same in their classrooms.

Pretorius (2005) used expository texts with L2 university students to assess the relationship between English proficiency, academic performance, and linguistic cue strength with anaphoric resolution. The participants were 68 first year medical students studying in L2 (English). The control group consisted of skilled L1 and ESL readers, and the experimental group included 'ESL distinction' students, or those who required language support. They read 30 paragraphs which included a total of 38 instances of anaphoric ties; each anaphor was underlined, and participants were instructed to underline the words or phrases that the anaphors referred back to. The anaphoric ties were categorized using the five Hallidayan categories: "repetition, synonymy, paraphrase, pronominal, and determiner" (p. 538). She further categorized the anaphoric ties by the 'strength of inference' required using four criteria: distance to anaphor, length of antecedent, anaphor grammatical function, and featural overlap. Scores were given to each anaphoric tie for each criteria and classified as either low inference or high inference strength. Academic performance was

measured by the final grades in two of the participants' content courses. She found that as each of the variables increased, including L2 proficiency, so did bridging inference ability and the level of text comprehension. As with L1 findings, the stronger (i.e. more explicit) the linguistic cue and more coherent a text was, the more likely readers were to make accurate bridging inferences.

In a similar study, Pretorius (2006) looked at L2 readers' ability to infer relationships in a text through illustrative, causal, and adversative connectives in expository texts and their relationship to academic performance and L2 proficiency. Participants were 82 first year medical and health science students at a major university in South Africa. Participants read two texts from an undergraduate science textbook and then wrote a comprehension test that was created specifically for the study's inferencing focus. Academic performance was assessed through grades in two content courses, and L2 proficiency through a norm-reference test developed by the Human Sciences Research Council of South Africa, but no proficiency scores were detailed. The findings were similar to her previous study in that as each variable increased, so did inferencing ability. Causal and adversative relationships were the most difficult inferences for the academically poor performers. Pretorius (2006) concluded that the ability to infer causal and contrastive relationships in expository texts is a necessity in academic reading, and students who are unable to infer these connections will not be academically successful. Thus, she advised ESL and EAP instructors to include explicit instruction in inferring causal and contrastive relationships in expository texts.

Uso-Juan (2006) included language proficiency and domain-specific knowledge as independent variables in a study of undergraduate EFL/EAP learners in Spain to investigate the effects of discipline-specific knowledge on L2 reading comprehension and "specify the levels at which the compensatory effect between the two variables takes place for successful EAP reading"

(p.210). The questions included anaphoric resolution, lexical resolution, literal comprehension, and summary, so the tasks assessed mainly bridging inferences. However, some questions “require[d] the student either to interpret literal information or to obtain it from various parts of the text and put it together in a new way” (p. 214) were also included, but those questions require elaborative inferences. The results showed that L2 proficiency and domain-specific knowledge contributed to reading comprehension of academic texts, but level of L2 proficiency was a stronger predictor of comprehension. However, limitations in either variable could be compensated for by the other, but there was a linguistic threshold that needed to be met in order for domain-specific knowledge to be compensatory. As L2 proficiency increased, but even if it were still at a fairly low level for academic studies, domain-specific knowledge positively affected reading comprehension of academic texts: “the higher the background knowledge, the lower the linguistic threshold” (p. 221) that was possibly due to more accurate lexical inferences made because of content knowledge. Unfortunately, Uso-Juan did not provide the data for each type of task; the data were reported as an entire score. Thus, any differences in bridging and elaborative inferencing abilities related to domain-specific knowledge and L2 proficiency remain unknown. Some researchers, however, have focused exclusively on one specific type of inference and its effects on reading comprehension.

Lexical inferences are a specific type of bridging inference for local coherence and are defined by Haalstrup as “making informed guesses as to the meaning of a word, in light of all available linguistic cues in combination with the learner’s general knowledge of the world, her awareness of context and her relevant linguistic knowledge” (as cited in Zhang & Koda, 2012, p. 1198). As Zhang and Koda (2012) were only interested in the effects of morphological awareness on lexical inferences and their contribution to vocabulary knowledge and reading comprehension, Haalstrup’s definition was modified to include only “intra-word morphological cues” (p. 1199).

Affix meanings such as *circum-*, meaning around, and structural uses, such as *-ous*, creating adjectives, were differentiated in the study. Participants, 130 engineering Master's Degree students in China who were enrolled in an EFL course as a foreign language degree requirement, completed assessments on morphological awareness, lexical inference ability, vocabulary knowledge, and reading comprehension. The data demonstrated that morphological awareness had a significant, but indirect, effect on L2 reading comprehension via the reader's ability to apply morphology to vocabulary learning as well as lexical inferencing while reading. While the results did not show a significant direct effect of morphological awareness on reading comprehension, its effect on lexical inferencing and vocabulary knowledge were significant; the higher the morphological awareness, the better the lexical inferencing ability.

Morphological awareness can foster appropriate bridging inferences for unknown vocabulary in adult, EFL readers (Zhang & Koda, 2012), but L2 proficiency also affects lexical inferencing (Hamada, 2014). Effective lexical inferences often include context clues as well as morphological clues, and Hamada (2014) investigated the source of lexical inferences and their accuracy with 107 college ESL students from a variety of L1s, at four levels of L2 proficiency: beginner, intermediate, upper-intermediate, and advanced. Participants completed multiple choice assessments for pseudo words in two conditions; condition one was morphologically reliable in which students could choose the best synonym by applying the semantic clue provided in the target pseudo word. Condition two was morphologically unreliable in that participants needed to apply contextual information to accurately choose the pseudo word's synonym. L2 proficiency had little effect in the morphologically reliable condition with participants performing similarly across proficiency levels, but when context clues were required to accurately lexically inference, the upper-intermediate and advanced groups performed significantly better than the beginner and intermediate

groups. The results suggested a positive correlation between L2 proficiency level and lexical inferencing ability.

L1 and L2 research have provided breadth and depth of knowledge on the bridging inferences required to comprehend a text at a literal level and investigated various variables affecting such inferences (Geva, 1992; Graesser et al., 1994; Narvaez et al., 1999). With L1 readers, bridging inferences are often made automatically, but task does affect inferencing processes, and it is possible that specific tasks cause readers to strategically infer. Furthermore, some inferences are more difficult for L1 readers than others, especially when the links or relations among antecedents and referents increase in distance or decrease in linguistic cue strength (Albrecht & Myers, 1998; Cooke et al., 1998). For L2 readers, background knowledge has been shown to affect bridging inferences and can cause misinterpretations (Carrell, 1983; Chu et al., 2002; Geva, 1992), but it can also compensate for lower vocabulary and language proficiency (Chen & Donin, 1997; Uso-Juan, 2006). Furthermore, L1 reading proficiency (or expertise), L2 proficiency, and academic background (Pretorius, 2005, 2006) as well as text and task type (Chu et al., 2002) affect bridging inferences.

2.3.2 Elaborative Inferences in L1 and L2 Reading Research

The basis of contemporary theories of reading comprehension is the interaction of the reader with the text; it is agreed that readers automatically employ bridging inferences while reading for local coherence (Carrell, 1983; McKoon & Ratcliff, 1992; Perfetti & Stafura, 2014). Elaborative inferences are generated from content schemata or textual information from a lengthier text and often related to a specific reading purpose (Koda, 2005; Narvaez et al., 1999). There is a large body of research on bridging inferences for local coherence at textbase levels of comprehension;

however, we are much less informed about elaborative inferences for global coherence and situational levels of comprehension.

In one of the few inferencing studies that used very long (1,300 words) expository texts, Durgunoğlu and Jehng (1991) differentiated between Kintsch's (1986, 1998) remembering and learning, or Carver's (1997) Rauding and Learning. Participants were native English speaking undergraduate students who read a text twice, once at a slower than normal reading rate (130 wpm) and a second time at a normal reading rate (260 wpm) (as per Carver, 1997). Text organization was an independent variable as there were two versions of the text: structured and unstructured. The structured text included headings, and the paragraphs were ordered in a 'good' rhetorical structure. The unstructured text did not have headings and the paragraphs were ordered in a 'less' rhetorically acceptable pattern, but not so much that the coherence of the text was compromised. The post-reading tasks were literal comprehension and elaborative inferencing. Literal comprehension was assessed by a remembering task in which participants were asked whether information was in the text or not. In order to minimize participants simply recognizing linguistic cues from the original text, all 'correct' statements were presented paraphrased from the original text. The elaborative inferences were assessed in a similar manner as participants were asked whether or not a statement were true based on information in the article. Inference statements required the participants to integrate information from across the text based on either fewer than five or more than five pieces of information, or to apply information to a novel situation.

The results indicated that text organization did not significantly affect text memory nor inferencing. However, text type did affect rejection of information that was not in the text. The two groups that read the same text twice performed much better on the rejection statements than the

group who read both the structured and unstructured texts. The amount of textual information affected inferencing as elaborative inferences that came from more than five pieces of textual information were made more easily than those that were made based on fewer pieces of information from the text. Moreover, the type of processing for the elaborative inferences mattered. The inferences from information across the text were performed more accurately than those that required application of the textual information to a novel context. These findings suggest there are different types of elaborative inferences, that they may engage different cognitive processes, and they may be affected by task.

Kang (1992) investigated cultural background knowledge and its effects on L2 reading comprehension, specifically in regard to inferences. Unfortunately, Kang did not define inferences beyond the application of schemata to a text and did not categorise the inferences from the qualitative data analysis. His focus was the application of inappropriate cultural knowledge to the text. Ten graduate students from Korea studying in the United States read a 1200+ word narrative in English and gave think-aloud protocols (online) for the researcher to be able to ascertain where their inferences ‘came from’. Participants completed post reading comprehension questions and five participants ‘passed’ and demonstrated comprehension of the text. The data showed that all participants generated inferences that were culturally inappropriate to the story but were culturally appropriate for the readers’ backgrounds. Further, all of the participants experienced “inferential intrusions and distortions from culture-specific schemata throughout the protocols” (p. 102). For many of the participants, the interference was minor and did not affect overall comprehension, but for some, the culturally inappropriate schemata caused low to no overall comprehension of the story. Kang attributed the low to no comprehension of some of the participants to inflexibility; they

failed to recognize or ignored explicit textual information that contradicted their bridging and elaborative inferences.

L2 elaborative inference research has also assessed whether or not elaboration improves recall and has shown that it does (Horiba, 1996). Horiba (1996) completed two studies that investigated L2 readers and the relationships between linguistically explicit causal sentences and linguistically ambiguous causal sentences in short narrative texts, as well as recall based on reading purpose: memorization or learning. Participants were given pairs of sentences and asked to either memorize them for a quiz (no inference) or to add a third sentence to create a story (elaborative inference). Both studies demonstrated that when readers elaboratively inferred, recall was significantly better than for the memorization group; even though, the inference group had not been informed of a later quiz and the memorization group had been forewarned.

More recently, Horiba (2002) looked at task effects on memory and comprehension in both L1 and L2 academic reading with undergraduate EFL students. Participants read two expository texts, one in L1 and one in L2, and were randomly placed in one of three conditions: read for surface forms, read for meaning, and read for critique. The surface forms group was told to read carefully by focusing on the words and expressions, the read for meaning group was instructed to visualize what they were reading, and the critique group was told to critique and contrast the author's position with their own. It is likely, that while the surface forms group focused on making local bridging inferences, the critique group focused more on making elaborative inferences by applying related background knowledge to the textual information in order to critique it. It is less clear which types of inferences the meaning group made as picturing events may engage both bridging and elaborative inferences. Previous research has demonstrated that while bridging

inferences are necessary for text comprehension, elaborative inferences tend not to be made unless a task or purpose requires them (Graesser et al. 1994; Narvaez et al., 1999). Thus, it is likely that the majority of the inferences made by the meaning group were bridging; although, elaborative inferencing may have occurred. All groups completed a recall which was analyzed for total number of propositions from the original texts to assess textbase comprehension. The results revealed that task affected recall for L2 texts and not L1. The recall of the critique group was significantly lower than that of the other two conditions in both L1 and L2. Horiba (2002) posited this was because of the increase in cognitive demand when reading to critique. Her data support Durgunoğlu and Jehng's (1991) findings that application of textual content to novel situations is much more difficult than elaborative inferences using textual information only. Thus, there may in fact be different levels of comprehension that require different types of elaborative inferencing, but this has yet to be addressed in the literature.

Building on prior research with adolescent L2 readers, Li and Kirby (2014) explored reading comprehension difficulties among poor, average, and good L2 readers. The participants were 246 eighth-grade English immersion students studying in China. The participants had a consistent L1 reading proficiency level as expected at their age and grade and all participants had "adequate word-reading skills" for their age and L2 proficiency levels (p. 81). The independent variables were measured via individually administered tests from various grade appropriate text books. Reading strategies and inferences were combined in one assessment, however, and the inferences assessed were elaborations and other inferences that were undefined, and the strategies included were predictions, summarizing, and finding main ideas. The major differences between poor and average L2 readers were vocabulary depth and breadth: the larger the vocabulary, the better the reading comprehension scores. Good L2 readers had a lexical breadth and depth, and also more

morphological awareness than the average readers. Further, Li and Kirby found that the good readers were better at making elaborative inferences, but elaborative inferencing ability was possible only at higher levels of L2 proficiency when lower-level processes were not overwhelming readers' cognitive capacities. The results showed that L2 proficiency affected reading comprehension in that those with a higher L2 proficiency were better able to elaboratively infer, and thus comprehended the text better.

Durgunoğlu and Jehng's (1991) findings suggest that there are different types of elaborative inferences and they may be affected by purpose. Yoshida (2012) demonstrated that L2 proficiency, text type and task type affect reading comprehension, supporting Horiba's (2002) findings that task and L2 proficiency affect memory and comprehension of texts. Khalifa and Weir (2009) state that there is a need in the field to clearly define and verify these cognitive processes in regard to reading purpose, and L1 and L2 researchers have provided evidence of strategic inferences employed by readers when reading for specific tasks.

2.4 Metacognition and Strategic Inferencing in L2 Reading

Strategies are deliberate, controlled, selected actions that readers employ to gain comprehension (Allen, 2003; Anderson, 1991; Bialystok, 1985; Carrell, Gajdusek, & Wise, 1998; Heeney, 2005; Macaro & Erler, 2008; Zhang, 2007). Cognitive reading strategies include paraphrasing, summarizing, elaborating, inferencing, and questioning in order to comprehend a text (Allen, 2003; Heeney, 2005; O'Malley & Chamot, 1990; Shih, 1992). Metacognition is the awareness of and ability to apply strategies while reading to foster comprehension (Carrell et al., 1998; Fraser, 1999; Kang, 1992; Koda, 2007; Parry, 1996; van Gelderen et al., 2004). The strategies applied by readers often depend on the task posed to the learner (Carrell, Pharis, & Liberto, 1989;

van den Broek et al., 2001; van Gelderen et al., 2004). Skilled readers use cognitive strategies automatically, but they also incorporate metacognition when a reading is perceived as difficult (Koda, 2005). Shih (1992) posited that L2 learners must be taught appropriate strategies to contend with the added difficulties they face when reading. Many linguists concur with Shih's (1992) contention and there is a large body of research that demonstrates metacognitive strategy instruction can improve L2 readers' comprehension (e.g.: Allen, 2003; Anderson, 1991; Bialystok, 1985; Block, 1986; Carrell et al., 1989; Carrell, Gajdusek, & Wise, 1998; Fraser, 1999; Heeney, 2005; Macaro & Erler, 2008; Salataci & Akyel, 2002; Zhang, 2007).

Using Flavell's framework, Carrell, Gajdusek, and Wise (1998) explained that there are two aspects to metacognition: knowledge and regulation. Knowledge incorporates three distinct categories: declarative knowledge or knowing what strategies are available, procedural knowledge or knowing how to perform the strategies, and conditional knowledge or knowing when and why to choose a specific strategy (Carrell et al., 1998). Regulation is the control of the strategies and includes planning, monitoring, testing, revising, and evaluating the effectiveness of the strategies (Carrell et al., 1998). Regulation is used to clarify the purpose, identify important aspects of the text, focus on major content, and monitor for comprehension, engage in self-questioning, and take corrective action (Carrell et al., 1998). Metacognition includes the application of strategies from the morpheme level all the way 'up' to the entire text; thus, metacognitive strategies can be applied at the morpheme, sub-propositional, propositional, sentence, paragraph, or textual levels (Carrell et al., 1989; Kang, 1992; Koda, 2007; Parry, 1996; van Gelderen et al., 2004). Palincsar and Brown (1984) identify six functions of metacognitive strategies:

- (1) understanding the purposes of reading, both explicit and implicit;
- (2) activating relevant background knowledge;
- (3) allocating attention so that concentration can be

focused on the major content at the expense of trivia; (4) critical evaluation of content for internal consistency, and compatibility with prior knowledge and common sense; (5) monitoring ongoing activities to see if comprehension is occurring, by engaging in such activities as periodic review and self-interrogation; and (6) drawing and testing inferences of many kinds, including interpretations, predictions, and conclusions (p.120).

Anderson (1991) concurred and explained that successful and non-successful readers use the same strategies, but skilled readers tend to use more of them and are better able to apply them appropriately. Carrell et al. (1998) agreed and stated that successful readers not only know what strategy options they have, but they are able to apply them appropriately. Many other studies have also shown that metacognitive strategy training can improve reading comprehension as well as inferencing ability in L2 readers.

Carrell et al. (1989) showed that two types of strategy instruction positively affected L2 reading comprehension, but that task type and strategy choice mattered. The 26 participants were a heterogeneous ESL group consisting of multiple L1s and included 17 undergraduate and 9 graduate students. Nine participants received experience, text, relationship (ETR) training, nine received semantic mapping training, and the final eight were the control group and received neither. The three texts were expository and approximately 300 words each, and comprehension was assessed via pre and post-tests including multiple choice and open-ended comprehension questions. The results indicated that the metacognitive strategies of ETR and semantic mapping increased L2 reading comprehension as compared to the control group. The authors concluded that ESL instructors include explicit and direct metacognitive strategy training in their classrooms.

Parry (1996) looked at the comprehension strategies and metacognitive awareness of two EFL groups: Chinese English Teachers and Nigerian high school students. She found what she

believes to be a clear link between comprehension strategies and L1 literacy experiences. The Nigerian students were multilingual, but most of their L1s did not have written systems prior to the 20th century and had very limited written texts; thus, the students did not develop advanced levels of literacy in their L1s. In contrast, all of the Chinese participants had graduated from university in their L1; therefore, they all had advanced levels of literacy in their L1. Parry described that the strategies chosen and applied by both groups differed according to their cultures and L1 literacy backgrounds. The Chinese students focused on lexical analysis and accuracy as they do in Chinese reading; whereas, the Nigerian students focused on global comprehension and minimized accuracy as they would do in a conversation in their L1s. The strategies employed by the Chinese students led to high levels of comprehension at the local and global levels with their texts. The Nigerian students, however, performed markedly better on summary tasks than they did on low-level tasks such as discreet vocabulary questions (41% and 28% respectively). Lastly, Parry noted that through the process of becoming aware of their strategic choices, the students were then able to reflect on and question what they did; thus, their strategy application became more flexible.

Fraser (1999) studied lexical processing strategies (LPSs) of eight, Francophone, undergraduate EAP students when unknown vocabulary was encountered. Participants took part in eight hours of direct strategy instruction followed by another eight hours of focused language instruction. The direct instruction included three strategic options when unknown lexical items were encountered when reading: ignore and continue to read, consult a person or dictionary, or infer the meaning based on linguistic or contextual cues. In the strategy training, she described the what, why, when, and how to use each strategy, as well as instruction on the monitoring of the strategies' efficacy and effectiveness. The language instruction focused on the linguistic features relevant to the LPSs and included "cognates, word structure (morphological word stems, prefixes, and suffixes),

grammatical function (noun, verb, adjective, adverb, and conjunction), lexical cohesion (reiteration and collocation), and structural redundancy (appositive constructions, intersentential relations such as defining relative and adverbial clauses, and summary and rephrasing discourse markers)” (p. 227). Data collection consisted of a baseline measurement, an after metacognitive training, an after focused language instruction, and a delayed period measurement after one month.

The results showed that participants inferred more frequently than they ignored or consulted, and when inferring was combined with another strategy, strategic inferencing was the first choice 96% of the time. Although the success rate of the inferences in regard to full comprehension of the lexical item was higher when consulting (78%), when partial comprehension was taken into consideration, the strategic inferences were successful 72% of the time. Further, the success rate of the strategic inferences drastically improved after the metacognitive strategy instruction demonstrating a statistically significant time effect. Fraser then characterized lexical inferences into two cognitive processes: word identification (automatic phonological or orthographic form association to L1 or L2 words such as *inherit-hériter*) and sense creation (deliberate application of textual content). She found that inferences based on context were used more frequently and were more successful than the automatic inferences. Additionally, the data showed that after both training sessions, participants’ success with sense creation inferences steadily increased, although not to the point of significance. Lastly, of the three strategies, inferences were the most stable and the only one to continually increase in frequency from the baseline to the delayed measurement.

Salataci and Akyel (2002) also provided evidence that metacognitive strategy training improved reading comprehension and inferencing skills in L2 (English) and were transferred to L1 (Turkish). Eight, pre-intermediate EFL Turkish students received 12 hours of L2 reading strategy

instruction over four weeks that focused on activating and developing background knowledge through ETR, metacognitive awareness of strategy choice, and monitoring comprehension. Data came from questionnaires, reading tasks, think-aloud protocols that were recorded and transcribed, researcher observations of reader behaviours, and a semi-structured interview. The results showed that after direct strategy instruction, bottom-up strategies such as word part analysis decreased and top-down strategies, not unlike Fraser's (1999) sense creation inferences, increased; additionally, after strategy instruction, there was an increase in participants attempting to infer meanings of unknown lexical items and a decrease in consulting a dictionary. L2 elaborative inferences such as prediction, background knowledge association, and visualising also increased after strategy training, and participants transferred those inference skills to L1. Participants were much more aware of and successful in monitoring their cognitive reading processes as well as their comprehension, but the frequencies were higher in L2 than L1; accordingly, L2 reading comprehension increased significantly.

In a longitudinal study with young teenagers, van Gelderen et al. (2004) looked at linguistic knowledge, reading speed, and metacognition in L1 and L2 reading comprehension. All 397 participants were assessed in both L1 (Dutch) and L2 (English) in the areas of vocabulary and grammar, word order, word recognition speed, sentence verification speed, and metacognitive knowledge in reading processes. The results of their first set of data indicated that for L1 reading comprehension, metacognitive knowledge is the only significant factor; whereas, in L2, metacognitive knowledge in conjunction with vocabulary knowledge were the significant contributing factors. The speed components had very little correlation to reading comprehension in both L1 and L2 when metacognition and linguistic knowledge were included in the data analysis.

Lastly, L1 reading comprehension contributed significantly to L2 reading comprehension, and of all the other variables, only L2 vocabulary had a significant effect on L2 reading comprehension.

Zhang (2007) demonstrated that metacognitive strategy instruction improved the reading comprehension of pre-sessional (English upgrading for university admission) EFL learners. The control group was comprised of 49, and the experimental group totalled 50 participants, all of whom were at the same level of English reading proficiency as per an IELTS test, although no IELTS scores were reported. The experimental group were given 48 hours of in-class direct instruction in reading strategies as well as in monitoring comprehension and strategy effectiveness over a two-month period. Data were collected by means of a pre and post training questionnaire asking for participants' self-reported frequency of use of the reading strategies as well as interviews that were recorded and transcribed. Of particular relevance to the current study is that many of the reading strategies in Zhang's study have been identified as inferencing strategies in both L1 and L2 research such as 'relating meaning to what is already known', 'asking how the main idea/purpose is related to the previous paragraph', 'looking for familiar affixes and roots in unknown vocabulary', and 'predicting content' (p. 107). Unfortunately, Zhang did not frame the study with an inference focus, but of the 19 reading strategies given, at least 10 fit the definition of either a bridging or elaborative inference. There are several others that may be inferences, such as 'evaluating reading' but they were not defined. Thus, 'evaluating reading' may be a monitoring strategy if it were defined as the reader evaluating their comprehension as opposed to evaluating textual content. Nevertheless, of the 10 strategies that are most likely inferences, all increased in reported frequencies of use after training, and the experimental group's reading comprehension scores increased at a statically significant rate as compared to the control group's increase. Zhang that EAP instructors include

direct reading strategy instruction in their classrooms to foster metacognitive awareness and improved reading comprehension.

More recent L2 publications have focused on whether or not L2 students can be taught to elaboratively infer. Beaumont (2010) detailed a lesson plan with a 'long' narrative text for ESL students at a community college to foster critical thinking. He applied a sequence of seven critical thinking tasks based on Bloom's Taxonomy. The first stage was "focus on the students' world" (p. 431) that is, essentially, equivalent to 'schema activation' or a pre-reading activity in SLA pedagogy. The next two categories, "focus on the text" and "focus beyond the text" (p. 431), included tasks that fostered both bridging inferences for local coherence such as guessing words from context, and elaborative inferences for global coherence such as explaining a character's emotions by integrating information from across the text. Further, he also suggested activities to foster elaborative inferences by analyzing, evaluating and integrating information from the text with content schemata or other texts. All of the activities were questions to ask the students which required them to elaboratively infer. Beaumont concluded that critical thinking can be taught to ESL students, but he cautioned that lessons must be scaffolded, and tasks must be modelled by the instructor and include metacognitive-awareness training.

In an EFL context with post-secondary students, Macknish (2011) described an action research study designed to evaluate whether or not critical reading (e.g.: questioning texts) would be engaged in by learners with explicit instruction and knowledge of its importance to the English medium academy. Macknish differentiated between critical thinking and critical literacy which she defined as "evaluating texts analytically" and "considering texts from a power perspective" respectively (p. 447). The types of critical reading questions she posed entailed both bridging and

elaborative inferences as she included questions ranging from pronouns and their referents to identifying author bias and judging claims as propaganda. Macknish's study, although not framed within an inferencing theoretical framework, showed that L2 students can elaboratively inference when tasks require it.

The students in Macknish's (2011) study were Chinese university students enrolled in a 26 week EAP program prior to attending an English-medium science or engineering program at a Singaporean university. The texts used were newspaper articles and the data were collected by filming in-class discussions of the texts. This action research was framed as critical reading and was presented and modeled to the students as such. Students were told to identify and analyse visual and grammatical structures, lexical choices, and socio-cultural biases to infer author intent and to assess the textual content based on their personal knowledge base, not unlike the elaborative inferencing tasks described by Narvaez et al. (1999) and Durgunoğlu and Jehng (1991). The participants were able to demonstrate elaborative inferences when directed to react to an article's content as well as form an opinion of the author's intent (Macknish, 2011). To illustrate, the negative connotative meanings of the words 'sluggish', 'haywire', and 'incontinent' were identified and used to elaboratively infer the reaction of the Canadian government (about whom the article was written) as well as the probable reaction of the Canadian populous. Participants also identified the author's intent to persuade readers by noting the lack of information from the opposing viewpoint. As Macknish (2011) hypothesized, the students strategically inferred based on task requirements.

Meyer Sterzik and Fraser (2012) proposed a pedagogical tool to foster critical reading for Kintsch's (1998) situational comprehension in EAP contexts. Although framed with strategic processing theory and advocating task-specific questioning of texts, the answers to the questions

required students to elaboratively inference at the discourse level, across texts, and by applying background knowledge. The evidence of the tool's success with EAP students was only anecdotal, but it was positive.

Both successful and non-successful readers use strategies while reading, but skilled readers use more of them and are more aware of which strategy options they have. Skilled readers also tend to employ the appropriate strategies for a particular task, especially in L1. Research has shown that metacognitive strategy training can improve reading comprehension, and reading strategies include inferencing. L2 readers can be taught to strategically elaboratively inference for specific academic tasks, but successful metacognitive instruction for reading, in L1 and L2, often requires explicit descriptions of the type(s) of cognitive strategy, how to perform the strategy, the purpose of the strategy, and how to evaluate the effectiveness (Beaumont, 2010; Carrell et al., 1998; Fraser, 1999; Parry, 1996; Macknish, 2011; Salataci & Akyel, 2002; van Gelderen et al., 2004; Zhang, 2007). Thus, L1 and L2 researchers have developed categorisations of inferences in an attempt to define one of the major subsystems of discourse processing.

2.5 Inference and Processing Components' Categorisations

Although there is a substantial body of research on inferences, there has been little consistency in categorizations, definitions, and methodologies in either L1 or L2 research (Graesser et al., 1994; Narvaez et al., 1999; van den Broek et al., 1993; Zwaan & Singer, 2003). Moreover, text types differ, and the inferencing processes of readers are also affected by text type (Narvaez et al., 1999). There have been many inference categorisations proposed by cognitive psychology researchers that differed based on research interests, purposes, and needs, but there is some agreement (Horiba, 2000), especially in regard to constructivist principles, directionality, and knowledge sources. The

findings, conclusions, and frameworks from L1 cognitive psychology research are the bases for the inference categorisations used in the present study.

Using a constructivist framework, Graesser and Kreuz (1993) proposed a categorisation of inferences which was expanded by Graesser, Singer, and Trabasso (1994). Graesser et al. (1994) included “knowledge-based inferences that are generated online during narrative comprehension” (p. 372), and, similar to other constructivist inference categorisations, it is based on the ‘search-after-meaning’ principle. This principle explains that readers read for the purpose of understanding what they read; readers try to make sense of what they read. Their inference categorisation includes three core assumptions:

1. *The reader goal assumption.* The reader constructs a meaning representation that addresses the reader’s goals...
2. *The coherence assumption.* The reader attempts to construct a meaning representation that is coherent at both local and global levels...
3. *The explanation assumption.* The reader attempts to explain why actions, events, and states are mentioned in the text (pp. 371-2).

These core assumptions about what readers attempt to do while reading can be explained by the Given-New Contract (Clark & Haviland, 1977; Zwaan & Singer, 2003). Although originally focussed on aural comprehension, the Given-New Contract has been applied to written discourse comprehension and memory (Zwaan & Singer, 2003). The Given-New Contract builds on Grice’s (1975) four maxims that a messenger (speaker or writer) must follow a cooperative principle that is expected by a receiver (listener or reader) of the message for both comprehension and remembering to occur:

1. Quantity: only give as much information as is required; no more and no less.
2. Quality: only give information that is believed and that there is enough evidence for
3. Relation: only give relevant information
4. Manner: only make utterances that are unambiguous and clear; make it easy to comprehend.

(Clark & Haviland, 1977; Grice, 1975).

Further, the messenger must also adhere to the maxim of antecedence in each proposition: there must be only one possible referent for the receiver to infer in relation to the given, or already known, information (Clark & Haviland, 1977). If any of the cooperative principles or the maxim of antecedence are broken, the receiver uses their schemata to make inferences in an attempt to comprehend. If the receiver is unable to infer appropriately, comprehension of the intended meaning may not occur, and this is true whether the mode of information transfer is oral/aural or written. Although a variety of inference categorisations were proposed and used in research, they were usually framed with similar principles and maxims which allowed van den Broek et al. (1993) to synthesise the types of inferences that had been proposed.

In order to “distinguish between the various types of inferences that are being studied”, van den Broek et al. (1993, p. 170) completed a meta-analysis of L1 inferencing research and proposed a categorisation based on inference direction and functionality. The authors stated that these categories allow for the direct comparison of results from most inferencing studies as all of the inferences will fit into one of their four proposed categories:

1. *Backward inferences* connect the statement that is currently being read (the *focal statement*) to events or states that have occurred earlier...examples...are the resolution of anaphoric references...[they] draw their primary information from three sources: *connecting inferences* connect the focal statement most directly to information that was processed recently... *reinstatements* connect the focal statement to information from the text that is...from long-term memory...and *backward elaborations* draw heavily on the reader's general background knowledge in connecting the focal statement.

2. *Forward elaborations* anticipate information that is yet to be described in the text...

3. *Orthogonal elaborations* concern the activation of information that is implied by and coexistent with the information in the focal statement...particularly...well-investigated type is the inference of spatial information.

4. *Associative inferences* activate information that is associated with a focal statement. These...are assumed to be generated automatically... (pp. 170-171).

The four types of inferences are not independent; however, their primary information sources differ.

All of the inferences have constraints based on the specific focal statements being read, the prior text representation constructed by the reader, and the background knowledge of the reader, but they may interact or be a trigger for another type of inference.

van den Broek (1994) expanded on the categories proposed in 1993 after a more comprehensive review of the literature and added sub-categories within the four inference types; although it may apply to non-narrative texts, he warned that the cognitive processing may very well differ in that context. van den Broek (1994) explained that causal inferences can come from three different knowledge sources: connections, reinstatements, or backward elaborations. Connecting inferences occur as a reader links the focal sentence with prior textual information activated from short-term memory. A reinstatement is defined as the activation of textual information that has been transferred to the reader's long term memory to provide causal explanations or support "provided that they are required for understanding the focal event" (p. 563). Backward elaborations are employed via the application of a reader's content schemata to connect events in a narrative.

Moreover, he described two types of information permanence that should be included in any inference model: transient and encoded. Transient information is information that is briefly (usually no more than one second) activated from short-term memory and applied to a text to infer. Encoded information has been made permanent in long-term memory and is also activated and applied to a text. Not all transient information will be encoded into long term memory, but he convincingly argued that all activated information, no matter the memory source, that is applied to a text fits the definition of an inference. He further explained that inferences may be reader-induced (automatic or strategic) or task-induced as “specific instructions [even when ‘normal’ reading den Broek, 1994, p. 558).

Based on the amount of attention given to each type of inference in the literature, Zwaan and Radvansky (1998) proposed five dimensions of situational model representation within narrative texts that are, essentially, a semantic categorisation of inferences that readers make in order to create a situation model of a text. Spatial relationships, the first category, include survey and map texts, where a piece of furniture is in a house, and placement of characters within a place. Causation has received a large amount of attention in research as well, and it includes why something happened or its effects. Intentionality is the third most studied type of inference and relates to character goals and motivations. Protagonists and objects are the next category and include anaphoric resolution, instrument inferences, gender information, and protagonist traits. The final inference category proposed by Zwaan and Radvansky (1998) is time, which has received the least amount of attention in cognitive psychology research.

Zwaan and Singer (2003) expanded on Zwaan and Radvansky’s types of inferences by applying Kintsch’s (1998) levels of comprehension. They stated that inferences are generated in

order to achieve or maintain local and global coherence for both textbase and situation model representations and can be bridging or elaborative. In communication, either oral/aural or written, receivers of messages make bridging and elaborative inferences. However, in reading, the type of text and the reading purpose affect the inferencing processes (Horiba, 2002, 2006; Narvaez et al., 1999; van den Broek et al., 2001), and more recent research has attempted to categorise and define the inferences employed by readers when reading expository texts for academic tasks.

van den Broek et al. (2001) endeavoured to capture the inferential cognitive processes that readers employ specifically with expository texts, and their categorisations were based on prior L1 research but chosen for their applicability to expository texts. They argue that so little research has been conducted with expository texts and how reader goals affect inferencing processes because there was no theoretical framework to guide research. Building on and modifying theoretical frameworks from narrative-based research such as the ‘search-after-meaning’ principle, they proposed the *standards of coherence* concept. This concept states that readers maintain coherence based on a ‘standard’ for a level of comprehension they wish to achieve. This standard includes criteria that foster a level of comprehension, and these criteria affect and dictate the inferential processes. Further, the authors argued that this framework parsimoniously includes reader goals as well as bottom-up and top-down knowledge sources. To define the inferences employed by readers with specific goals for expository texts, 71, L1 college students produced think-alouds as they read each sentence from one of four expository texts (32 – 40 sentences) for either a study or pleasure purpose. The think-alouds were recorded, transcribed, and coded into one of the inference categories van den Broek et al. (2001) proposed. This classification system does not focus solely on inferences (as they are defined in this study) but includes strategic reading behaviours such as text repetition and monitor comprehension which are not relevant to the current study. Many of the inferences in

van den Broek's (1994) classification have been omitted, such as maintenance of event and causal consequence, as they are generally not applicable to expository texts. van den Broek et al. (2001) content that the only inferences from narrative text research that occur with expository texts are backward inferences based on textual content and schemata, forward elaborations (now predictive), associations, and affective reactions. Evaluation has been added as a new type of inference specific to expository texts (see Table 2.2).

Table 2. 2: Inference Categories for Expository Texts (Based on van den Broek et al., 2001, p.1084).

Inference Type	Definition	Example
Explanatory inferences (Backward/explanations)	“retrieval of information from either prior text or background knowledge that explains the current text sentence”	“Oh. This is related to what I read earlier...”
Predictive inferences	“forward inferences that anticipate upcoming text”	“I bet the turtles will use sense of smell...”
Associations	“retrieval of information not related to text coherence”	“That reminds me of a documentary I saw...”
Monitor Comprehension	“reflecting on one's own understanding”	“Oh! I never knew that”
Paraphrase	“comments that capture the gist meaning of a sentence”	“So this sentence is saying that...”
Text Repetition	“verbatim repetition of all or a large proportion of the text sentence”	No example given.
Evaluation	“opinions about the text”	“These turtles are really intelligent...”
Affective	“Emotional comment regarding the text”	“It makes me sad to think...”

Within L2 research, Horiba (2000) proposed a classification of cognitive processes, including inferences, that she expanded in 2013. The categories were created specific to cognitive processing research with post-secondary L1 and L2 students reading expository texts for a variety of reading tasks (see Table 2.3). There are four overarching categories and the definitions of and analysis of the inferences and processes are further framed by Kintsch's (1998) textbase and situational levels of comprehension. Horiba (2000, 2013) was concerned with strategic processing while reading, so her focus was broader than examining inferencing alone. In her 2000 study,

elaborative inference was a category, but that has been removed in the more recent iteration. Horiba (2013) included two categories (self-monitor and other) that do not focus on inferencing, and like van den Broek et al.'s (2001) Monitor category, Horiba's (2013) Self-monitoring seems to focus on a reading strategy rather than a type of inference. Further, Horiba (2013) explained that because all of the comments related to her category of text-structure "overlapped with the comments in other categories, they were not included in subsequent analysis" (p. 108).

Table 2.3: L2 Strategic Processing Categories (Horiba, 2013, pp. 122-3).

Process Level	Category	Definition
Structure Analysis	Word	The reader attempts to analyze the formal or semantic features of a word or phrase.
	Sentence level	The reader attempts to analyze the formal or semantic features of a clause or a larger part of the current sentence. This category also includes L1 translation and paraphrasing of the sentence.
In-Text Inference	Backward	The reader generates an inference which is intended to explain the contents of the current sentence by connecting it to prior text or on the basis of general knowledge.
	Predictive	The reader anticipates something about what will occur in the incoming text.
Reader Response	Association	The reader generates an inference that is brought to mind by the text that is not intended to enhance the understanding of the textual information.
	Evaluation	The reader makes a comment or states an opinion about the text that is evaluative.
	Reaction	The reader makes a comment to react, often emotionally, to the text.
Self-Monitoring		The reader makes a comment about the degree of his/her own comprehension or use of a reading strategy.
Comment on text structure		The reader comments about the structure of the text.
Other		The reader comments on things that are not directly related to their comprehension of the text.

Her final category encapsulates any comments made by the participants that were not related to their understanding of the text, so they are most likely not inferences and not relevant to this study. However, the inference categorisations and definitions presented by Horiba (2013) are of particular relevance to the current study. The categories and definitions are grounded in decades of L1 theory and research which she modified through an analysis of and integration with a large body of L2 reading research and theory. Horiba's (2013) cognitive processing categories are the basis for this study's inference categories which are explained in detail in Chapter 3.

Reading purpose and text type affect inferencing processes while reading, and these processes are often made automatically, but they can also be made consciously and strategically applied by readers. What remains unknown is whether specific academic tasks foster specific inferencing strategies. Further, whether or not effective strategic inferencing transfers from L1 to L2 reading in specific academic tasks is uncertain. What is known, is that strategic cognitive processing, including inferencing, occurs in both novice and skilled readers, and can improve or impede reading comprehension. While we know a great deal about which bridging inferences are required for local coherence and textbase comprehension, the elaborative inferences skilled readers employ for situational comprehension in specific academic tasks have yet to be detailed in the literature. The current study endeavours to begin to fill this gap through using think-aloud protocols while skilled L1 and L2 readers process expository texts for two different academic tasks.

2.6 Summary

While all language skills (e.g.: listening, speaking, reading and writing) are important, written texts are the mode through which much knowledge is gained and shared in academic environments. Written discourse is one of the most common modes of information transfer and

learning within educational contexts in literate societies; reading, therefore, is a necessity for success in educational contexts (Bosley, 2008; Fisher & Hoth, 2010; Li & Kirby, 2014; Schmitt et al., 2011).

Historically, reading was viewed as passive because the cognitive actions during reading could not be seen (Block, 1986; Heeney, 2005), and reading comprehension research was dominated by “knowledge-driven top-down procedures...and other forms of schemata” (Perfetti & Stafura, 2014, p. 23). Contemporary reading experts, however, agree that reading is an active process in which readers engage with texts. There is large body of research in reading comprehension that spans over 30 years which includes memory processes, activation processes, textbase representations, situational representations, taxonomies, reading purposes, and other variables affecting reading comprehension and discourse processing in both L1 and L2 contexts (Koda, 2005; Perfetti & Stafura, 2014).

Presently, reading is viewed as an individual cognitive process in which many cognitive actions occur simultaneously, and the cognitive processes, specifically inferencing processes, are most likely task dependent (Carver, 1997; Cohen & Upton, 2006; Horiba, 1996, 2000, 2002, 2013; Horiba & Fukaya, 2015; Kintsch, 1986, 1998; Koda, 2005; Rosenfeld et al., 2001; van den Broek et al., 2001; Yoshida, 2012) and are also affected by type of text (Horiba, 2000, Narvaez et al., 1999; Yoshida, 2012). It is generally accepted that L1 readers strategically allocate cognitive processes and resources based on reading purpose (Perfetti & Stafura, 2014; van den Broek et al., 2001; Zwaan, 1994), but it is much less clear how, or if, reading goals affect L2 readers’ cognitive processes (Horiba, 2013; Horiba & Fukaya, 2014; Yoshida, 2012).

The vast majority of what we know about inferencing is based on research with narrative texts even though the participants in the studies were often in academic contexts. Narrative and expository texts are processed by readers differently (Horiba, 2000; Narvaez et al., 1999; van den Broek et al., 2001). Further, only a limited number of researchers has included reading purpose as an independent variable in inferential processing studies. Many researchers mention that their studies are limited to narrative texts, and that task type or reading purpose may, or most likely, affects inferencing processes, but there is a lack of data to either support or refute these statements.

MB models of discourse processing have provided definitive evidence that bridging inferences are required to create a textbase level of comprehension (Perfetti & Stafura, 2014), but they did not investigate situational levels of comprehension. MB researchers recognized that readers can go beyond a literal level of comprehension and elaboratively inference when tasks require it, but it was not addressed in their research. Kintsch's (1989, 1998) Construction Integration model of discourse processing, however, includes, addresses, and demonstrates multiple levels of comprehension. Given the data, Kintsch concluded that different reading purposes, specifically reading to remember and reading to learn, engage different cognitive processes. Carver (1997) furthered the explanation of the cognitive processes involved in reading for specific purposes and described the increase in cognitive load and processes required for readers to move from partial comprehension (Skimming), to reading to understand (Rauding), to reading to learn (Learning). "As for L2 reading, there are only a few studies conducted so far on the effect of task on text processing" (Horiba, 2013, p. 100).

Much L1 and L2 research has been conducted to describe and define inferences, variables affecting inferencing, and whether or not inferencing can be taught. The majority of the research

that has attempted to define and categorise inferences has been in L1 and used short narrative texts, but text type and task have been shown to affect inferencing processes in both L1 and L2. Thus, readers must be employing inferences strategically based on task requirements (Horiba, 2000, 2013; Li & Kirby, 2014). Further, the vast majority of inference research in both L1 and L2 has focused on bridging inferences, and thirty-plus years of bridging inference research has improved reading pedagogy. For instance, many L2 reading teachers now include context clue and morphology training in curricula to foster effective bridging inferences to improve textbase levels of comprehension in L2 readers. We are much less informed about the elaborative inference processes of skilled readers in L1 and L2. “In order to understand the effect of task on L2 text comprehension, further research is needed which investigates both the processes and products of comprehension under contrasting task conditions” (Horiba, 2013, p. 100). Academic success is often related to students’ abilities to read expository texts (Cohen & Upton, 2006; Grabe, 2009; Pretorius, 2006; Rosenfeld et al., 2001). As per Yoshida (2012), in order to ascertain which cognitive processes are engaged by specific tasks and how they affect reading comprehension, more precise research with specific tasks is needed, “especially when the goal is to specifically assess academic reading” (Cohen & Upton, 2006, p.7). Controlling for multiple internal and external variables such as language proficiency, background knowledge, task authenticity, and text type is imperative to any reading comprehension research for the findings to have evidence of validity. Including those considerations and employing Think-Aloud protocols make it possible to define the inferences that skilled readers employ to successfully complete academic reading tasks. Reading strategies can be taught and improve reading comprehension when the appropriate strategy(s) for the task is applied. Armed with a description of the inferences that skilled readers employ with academic texts for

specific academic tasks, reading instructors will be better able to assist their students in reaching situational levels of comprehension for academic success in the English-medium academy.

Given the growing market for L2 instruction and assessment and the importance of reading proficiency in academic contexts within a globalized economy, there is clearly a need for L2-specific inferencing research that is framed by accepted SLA theories and cognitive processing theories of discourse, well defined levels of language proficiency, and theoretically grounded and detailed inferencing taxonomies that are specific to expository texts for use with adults in postsecondary contexts. “[I]t has not been made fully clear how a reading goal affects L2 students’ processing of and learning from a text and how reader variables, topic familiarity and language proficiency influence goal-oriented L2 text processes and learning” (Horiba & Fukaya, 2015, p. 23). In order to do so, “a general framework that provides a view of the component subsystems of reading comprehension” (Perfetti & Stafura, 2014, p. 23) is necessary. This study aims to inform the field of the inferencing processes employed by skilled readers in L1 and L2 when reading academic texts for academic tasks.

CHAPTER 3: METHODS

The perspective adopted in this paper and used to frame the current study is the *Reader's Task Perspective* which asserts that multiple factors, such as language proficiency and task affect reading comprehension and must be controlled for as much as possible in reading research.

Additionally, research materials and tasks that are as authentic as possible are imperative to reading research in order for the data to have evidence of validity. In order to define and describe the inference processes of skilled readers in L1 and L2 with expository texts for academic tasks, this small, exploratory study endeavours to answer the following questions:

1. Do the inferences generated by skilled, adult readers differ between a summary task (textbase comprehension) and a position-paper task (situational comprehension) in the L1?

a) If so, in what way(s)?

2. Do the inferences generated by skilled, adult readers differ between a summary task (textbase comprehension) and a position-paper (situational comprehension) in the L2?

a) if so, how?

3. Do the inferences generated by skilled, adult readers in the L1 differ from the inferences generated in the L2?

a) In a summary task? if so, how?

b) In a position-paper task? if so, how?

This study used a within-subject approach and is a 2 x 2 factorial, repeated-measures design. The two independent variables are task type: summary and position-paper tasks, and language: German (L1) and English (L2). The dependent variable is the frequency of use of inferences, both bridging and elaborative, and their respective sub-types. Quantitative analysis of the reported frequencies of inferences as well as a qualitative analysis of the Think-Aloud protocols comprise the data used for comparison. Prior to the study, materials, instruments, and protocols were piloted on a small (N=3) group of volunteer participants who matched the selection criteria, and several adjustments were made to the materials, timing, and methodology which are discussed below.

3.1 Participants and Materials

This section describes participant demographics, the materials used to verify participants' applicability to the study, and the data collection tools. A total of ten participants ($n=10$) from a large university in Germany whose L1 was German and L2 was English participated in the study. Participants were all first-time undergraduate students enrolled in a four year B.Ed. program. The program has an English proficiency minimum of B2 (upper-intermediate/low advanced) because a degree requirement is the completion of several English medium courses, whether or not students' area of focus is languages. Participants' areas of focus within the B.Ed. program represented five disciplines: languages (German and English), Physical Education, Math, Biology, and Political Science. All participants were female, and the age range for participants was 19-39 years old, with a mean age of 25.

Data collection took place in Europe, so proficiency levels are given using the Common European Framework of Reference (CEFR) (Council of Europe, 2001). The CEFR has a total of 6 levels and divides language speakers into 3 categories: basic users A1, A2; independent users B1,

B2; and proficient users C1, C2. As L1 reading proficiency affects L2 reading proficiency, to ensure all participants were advanced L1 readers (a minimum of CEFR C1), all participants completed a paper-based reading proficiency test at the C1 level from the Goethe Language Institute. Although originally designed specifically for L2 learners of German, the Goethe Institute has aligned all of their proficiency assessments to the CEFR which is the standard for all language speakers, L1 and L2, in Europe. Sample tests can be found at http://bfu.goethe.de/c2_mod/lesen.php. The test consisted of three sections, but for the purposes of this study, academic reading comprehension was deemed more relevant than social media texts, so participants only completed the two academic sections. The allotted time for the two sections of the test was 25 and 15 minutes, and a score of 60%, according to Goethe, was a pass. Tests were graded by a native-German speaker who is familiar with the test. Participants' scores met this study's minimum L1 reading comprehension criterion of a C1 level.

L2 proficiency was self-reported; however, admission to the degree program requires a minimum B2 level of English proficiency, in all four skill areas, and was demonstrated to the university by participants prior to admission. The program requires a standardized proficiency assessment such as the CEFR Secondary school exam, TOEFL, Cambridge, or the results from an in-house exam that has been aligned with the CEFR, IELTS and Cambridge scores as demonstration of English language proficiency.

Because text type affects inferencing processes, and expository texts are the most commonly read in post-secondary programs, two expository texts were used in this study: one in English and one in German. Both texts came from the practice sections of a standardized language proficiency assessment: English from IELTS (see Appendix A), and German from The Goethe Institute (see

Appendix B). The English text is 1,136 words, and has a Flesch-Kincaid readability level of 12.2. The German text is 785 words and has a very similar Flesch-Kincaid level of 12.4. A major difference between the texts is that the English text includes headings at sections of the text; whereas, the German text does not. This difference can be explained by a contrastive analysis of English and German rhetorical structures in academic writing. Generally, English academic writing includes more ‘front-loading’ and a greater tendency to include advance organizers at the beginning of paragraphs or sections of a text than German academic writing (Siepmann, 2006). German writers, on the other hand, “tend to place advance organizers in somewhat obscure locations” (p. 136); thus, inclusion of headings in academic texts is not the norm in German writing. Because the participants were L1 German readers, it was decided that the lack of headings in the German text would not be problematic as participants would be comfortable with this rhetorical structure.

Given the advanced proficiency levels of the participants, the texts needed to be at a level that was not “so easy that reading activities are automatic and inaccessible to verbalization” (Yoshida, 2008, p.200) but not so difficult as to cause linguistic interference that would inhibit inferencing processes due to lower-level processing issues such as decoding problems. The Linguistic Hypothesis Theory states that “limited language proficiency appears to exert a powerful effect on the behaviours utilized by readers...[and]...limited control over the language ‘short circuits’ the good reader’s system, causing him/her to revert to poor reader strategies when confronted with a difficult ...task in the second language” (Clarke, 1980, p. 206).

The texts were deemed appropriate for the study because pilot participants were not solely, or mainly, focused on lower-level processes while reading, but were able to construct an effective textbase as evidenced by successful completion of the summary task, and they were able to

verbalize both bridging and elaborative inferences while reading. Task completion success in this pilot was assessed for the summary writing task by an experienced post-secondary instructor who was fluent in German and English. The pilot participants were considered successful if their written summary encapsulated all of the main ideas of the texts and did not include extra or incorrect information; all pilot participants wrote acceptable summaries of the texts. The inferences reported by pilot participants also verified the inference categorisations created for the present study which are described in section 3.4.1.

3.2 Data Collection Procedures

Data were collected over a three month period at the university in Germany. Participants were assigned a number to ensure anonymity, and all participants read and signed an informed consent form (see Appendix C) as per York University's Research Ethics Board (REB) requirements. In Germany, there are no REB requirements if participants are 18 years or older; thus, none were required in addition to York's REB. Participants were offered a free, one hour English tutoring session with the researcher as compensation for their participation. All tasks were presented to participants in an individual setting in a quiet office.

Rauding, learning, and memorizing employ different cognitive processes (Carver, 1997; Kintsch, 1998), and as the goal of this study was to explore what advanced L2 students do as they normally read for academic tasks and not exam situations, participants were informed that they would have access to the article as they completed the written task. In academic settings, it is common for students to complete course readings initially to comprehend the writer's intended meaning and then return to some texts and reread them for another purpose, such as a critical analysis or opinion paper, later in the semester. Two tasks, a summary (textbase comprehension)

and a position paper (situational comprehension), were included in the study, and were completed by all of the participants in both L1 (German) and L2 (English).

For the summary task, participants were instructed to read each text in order to write a summary that is approximately 250 words in the same language as the text that reports on the main ideas and major points from the text. They were further instructed that the summary was not to include their opinions or thoughts of the topic nor the article (see Appendix D). The position-paper task instructed participants to read each text in order to write a short essay (approximately 400 words) in which they take a position on the issues presented by the text. They were told that the essay should include information from the text and to explain why they agree or disagree using support from both the text and their personal knowledge or experiences (see Appendix E).

Task instructions were presented to participants individually at the onset of each session. The time between session 1 and session 2 was approximately 2.5 weeks for each participant. The minimum time between tasks was 16 days, and the maximum time was 24 days, with an average of 19 days between tasks. Task 1, Summary, was administered first, in both German and English, to minimize the likelihood that participants would read with the position paper task as a goal. Participants were given the German and English texts one at a time, and to counterbalance for language effect, half of the participants began with the German text, and the other half began with the English text. Participants were instructed to work as they normally would for such an academic task. For example, they might make an outline of the text or point form notes or choose not to write any notes. Participants were also instructed that any notes written while reading could not be a portion of their summary as that must be written wholly after they had completed reading the text.

Any notes and all written responses were collected by the researcher. Instructions were scripted (see Appendices C, D and E) to ensure they did not change throughout the study.

In Task 2, participants were given the same texts that they had read in their first session and retrained in Think-Aloud protocols. Prior to receiving the texts, participants were asked to explain everything that they remembered about the texts they had read in the first session to account for memory. All participants remembered the general topics of the articles, and most were no more specific than “environment problems”, “good energy”, and “resources”, but one participant said “resources and how you can get them environmentally helpful...nicer. And the other one was about environmental something as well”. No participant recalled more than a few details, and they tended to state details from both texts and were not able to specify which article the details came from. Two participants were able to give three lexical items, but they were unable to explain them: “I remember the word ‘tortilla-crisis’ and it’s bad”; “Flugbenzin was in one, but I don’t remember if it was English or German text”. After asking what participants remembered, they were then given ‘clean’ copies of the texts, so they needed to reread the articles and could not rely on any markings or notes from the first task. They were also instructed to reread the texts with the new task in mind. All written notes and materials were collected by the researcher at the end of the session. Finally, neither of the task sessions were timed nor was a time limit imposed on participants. Sessions were audio recorded, and the Think-Aloud procedures are described in the following paragraphs.

More careful research methodologies are needed that focus on particular cognitive processes with specific tasks (Yoshida, 2012). This can be accomplished through think-aloud protocols during academic tasks with expository texts (Macknish, 2011; Yoshida, 2008). Many SLA researchers have utilized Think-Aloud protocols (TAs) in research in order to access the normally hidden cognitive

processes involved in reading and writing (Barkaoui, 2015; Bowles, 2010; Cohen & Upton, 2006; Gass & Mackey, 2000; van den Broek et al., 2001; Yoshida, 2008). TAs require that participants to verbalize what they are thinking, and they may be concurrent or retrospective (Bowles, 2010; Gass & Mackey, 2000; Ericsson, 2002).

Concurrent TAs require the participant to verbalize on-line, or during task completion; whereas, retrospective TAs happen after task completion and participants are asked to recall and then verbalize what they were thinking during task completion (Bowles, 2010; Ericsson, 2002). TAs can be further divided into two sub-types: metalinguistic and non-metalinguistic (Bowles, 2010; Yoshida, 2008). Metalinguistic, or metacognitive, TAs require participants verbalize justifications and explanations, and they have been found to cause reactivity effects in text comprehension and cognitive processing (Ericsson, 2002; Yoshida, 2008). In contrast, non-metalinguistic, or non-metacognitive, TAs have been found to support Ericsson and Simon's prediction that "verbalizations of thoughts per se, without the requirement to verbalize justifications, should provide a fairly pure reflection of thought processes" (Bowles, 2010, p. 15). Although non-metalinguistic TAs have consistently be shown to have latency reactivity, they increase time required to complete the task (Bowles, 2010; Ericsson, 2002; Yoshida, 2008). Further, prompts to verbalize at the end of each sentence can be excessive and cause participants to lose their train of thought. Yoshida (2008) explained that "frequent interruptions, or heavy cognitive load" (p.200) can lead to incomplete reports. Further, as reading speeds differ, and because TAs increase reading time (Bowles, 2010; Ericsson, 2002) amount of text can be used as the measure for the prompts and not a specific amount of time.

Retrospective TAs, otherwise known as Stimulated Recall (SR), are employed to gather further data as participants using TAs will “differ in their tendency to produce verbal reports...due to differences in gender, personality, and previous experience” (Yoshida, 2008, p. 200). Thus, not all participants verbalize as much as others. SR offers the researcher the opportunity to “inspect specific occurrences” (Barkaoui, 2015, p.8) in which no, or incomplete, TAs were offered by the participant. SR occurs after the text has been read, and participants are given a stimulus and asked what they were thinking at the point in the task. SR is based on the belief that when participants are given a visual or auditory stimulus, they will be able to recall the cognitive processes that were in use at the time of the task (Barkaoui, 2015; Bowles, 2010; Ericsson, 2002; Gass & Mackey, 2000). Retrospective reporting, as in SR, is not without debate. Veridicality in SR is one such issue. It is possible that reports are incomplete because participants may not recall what they were thinking at the time (Bowles, 2010). To minimize this risk, there must be a tangible stimulus (Bowles, 2010; Gass & Mackey, 2000), and SRs that are conducted immediately after a task has been completed are quite reliable and non-reactive (Bowles, 2010; Ericsson, 2002).

In order to access the normally hidden cognitive processes while reading, TAs were the main source of data for this study. Participants were instructed to verbalize what they were thinking as they were reading the text, and were trained in Think-aloud Protocols through practice TA tasks prior to both data collection tasks (Bowles, 2010; Ericsson, 2002; Gass & Mackey, 2000). The practice tasks were mathematical questions (Ericsson, 2002), and participants were instructed to think aloud, in L1, L2, or both, as they solved the problems. They were informed that their answers did not matter, but that the important information was that they verbalize their thought processes as they attempted to solve the problems (see Appendix F). Participants completed the TA training twice; the same instructions but different math problems were presented to participants at the

beginning of both data collection sessions. Math questions were chosen as the practice materials so as not to unintentionally inform or bias the participants to the text topics nor the research purpose. Schemata affect reading comprehension; therefore, if texts had been chosen as practice materials, the topic(s) of said texts would have activated participants' schemata and could have affected the reading processes during data collection.

Based on pilot feedback, if participants had not verbalized anything, prompts from the researcher at the end of each sentence were found to be excessive and caused participants to lose their train of thought. Thus, in the main study, participants were prompted only after reading three full lines of text (generally, two to three sentences) if they had not verbalized. Participants were also encouraged to verbalize in L1, L2 or both to reduce their cognitive load (Yoshida, 2012). Lastly, as reading speeds differ, and because TAs increase reading time (Bowles, 2010; Ericsson, 2002) amount of text read was used as the measure for when to prompt participants to think aloud. As task completion time was not a variable in this study, the reactivity should not affect processing. Further, SR occurred immediately after reading and prior to the writing task to minimize participants being unable to recall what they were thinking. The stimulus provided was the text that had been read by the participant including all of their markings. Video recordings were not used as the SR stimulus for several reasons. First, as a visiting scholar at the university, the primary researcher was not able to book A-V equipment, so there were logistical issues for video equipment. Second, the object of the introspection was the text, and the use of participants' task completion materials is a concrete stimulus for recalling thoughts related to a specific action (Gass & Mackey, 2000). Further, the use of the text is a strong stimulus in that its relationship to the action being investigated is high (Gass & Mackey, 2000).

While participants were reading, the researcher also had a copy of the text and at specific points in the text, noted verbal and non-verbal cues such as sounds (i.e.: hm, uhh etc.), facial expressions, body language, pauses, and notations made by the participants. During SR, if participants had not verbalized at a particular section of the text in which the researcher had noted a cue, participants were asked what they were thinking as they were reading the specific clauses, and what they were thinking at sections of the text in which they re-read, or their facial expression changed, or they had made notations on the text. Some of the questions asked during SR were *what were you thinking as you read this statement? What were you thinking as you re-read this section of the text?* At the end of the SR, participants were asked if there was anything else they would like to say about what they were thinking as they were reading the text. The use of open-ended, non-guiding questions, which do not demand ‘why’ something was done, have been found to more reliably reflect on-line cognitive processing of participants (Bowles, 2010; Ericsson, 2002). If participants were unable to recall what they were thinking, no further questions were asked about that portion of the reading.

3.3 Data Transcription

After data collection, the TAs and SR were transcribed using ELAN software and transcription conventions created by the researcher which were adapted from the conventions outlined by Schegloff and Sacks (1973) (see Table 3.1). ELAN is a free program that allows for complex transcriptions of video and audio recordings and is available through the Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands at <http://tla.mpi.nl/tools/tla-tools/elan/>. The researcher is quite familiar with ELAN and has transcribed multiple research sessions with it as a graduate student for course work and as a research assistant.

Transcriptions were completed by a research assistant (RA) hired by the researcher. The RA was fluent in German and English; thus, she was able to complete the English, German and the translation of the German transcriptions. The RA was trained on ELAN over several sessions prior to being given the audio data on a separate, password protected PC which had been cleared of all participants' identifying information by the researcher.

All transcriptions and translations were reviewed by the researcher who has B1 level of German proficiency. In instances in which a vocabulary or translation questions arose, a colleague who is completely bilingual was conferred with. Several minor changes were made to the RA's transcriptions such as fixing typos, adding as missing word, or choosing a synonym that better suited the context.

Table 3. 1: Transcription Conventions

Transcription Symbol	Definition
()	uncertain transcription
[]	procedural and other behaviours
?	question intonation
X	incomprehensible word(s)
...	pause (3-5 seconds)
, -comma	short pause (1-2 seconds)
<u>underline</u>	emphatic stress
' -apostrophe	reduced speech. (participants' words have not been modified from how they were said to conform to Standard English: 'cause instead of because. Grammatical errors have also not been modified).
P#	Participant number
G	German
E	English
S	Summary Task
P	Position-paper task

3.4 Data Analysis

3.4.1 Coding

The present study used a modified version of Horiba's (2013) cognitive processing categories for inference coding (see Table 3.2). It was the most appropriate for the current study as it was created based on multiple processing and inferencing categories from L1 researchers, proposed for use with expository texts for L1 and L2 readers, and framed with Kintsch's Construction Integration model of discourse processing. However, it has been modified for this study for several reasons and in several ways. Firstly, her main focus was strategic text processing and not inferencing specific, and although the studies are framed with Kintsch's (1998) levels of text representation, she did not use the bridging and elaborative distinctions to frame her categories. Horiba's (2000, 2013) categories were based on levels of cognitive processing and the inferences' functions, not unlike the L1 cognitive psychologists' categories. The current study focused on the types of inferences and their sources, so modifications were made based on the inference definitions previously discussed. To refresh, an inference is *information that is activated or tested or applied to a text but is not explicitly stated in the text*. Further, a bridging inference is *an inference generated for the purpose of local coherence of the author's explicitly stated meaning*, and an elaborative inference is *an inference generated for the purpose of global coherence and does not bear on comprehension of the author's explicitly stated meaning*.

Within Horiba's (2013) original taxonomy, the inferences within "Structure Analysis" can be classified as bridging inferences and those in "Reader Response" as elaborative. Within "In-text Inference", however, only one of her categorisations can definitively be placed in the elaborative distinction: predictive. "Backward Inference" in Horiba's (2013) categories can be classified as

either bridging or elaborative. She did not distinguish readers going back within a paragraph or across paragraphs. Bridging inferences are employed to assist in local coherence (Geva, 1992; Koda, 2005; Zwaan & Singer, 2003) not for global coherence. Further, most research in bridging inferences has used texts no longer than a paragraph and often with only sentence pairs since anything longer than one paragraph tends to be viewed as global coherence. Thus, it can be argued that backward inferences across paragraphs are elaborative inferences. Moreover, predicting textual content is not necessary for a textbase representation; it is a strategy employed by skilled readers, but it is an inference as it is information activated and tested by directly applied to textual content. If it is not required to create a textbase, it must be an elaborative inference.

Reaction will also be characterised as an elaborative inference in the current study. For a text to evoke an emotional response, the reader is most likely associating the information with a personal experience and/or some background knowledge. To illustrate, if a reader finds something interesting, they must be comparing it to things that they have found to be interesting or boring in the past; if something is sad, they must be associating the content with a personal experience that caused feelings of sadness or comparing it with something that evoked feelings of happiness.

Horiba's (2013) category of "self-monitor" has been removed as this is a metacognitive strategy and is not considered an inference. Similarly, L1 translation and paraphrasing are reading strategies which are often employed by readers to monitor their comprehension (Cohen & Upton, 2006). Therefore, they have also been removed from the inference categories proposed here. The final two deletions are "comment on text structure" and "other". The example given by Horiba (2013) to explain "comment on text structure" is "The title eye-contact is derived from here" (p. 123). That comment seems to demonstrate associating textual content to the title. As the title of a

text is, in fact, part of a text, that comment demonstrates a backward inference. Further, Horiba (2013) found that most text-structure comments overlapped with other categories, so she removed it from her data analysis.

The present study has three categories of bridging inferences based on function and knowledge source. *Structure analysis* is defined as ‘using formal or semantic features (linguistic knowledge: discourse markers, cohesive devices etc.) of a word, phrase, clause or a larger part of focal sentence, the reader makes an inference and attempts to understand the writer’s meaning.’ This includes all anaphoric and lexical issues that the reader attempts to solve by using the immediately surrounding text, whether successful or not. For example, readers may use morphology to solve a lexical issue (i.e.: topsoil must be dirt on farms that farmers put over the plants’), but they may also employ a discourse marker such as ‘however’ to infer that an unknown lexical item has the opposite meaning of a focal word in the prior clause.

Backward text-based bridging inferences occur when the reader uses or refers back to textual information within the same paragraph, to comprehend the current clause/sentence, or the participant references a prior piece of text to explain relationships among clauses within a paragraph. Sometimes, rhetorical and structural conventions were included in comments that fit this category. However, it was decided that linguistic knowledge in this case is not as relevant as the fact that the reader has connected textual information across several clauses to build a textbase representation. Thus, when the thesis statement is ‘found’, the reader has already connected the propositions in the paragraph and organized them into their hierarchal structure; hence, it is considered a backward bridging inference.

Backward background-knowledge based bridging inferences are based on the reader's schemata and are the same as the backward text-based, but the reader does not go back to the text to ascertain the connection, or the text did not give a clue to the relationship. Instead, background knowledge is used to infer connections, hierarchy, or meanings within the same paragraph. To illustrate, if a paragraph describes 'new' procedures to create energy but does not identify the procedures as atypical or new, and the reader infers that these procedures are not the norm, they have searched their background knowledge to infer this.

There were seven categories of elaborative inferences used in the present study based on function and knowledge source. *Elaborative text-based predictions* occur when the reader anticipates something that will occur later in the text based on textual information or features. For example, in expository texts, it is common to present both sides of an issue. After reading a paragraph that presents the positive effects of a procedure, a reader may infer that the following paragraph will present the negative effects. *Elaborative background knowledge-based predictions* rely on the reader's knowledge of the events or concepts in the texts to cause a prediction for what will occur later in the text, or the future in general, and are directly related to text content. An example of this is if a reader infers that the cutting of trees described in the text will cause ecological damage to the region in question.

Associations occur when a reader infers a relationship of textual content to other textual content across multiple paragraphs or to their background knowledge. In the case of text-based associations, for example, a reader links a result explained in paragraph 5 to an event described in paragraph two, but the author did not make this link explicit. In regard to background knowledge associations, readers connect textual content to information in their LTM from other articles, news

reports, or their life experiences such as relating a method described in the text to a European policy.

Evaluations can come from linguistic features or prior textual content which the reader uses to make a comment or state an opinion about content or the text that does not bear on comprehension. The comment that a procedure or method should or should not be employed is evaluative and text-based if the reader bases that evaluation on information that was presented earlier in the text, or uses the connotative meaning of a word to make the same claim. Further, *evaluations* can also come from a reader's background knowledge and occur when the reader makes a comment or states an opinion about the text that is evaluative and is based on their content schemata. To explicate, in a text that presents procedures for plant-based energy production but does not explicitly discuss non-renewable fossil fuels, when a reader states that plants are better than oil because they are renewable and oil is not, the reader has applied their knowledge of natural resources to the text. Finally, *reactions*, are comments that refer to an emotional response on the part of the reader sparked by reading the text. Comments related to a reader's interest in, or lack thereof, in the topic of a reading are reactive. Additionally, emotional responses are included in reactions. If a reader comments that a lack of access to clean drinking water is 'sad', that is also an elaborative reaction (see Table 3.2).

Table 3.2 Inference Categorisations (Modified from Horiba, 2013).

Inference Type	Category & Source	Definition	Examples (from this study) (P=Participant #, G=German, E=English, S=Summary, P=Position-paper)
Bridging	Structure analysis	Using formal or semantic features (linguistic knowledge: discourse markers, cohesive devices etc.) of a word, phrase, clause or a larger part of the local text, the reader makes an inference and attempts to understand the writer's meaning.	"Topsoil must be dirt on farms that farmers put over the plants" (P10 ES) "I really wish I had a dictionary because um, I forgot what exacerbate means" (P9 ES)
	Backward	Text-based	Using prior textual information within the same paragraph, the reader makes an inference and attempts to comprehend the current clause/sentence. "This is a concrete example of that." (P5 GP)
	Background Knowledge	Using general knowledge, the reader makes an inference and attempts to comprehend the current clause/sentence in relation to the current paragraph. "Okay. All this made plants disappear." (P8 EP). "So, those are just the methods they apply." (P6 ES). "Okay. Instead of taking the typical stuff, you take plants and out of that make energy" (P8 GP).	
Elaborative	Prediction	Text-based	Using textual information, the reader anticipates something that will occur later in the text. "Now here, obviously, the chemical process gets explained." (P4 GS). "So, this is probably the main topic of the text." (P7 EP). "So, that must have a positive influence on the soil." (P8 EP).
		Background Knowledge	Using background knowledge, the reader anticipates something that will occur later in the text. "If they damage nature, then, that's going to be a huge issue." (P7 GP).
	Association	Text-based	The reader associates textual content with prior textual content across paragraphs that does not bear on the comprehension of the author's meaning. "It's one of the main arguments that comes up in the text a lot of times." (P2 GP). "What they talked about earlier, that, you know, the pulling and reducing." (P8 EP).
Evaluation	Background Knowledge	The reader associates textual content with background knowledge that does not bear on the comprehension of the author's meaning. "They do that as well in Europe." (P2 ES). "Like the problems that came up in the text from um two weeks ago." (P4 EP). "It would be the same kerosene like the current one." (P5 GS).	
		Text-based	The reader makes a comment or states an opinion about the text that is evaluative based on linguistic features or prior textual content. "So they actually do exactly what they shouldn't do." (P10 ES). "So, it's all the positive stuff." (P1 ES).
	Reaction	The reader makes a comment to react, often emotionally, to the text that does not bear on comprehension of the text. "I think most of the points are logical." (P10 EP). "Plants regrow which is different than oil that eventually runs out." (P8 GP). "Ah, and air traffic that is interesting." (P3 GS). "Uh environment, that's not my uh favourite" (P9 ES).	

Transcripts were analyzed for instances of the inference episodes (IEs) as defined by the coding scheme (see Table 3.2). Verbal reports were parsed into clauses (generally), and propositional content was used as the basis for categorization of an inference. For example, the clause ‘*That’s a really bad example*’ has two propositions: 1: ‘That is an example’ which demonstrates that the reader has inferred that piece of information’s hierarchal structure within the paragraph in relation to the rest of the content. That example falls under a backward text-based bridging inference, and 2: ‘the example is bad’ in which the reader has evaluated the validity or efficacy of the information which is an evaluative inference. In the latter example, if the participant did not reference a textual feature or their knowledge, in SR they would have been asked what they were thinking so the knowledge source could be identified as either textual or schemata. Each inference episode was coded as a single inference. Each Inference type was given a number for coding purposes (e.g.: *structure analysis* = 1, *backward text-based bridging* = 2a, *backward background-knowledge bridging* = 2b).

A coding reliability check was completed for intercoder agreement to be established. A colleague of the researcher was given the coding scheme (Table 3.2) that included the corresponding numbers for each inference type and a randomly selected 10% of the transcribed sessions including translations (4 full transcripts). Following discussions, intercoder agreement of 84% was reached. Disagreements were resolved through discussion. Lastly, the TA and SR reports were examined qualitatively by the primary researcher to determine any patterns, oddities, variances, and any other qualitative aspects that could be determined from the data.

3.4.2 Statistical Analyses

The purpose of this study was to describe and compare the types and frequencies of Inference Episodes (IEs) of advanced readers on expository texts across academic tasks and languages. Given the

variety of types and occurrences of inferences across participants, raw frequency comparisons are problematic (Barkaoui, 2015; Dörnyei, 2007; Field, 2014). As Barkaoui (2015) explains, comparing two participants who have the same number of a specific IE (such as 4B – association background knowledge) is problematic if their overall number of IEs differ. To specify, if one participant has a total number of IEs of 30, and the other has a total number of IEs of 40, and they both elaboratively inference (association background knowledge) 10 times in one task, the first participant’s proportion for that IE is 33% and the second participant’s is 25%. The percentage of IE frequencies is a better reflection of individual differences in IEs (Barkaoui, 2015). Thus, the data used for comparison in this study are percentages.

The non-parametric statistical test, Wilcoxon signed-rank test, was chosen to address the research questions (Barkaoui, 2015; Field, 2014) because it compares the proportion of inferences across tasks and languages when the sample is small (Dörnyei, 2007; Field, 2014), and also because it “...compares two conditions when the same participants take part in each condition and the resulting data have unusual cases...” such as outliers and instances of zeros which the present data set includes (Field, 2014, p. 235); therefore, it is more appropriate for the given data set. Further, results are reported using the median (Mdn) “because this statistic is more appropriate than the mean for non-parametric tests” (Field, 2014, p. 227). As per Dörnyei (2007) and Field (2014), the confidence interval of 95% ($p \leq 0.05$) was used to determine statistical significance, and a confidence interval of 90% ($p \leq 0.10$) was used as approaching significance in the discussion. Further, r value was calculated for effect size only at the 95% confidence interval ($r = Z/\sqrt{n}$) (Field, 2014). Effect size can be interpreted as follows: $r = .10$ small effect, $r = .30$ medium effect, $r = .50$ large effect (Field, 2014). To explicate, Field (2014) explains that a small effect size explains 1% of variances, a medium effect explains 9%, and a large effect explains 25% of the variances. Statistical analyses were not run on the differences of

the totals of bridging and elaborative inferences in the four conditions because analyses of the sub-categories are more likely to highlight any differences in inferencing processes than the totals. To illustrate, if inference A were reported at 25% in the first task and at 15% in the second task, but the opposite were true for inference B (e.g.: 15% and 25% respectively), they would essentially cancel out the differences when the totals were analysed. Chapter four presents the results of the analyses.

CHAPTER 4: RESULTS

The purpose of this study was to describe and compare the types and frequencies of inferences made by advanced readers on expository texts across tasks (summary and position paper) and languages (L1 and L2). The data used for comparison are percentages of the reported inferences (Barkaoui, 2015).

The descriptive statistics and the Wilcoxon Signed Rank results are displayed in Tables 4.1 to 4.6. All tables show $N=10$. The total number of inference episodes reported by participants across all four tasks was 1,832, and of these, 816 (44.5%) occurred during the summary tasks, and the remaining 1,016 (55.5%) were reported during the position-paper tasks. Comparisons of the proportions of IEs across languages show that participants made more inferences in L2 than in L1 in both task conditions. L2 accounts for 52.9% of the inferences made during summary tasks, and the L2 position-paper task also has a slightly higher proportion at 52.6% than the L1 position-paper task. Table 4.1 presents the percentages of reported IEs across all tasks in L1 and L2: the column labeled (M) presents the mean percentages, and the columns labeled % indicate the median (Mdn), the minimum (min) and maximum (max) percentage of number of reported IEs by any participant in each activity related to the total number of inferences reported. The rows labeled Total give the percentages of bridging and elaborative inferences of the total number of reported inferences per task and language

Table 4. 1: Percentage of Inference Type of the Total Number of Reported Inferences across Tasks and Languages

	Inference Episodes per Task	L1 Summary (Mean %)	% Mdn	% Min	% Max	L2 Summary (Mean %)	% Mdn	% Min	% Max	L1 position (Mean %)	% Mdn	% Min	% Max	L2 position (Mean %)	% Mdn	% Min	% Max
Bridging Inferences																	
	Structure analysis	3.5	2.5	0.0	11.1	6.4	5.2	2.7	14.9	1.3	0.0	0.0	5.7	2.8	2.2	0.0	7.9
Backward	Text-based	15.3	16.8	3.6	27.3	14.8	14.6	0.0	23.9	13.2	13.9	5.0	20.8	16.2	19.0	6.7	23.1
	Background knowledge	2.6	1.1	0.0	10.5	4.3	2.8	0.0	21.6	2.4	2.3	0.0	6.7	1.6	0.7	0.0	5.5
	Total Bridging	21.4	23.5	5.9	42.1	25.5	25.6	8.5	37.5	16.9	18.4	7.1	30.2	20.6	25.2	6.7	28.9
Elaborative Inferences																	
Prediction	Text-based	7.7	7.8	0.0	16.0	7.7	6.0	0.0	18.6	5.5	4.5	0.0	12.2	5.6	5.1	0.0	9.5
	Background knowledge	3.5	3.1	0.0	8.0	5.3	5.7	0.0	37.0	4.5	4.1	2.3	7.3	6.2	6.3	1.6	10.5
Association	Text-based	13.4	13.5	4.0	20.0	17.7	15.1	6.4	37.0	14.8	13.5	9.4	23.7	12.2	11.7	6.7	19.0
	Background knowledge	16.7	16.4	0.0	34.5	15.1	14.4	2.7	34.0	22.1	19.3	11.3	37.5	19.0	18.1	8.3	40.0
Evaluation	Text-based	17.6	17.0	4.0	36.1	13.3	10.8	4.1	25.0	18.7	17.3	10.0	31.7	17.4	18.3	7.9	30.2
	Background knowledge	15.8	12.4	11.1	29.4	10.0	9.4	2.7	24.3	14.6	12.3	9.1	22.7	15.9	15.8	9.3	21.8
	Reaction	3.7	3.0	0.0	9.1	5.5	5.6	0.0	16.2	2.9	1.8	0.0	7.5	3.1	2.9	0.0	7.7
	Total Elaborative	78.6	76.5	57.9	94.1	74.5	74.4	62.5	91.5	83.1	81.6	69.8	92.9	79.4	74.8	71.1	93.3

4.1 Inference Variability across Tasks

4.1.1 L1: German Summary and Position-paper Tasks.

Research question 1 asks if the inferences that are generated by skilled, adult readers differ between a summary task (textbase comprehension) and a position-paper task (situational comprehension) in L1. Table 4.2 displays the percentages of the reported inferences during the L1 tasks. It shows that the patterns of inferencing were quite similar across tasks in L1. The percentages of bridging and elaborative inferences differed slightly across tasks in L1, but participants had higher reported percentages of bridging inferences in the summary task and elaborative inferences in the position-paper task. Additionally, the participants reported more elaborative inferences than bridging inferences with both tasks.

In regard to research question 1: *Do the inferences generated by skilled, adult readers differ between a summary task (textbase comprehension) and a position-paper task (situational comprehension) in L1*, Table 4.2 shows that there was no statistically significant difference overall ($z = 1.32, p > .05$) when the percentages of all IEs were compared across the L1 tasks, nor of individual inferences at the 95% confidence interval. However, at the 90% confidence interval ($p \leq 0.1$) with specific types of inferences, there are three inferences that differed significantly, which suggests that with a larger sample size, they may be found to be significant. Participants differed in structure analysis bridging inferences ($z = 1.64, p \leq .1$) and in two elaborative inference categories: text-based predictions ($z = 1.68, p \leq .1$) and background knowledge associations ($z = 1.68, p \leq .1$).

Table 4. 2: Descriptive Statistics of Percentages of Inference Episodes in L1 Tasks

Inference Types		L1 Summary			L1 Position			Wilcoxon signed-rank Test
		<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>p.</i>
Overall IE Comparison								0.18
BRIDGING								
	Structure Analysis	2.5	0.0	11.1	0.0	0.0	5.7	0.10
Backward	Text-based	16.8	3.6	27.3	13.9	5.0	20.8	0.20
	Background Knowledge	1.1	0.0	10.5	2.3	0.0	6.7	0.47
	Total Bridging	23.5	5.9	42.1	18.4	7.1	30.2	
ELABORATIVE								
Prediction	Text-based	7.8	0.0	16.0	4.5	0.0	12.2	0.09
	Background Knowledge	3.1	0.0	8.0	4.1	2.3	7.3	0.38
Association	Text-based	13.5	4	20	13.5	9.4	23.7	0.79
	Background Knowledge	16.4	0.0	34.5	19.3	11.3	37.5	0.09
Evaluation	Text-based	17.0	4	36.1	17.3	10.0	31.7	0.57
	Background Knowledge	12.4	11.1	29.4	12.3	9.1	22.7	0.87
	Reaction	3.0	0.0	9.1	1.8	0.0	7.5	0.56
	Total Elaborative	76.5	57.9	94.1	81.6	69.8	92.9	

4.1.2 Bridging Inferences.

The total percentages of bridging inferences across tasks differed somewhat, and participants reported a higher percentage in the L1 summary task ($Mdn = 23.5\%$) than in the L1 position-paper task (18.4%). The bridging inference with the highest reported percentage in L1 for both summary and position-paper tasks was backward text-based which accounted for 16.8% (Mdn) in L1 summary and 13.9% in L1 position. When reading in L1, participants reported going back to the surrounding text intra- and intersententially much more often than using the focal clause, discourse markers, or applying

their background knowledge to resolve lexical problems and infer connections among propositions within a paragraph.

Participants reported going back to the paragraph to attempt to infer meanings of unknown lexical items in both task conditions in L1. There were very few reports of strategically skipping unknown words in L1; participants reported choosing to back through the paragraph to attempt to infer a meaning. If the inference attempt failed, they would continue reading, but often they would retain the word in memory and report if they were able to infer its meaning or if they were still unable to do so later in the text. To illustrate, while reading paragraph seven of the German text for the summary task, Participant 1 explained at the beginning of the session that the title of the German article demonstrated it was on a topic in which she was really not interested and didn't know a lot about, and that she anticipated lexical and content comprehension breakdowns. She often re-read sentences several times when an unknown word appeared in the text in order to attempt to infer the meaning and made many reports similar to Excerpts 1a and 1b.

Excerpt 1a: *But I had to read it again 'cause I don't know what synthetischem Flugbenzin is (P1 GS).*

In the above example, Participant 1 was not successful in her lexical inference until she had read the second sentence which refers to the aviation industry and BTL which the article had previously discussed and defined as an alternative fuel. However, her first reaction was to return to the beginning of the sentence to attempt to infer its meaning; she did this multiple times throughout the summary task. During the SR, after Participant 1 had finished reading the German text, I asked what she was thinking during several instances in which she had re-read a sentence or more than one in a paragraph after circling a specific lexical item and she explained why in Excerpt 1b.

Excerpt 1b: *I really have to focus on what I read 'cause there's certain words um, which I don't know exactly or know the meaning of it. And so, in order to understand what follows I have to read the paragraphs over again (P1 GS)*

She, like all of the participants, often went back to the surrounding text at the sentence and paragraph level in the L1 tasks and attempted to use content to infer meanings of unknown words far more often than attempting to infer based on linguistic cues or structural features of the focal sentence or text. The majority of the reported backward text-based bridging inferences in both L1 task conditions were to infer hierarchal relationships within a paragraph, however. In order to choose a sentence in a paragraph that summarizes the main idea of the paragraph, current propositions must be attached to prior propositions within the paragraph to construct a hierarchal textbase representation which requires bridging inferences. In both L1 tasks, participants reported connections and hierarchal structure of information within paragraphs through backward text-based bridging inferences. Excerpts 2a and 2b exemplify backward bridging inferences to construct a hierarchal textbase of a paragraph. After reading the introductory paragraph of the German text, Participant 2 had not made her decision as to the paragraph's main idea, so she chose to go back and re-read from the first sentence of the paragraph to infer the propositional relationships within the paragraph in order to ascertain the main idea (Excerpt 2a). She continued to read the paragraph and highlighted a key word in the third sentence and explained why in Excerpt 2b.

Excerpt 2a: *Okay, so I read the sentences again 'cause it's, um, I have to see the uh, connections (P2 GS)*

Excerpt 2b: *and I highlight the 'newest case' be, uh 'cause that's um follows in the next sentence (P2 GS)*

The next sentence in this case was the thesis statement, which she also highlighted; thus, she inferred that there was a connection with the word and the thesis. She also correctly identified the thesis statement and was thus able to infer the relationships among the propositions in the paragraph. All participants reported backward text-based bridging inferences within a paragraph to construct a

hierarchical textbase representation distinguishing paragraph topics, main ideas, and examples in both L1 tasks similar to Excerpts 3, 4 and 5 below.

Excerpt 3: [highlighting sentence] *That seems like the good sentence to summarize the idea in this paragraph* (P3 GS)

Excerpt 4: *And that's the main issue he's pointing to in this paragraph* [underlining] (P10 GP).

Excerpt 5: *And then there's a concrete example from um the USA which are the tortilla crisis* (P4 GP)

The remaining two bridging inferences, structure analysis (2.5% in L1 summary and 0.0% in L1 position) and backward background knowledge-based (1.1% L1 summary; 2.3% L1 position) were reported at very low percentages. In fact, across tasks in L1, those two bridging inferences were the two least (L1 summary) or two of the three least (L1 position) reported inferences.

After reading the first paragraph of the German text, which has a negative tone, Participant 5 said that she thought plants as an alternative source of energy was positive for the environment, but that she had very little knowledge of the topic and was unsure. As she read the second paragraph, she verbalized that she didn't understand what the term 'climate neutral' actually means. She then used the discourse marker 'because' to infer that the relationship between plants and CO₂ that follows the term was in fact its definition.

Excerpt 6: *Because it's climate neutral which means no extra CO₂!* (P5 GS)

Participant 1 reported a similar use of linguistic markers to infer a definition for the term 'second generation biofuels'. The text explains that because no food plants are needed like in biodiesel, people call it 'second generation biofuels'. If something has been named based on its difference to something of a similar name, that must be the defining feature of the referent. Participant 1 used the linguistic

marker ‘spricht man von’ (*one speaks of*, my translation) to be able to define second generation biofuels.

Excerpt 7: *so, um I know what, like, um in order to be able to explain what that actually is. Biomass fuel of the second generation (P1 GS)*

Bridging inferences from participants’ background knowledge were also minimally reported across both tasks in L1. There were more reported during L1 position, and several of those came from participants searching their memories of prior readings, including the one used in this study. To illustrate, while reading the German text for the position-paper task, participant 8 paused at ‘tortilla crisis’, highlighted it, marked a negative symbol in the margin and continued through the paragraph fairly quickly. In SR, she was asked what she was thinking as she did that.

Excerpt 8: *Ya, ya. Well first I didn’t remember the word and I remembered that last time I read an article, you know, here, I didn’t know what it meant, and uh I remembered its negative effects for food (P8 GP)*

Further, Participant 8 reported a similar background knowledge based inference while reading for the position-paper task and explained during SR what she was thinking as she underlined ‘second generation biofuel’. She explained that she couldn’t remember what the term referred to when she read it, but she remembered she had read a similar text and figured she could approximate its meaning if she remembered some of the prior read text as seen in Excerpt 9.

Excerpt 9: *I remembered uh this, uh a definition from the last time I read an article here (P8 GP)*

4.1.3 Elaborative Inferences.

Looking at elaborative inferences across summary and position-paper tasks in L1, participants reported a higher total percentage in the position-paper task (Mdn = 81.6%) as compared to the summary task (76.5%). Both types of evaluations and associations were reported by participants at

much higher rates than the remaining three elaborative inferences. Participants reported text-based evaluations at 17.0% (Mdn) in L1 summary and 17.3% when reading for an L1 position-paper task; text-based associations were reported at the same percentage of frequency across both tasks (13.5%), and background knowledge-based evaluations were reported at almost the same percentages in L1 summary (12.4%) and L1 position (12.3%). Although not at similar percentages of frequency, participants reported background knowledge-based associations at very high percentages: 16.4% in L1 Summary and 19.3% in L1 position.

Participants used the text to make evaluative inferences at very similar rates across both task conditions in L1 and often to evaluate the tone of the text. For example, while reading the German text for the position-paper task condition, Participant 10 seemed to be reading for tone. As soon as she read the first sentence, she stated her assessment of the mood of the sentence in Excerpt 11.

Excerpt 11: *This first sentence sounds like it's pretty much hopeless* (P10 GP)

Similarly, Participant 8 seemed to read to infer positivity or negativity. The focus word used to make the evaluative elaborative inferences below is 'dramatic', and the introduction paragraph of the text from which it comes has a negative tone, but the text presented both positives and negatives and included both connotations. Regardless, the participant inferred negativity from the author.

Excerpt 12: *Dramatic consequences when you use them. That must be negative* (P8 GP)

The majority of the text-based evaluative inferences made by participants when reading in L1 ascribed correctness or questionability, and positivity or negativity to textual information based on word choices and grammatical structures. To illustrate, Participant 10 reported that a piece of information must be correct because of the grammatical structure chosen by the author. In Excerpt 13 below, the German Konjunktiv is often used in newspapers in a similar manner to how reported speech is applied in

English, so it seems from the excerpt, Participant 10 took the information as expert testimony, thus correct, based on the grammatical (mood) structure.

Excerpt 13: *the sentence is right because it uses the Konjunktiv all the time* (P10 GP).

Participants also reported evaluative elaborative inferences based on their background knowledge while reading under both L1 task conditions. To explicate, participants tended to give opinions about textual content based on their knowledge of the topic, although these opinions were not necessary to comprehend the text. For example, in the middle of the first paragraph, Participant 3 ascribed improbability to the use of plants as energy sources. When asked what she was thinking in SR, she explained that she had read articles and heard news reports that question the viability of moving toward plant-based energy sources.

Excerpt 14: *Plants as energy sources for future, but, a little bit unrealistic* (P3 GS)

Similarly, while reading a section of the text that describes the cutting of fast growing trees and also trees from forests for use in biofuels, Excerpt 15 shows Participant 7's opinion.

Excerpt 15: *cutting down trees, I don't think that's too good* (P7 GS)

Moreover, when reading under L1 position condition, in response to the text stating that plants as energy sources are threatening the rainforests, Participant 6 commented that cutting trees for energy was a con (negative), but she changed her evaluation as she continued to read.

Excerpt 16: *it is just remaining timber from the forest, or comes from quickly regrowing trees, so technically the con is a little bit balanced* (P6 GP)

Participants reported evaluative inferences about textual content at very high percentages in L1 while reading for both tasks, but they also reported elaborative associations in which they inferred links of textual content to their background knowledge.

While reading for both task conditions in L1, participants reported many elaborative associations, but more often the associations were to participants' background knowledge such as previously read texts and media sources. Excerpt 17 below illustrates how participant 8 associated the current text for the position-paper task with content from the text in the summary task; even though they were the same text, participant 8 never vocalized that fact.

Excerpt 17: *again it's about from the plants, plants that can be used for energy* (P8 GP)

Participant 1 was also unable to remember where she had read the text before when she explained a pause during the L1 position-paper task. During the summary task, she had verbalized mainly in English; thus, she had actually translated some of the text during her TAs as she described what she was thinking. She was able to associate the content with an existing schema, but she was unable to identify the exact source of the previously read text.

Excerpt 18: *'cause I'm doing the translation course as well, and we had a text like that too, and I was like did I translate that text? It sounds uh seems really familiar to me* (P1 GP)

There were also many reports of participants attempting to infer links associating textual content with personal background knowledge which were unsuccessful, as the following excerpt illustrates.

Excerpt 19: *I've never heard of it before* (P8 GS)

Further, after reading about the tortilla crisis in which corn from Mexico was sold to the USA for bioethanol which caused the price of corn tortillas in Mexico to become much more expensive very quickly, Participant 3 expressed what she had thought prior to reading the text and how the text contradicted what she knew.

Excerpt 20: *I always thought they have so much corn that they don't need it all* (P3 GS)

Moreover, there were many examples of elaborative background knowledge-based associations of personal experiences to many pieces of information from the text which did not bear on coherence or comprehension such as destruction of forested areas (Excerpt 21), plants grown as cash crops (Excerpts 22a & 22b), and news reports (Excerpt 23).

Excerpt 21: *I was thinking about all the trees they are tearing down in order to, for places to build houses* (P8 GS)

Excerpt 22a: *Yeah, there is canola that is I think the most commonly used especially like in middle Europe* (P5 GP)

Excerpt 22b: *I was thinking about the canola fields that are, um, around where I live. There are, um, like ten years ago there were a lot of different uh plants growing, and uh, now there's canola* (P9 GP)

Excerpt 23: *It has been in the media for I don't know how many years that we can use plants as a substitute for diesel* (P7 GS)

While most participants stated that they did not know a lot about the topic of the text at the beginning of each session, they still reported background knowledge-based elaborative associations at very high percentages in both task L1 conditions. Elaborative associations across the text were also reported fairly frequently, and at the same percentage (Mdn = 13.5 %) across both task conditions. Participants reported inferring textual content connections across paragraphs in both task conditions such as in Excerpt 24. While reading the sixth paragraph, Participant 4 inferred a relationship of the content she was currently reading to information from the beginning of the text.

Excerpt 24: *connected to um the biofuel from like the beginning um of this article* (P4 GP)

There were many more reports of inferring connections across multiple paragraphs in the text as Excerpts 25a, 25b and 25c below occurred while the participants were reading paragraph six.

Excerpt 25a: *Then I highlight damage to nature because that refers to the first two paragraphs* (P1 GS)

Excerpt 25b: *that it's uh that it makes the connection between the second and the fourth paragraph* (P2 GP)

Excerpt 25c: *plants that don't serve as food, so you can directly tie this with paragraph two, and uh, three* (P5 GP)

Finally, participants reported actively going back to the text to elaboratively infer connections in content across multiple paragraphs while reading in L1 in both task conditions.

Generally, participants in this study reported similar inference patterns across L1 tasks; however, structure analysis bridging inferences and text-based predictions are approaching significance. Participants reported higher percentages of structure analyses and text-based predictions while reading for the L1 summary task. After having made a marginal note to denote a paragraph as pro, or positive, in excerpts 26a and 26b below, both participants predicted the next paragraph would present the cons or counter arguments.

Excerpt 26a: *so, now I'm wondering what follows in the next paragraph. If there's a contra argument maybe* (P1 GS)

Excerpt 26b: *now comes the cons in the next paragraph* (P6 GP)

In contrast, participants tended to report a higher percentage of background knowledge-based associations while reading in L1 for the position-paper task as compared to the summary task, and this difference is approaching significance.

The findings above suggest that skilled, advanced readers largely transfer inferencing processes across academic tasks in L1; however, a larger sample size may reveal statistically significant

differences in at least three of the types of inferences. These inferences may have been applied strategically by the participants based on task requirements in L1.

4.1.4 Summary

The inferencing patterns were quite similar across tasks in L1 although participants had higher total percentages of bridging inferences in the summary task and elaborative inferences in the position-paper task. In regard to research question 1, there is no statistically significant difference overall ($z = 1.32, p > .05$) when the percentages of all IEs are compared across the L1 tasks, nor of individual inferences at the 95% confidence interval. However, at the 90% confidence interval ($p \leq 0.1$) there are three inferences that differed significantly. Participants differed in structure analysis bridging inferences ($z = 1.64, p \leq .1$) and in two elaborative inference categories: text-based predictions ($z = 1.68, p \leq .1$) and background knowledge associations ($z = 1.68, p \leq .1$). The qualitative analysis of the TAs and SR revealed that a majority of the text-based evaluative inferences made by participants when reading in L1 ascribed correctness or questionability, and positivity or negativity to textual information. Further, participants reported more background knowledge-based associations while reading for the L1 position-paper task as compared to the summary task, and this difference is approaching significance. Lastly, also approaching significance, participants reported higher percentages of text-based predictions while reading for the L1 summary task as compared to the L1 position-paper task.

4.1.5 L2: English Summary and Position-paper Tasks

Table 4.3 presents the descriptive statistics for the L2 summary and L2 position-paper tasks. The total reported percentages for bridging and elaborative inferences show very little difference across

tasks in L2. Participants reported slightly more bridging inferences during the L2 summary task, and slightly more elaborative inferences in the position-paper task. Interestingly, participants had a much higher percentage of backward text-based bridging inferences during the the L2 position-paper task condition as compared to the L2 summary task condition. Again, participants reported more elaborative inferences than bridging inferences with both tasks in L2.

Table 4.3 shows that the answer to research question 2: *Do the inferences generated by skilled, adult readers differ between a summary task (textbase comprehension) and a position-paper (situational comprehension) in L2* is yes ($z = 1.99, p \leq .05, r = .62$). Not only was the overall difference of all percentages of IEs statistically significant, but two inference categories were statistically significant and two others were approaching significance. Structure analysis bridging inferences ($z = 2.34, p \leq .05, r = 0.74$), and evaluative background knowledge-based inferences ($z = 1.63, p \leq .05, r = 0.73$) differed significantly across the L2 summary and position-paper tasks. There were far more structure analysis bridging inference reports in the L2 summary task condition than the L2 position-paper task. Participants seemed to be fairly comfortable ignoring lexical issues and clausal comprehension breakdowns while reading for the L2 position-paper task, but seemed much less so in L2 summary task condition. Background knowledge-based evaluations were reported significantly more frequently in L2 position-paper task than in L2 summary, and the higher percentage of frequency in L2 summary task for text-based evaluation were approaching significance.

Table 4. 3: Descriptive Statistics of Percentages of Inference Episodes in L2 Tasks

Inference Types	L2 Summary			L2 Position			Wilcoxon signed- rank Test	
	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>p.</i>	
Overall IE Comparison							0.04 r = 0.62	
BRIDGING								
	Structure Analysis	5.2	2.7	14.9	2.2	0.0	7.9	0.01 r = 0.74
Backward	Text-based	14.6	0.0	23.9	19.0	6.7	23.1	0.72
	Background Knowledge	2.8	0.0	21.6	0.7	0.0	5.5	0.28
	Total Bridging	25.6	8.5	37.5	25.2	6.7	28.9	
ELABORATIVE								
Prediction	Text-based	6.0	0.0	18.6	5.1	0.0	9.5	0.28
	Background Knowledge	5.7	0.0	10.8	6.3	1.6	10.5	0.72
Association	Text-based	15.1	6.4	37.0	11.7	6.7	19.0	0.07
	Background Knowledge	14.4	2.7	34.0	18.1	8.3	40.0	0.54
Evaluation	Text-based	10.8	4.1	25.0	18.3	7.9	30.2	0.10
	Background Knowledge	9.4	2.7	24.3	15.8	9.3	21.8	0.02 r = 0.73
	Reaction	5.6	0.0	16.2	2.9	0.0	7.7	0.12
	Total Elaborative	74.4	62.5	91.5	74.8	71.1	93.3	

4.1.6 Bridging Inferences

Of the three types of bridging inferences, backward text-based were the most frequently reported in the L2 summary ($Mdn = 14.6\%$) and the L2 position-paper (19.0%). There were many reports in both L2 summary and position-paper in which participants described inferring the relationship of the focal proposition to prior propositions hierarchically within a paragraph. For instance, Participant 9 explained her highlighting of several details in a paragraph as she connected the examples provided to the topic sentence to create a textbase representation of the paragraph's hierarchy

(Excerpt 27). Similarly, Participant 4 described a paragraph's content and hierarchal structure after she had finished reading it as in Excerpt 28.

Excerpt 27: *he's um, uh, pointing to some problem that arised from using pesticides and artificial fertilisers* (P9 ES)

Excerpt 28: *the characterization of um, politics then as an example, um, and then there was further, further examples* (P4 EP)

As in L1, participants often went back through a paragraph in an attempt to overcome a lexical issue rather than apply structure analysis or their background knowledge. For example, Excerpts 29a and 29b illustrate how Participants 9 and 10 did not understand the word subsidies. Participant 9 assumed it was an important word for text comprehension; hence, she went back to the beginning of the paragraph and re-read it to attempt to infer its meaning; she was unsuccessful and complained. Participant 9 also reported the same strategy described for participant 10 above.

Excerpt 29a: *I still don't know. They are supposed to tell me what they are* (P10 ES)

Excerpt 29b: *I'm starting from the beginning for the, I'm not sure what subsidies is* (P9 ES)

Participants overwhelmingly reported going back to the text when reading in L2 to attempt to infer meanings of unknown lexical items as well as relationships among propositions within a paragraph. The majority of the reported backward text-based bridging inferences in both the L2 task conditions were to infer hierarchal relationships within a paragraph.

The remaining two bridging inferences were reported at much lower percentages than backward text-based bridging inferences. Structure analysis bridging inferences were reported more often in L2 summary (Mdn = 5.2%) than in L2 position-paper (2.2%). In Excerpts 30a and 30b below, both structure analysis bridging inferences, the emphatic stress shows that the participants used morphology

to infer the meanings of the words, and there were some other examples reported by participants of morphology use to infer the meanings of unknown lexical items in L2.

Excerpt 30a: *Topsoil must be dirt on farms that farmers put over the plants* (P10 ES)

Excerpt 30b: *Monoculture? Is that one variety of the the plants?* (P6 EP)

Further with structure analysis bridging inferences, there were also examples of participants rereading the focal clause or sentence more than once and attempting to infer the meaning of an unknown word from the immediately surrounding text as in Excerpts 31a and 31b. In paragraph three, Participant 2 did not know the word ‘fallow’ and chose to reread the sentence it was in twice, and aloud, in an attempt to infer its meaning through the other examples listed in the sentence. She decided it was similar to intensive farming because of the conjunction ‘and’ in the clause.

Excerpt 31a: *so I need to read this aloud because I can't get the sense of it. [reading aloud]. It's the same? Or no?* (P2 EP)

Additionally, Participant 6 reported a similar strategy and reread a focal clause aloud several times before reporting that she was unsuccessful in inferring the meaning of enlightened countries.

Excerpt 31b: *like the EU? No. I still don't know what less enlightened countries are [laugh]* (P3 EP)

Even when an inference fails, the inference process occurred. Whether successful or not, participants regularly reported episodes of bridging inferences across L2 tasks. They tended to report few instances of structure analysis and background knowledge-based bridging inferences, and to overwhelmingly choose to go back through the text at the sentence and paragraph level as their strategy to attempt to infer meanings and connections at the local level.

4.1.7 Elaborative Inferences

Of the seven elaborative inferences, the same four were the most reported by participants in L2 tasks, but their sequence of most to least reported varied. The two elaborative inferences with the highest percentage of reports overall were text-based evaluations (Mdn = 18.3%) and background knowledge-based associations (18.1%) in L2 position-paper task. In L2 summary, text-based evaluations were reported at 10.8%, and background knowledge-based associations were reported at 14.4%. Text-based associations were reported at 15.1% in the summary task and 11.7% in the position-paper task. Lastly, background knowledge-based evaluations were reported 15.8% during the L2 position-paper task condition; whereas, they were reported at a much lower percentage in L2 summary (9.4%).

Evaluations can come from linguistic features or prior textual content which the reader uses to make a comment or state an opinion about textual content that does not bear on comprehension. The evaluative comments on the English text were somewhat similar to those made by participants with the German text because participants assigned positivity or negativity to textual content, but participants often attributed importance or triviality to textual content while reading the English text. To illustrate, paragraph four of the English text describes consequences of subsidies in wealthy countries, but there is very little mention of the government other than the first sentence. While highlighting land price increases, increased crop yields and pesticides, Participant 5 inferred that the government's role was being criticized and attributed negativity to government actions.

Excerpt 32: *The things I highlighted in orange are kind of criticisms on the role of the government* (P5 EP)

While reading the first paragraph, Participant 10 read faster, at a skimming rate; this was evident because she moved her pen along the text as she read. When prompted by the researcher as to

what she was thinking, she explained that she did not really ‘need’ to read the examples. She made several similar comments throughout the position-paper task condition as illustrated in Excerpts 33a and 33b.

Excerpt 33a: *In this specific context I will skip it because it doesn't really matter to the opinion essay* (P10 EP)

Excerpt 33b: *I'm actually wondering how important the numbers are. I don't think they are very important* (P10 EP)

Reading paragraph two of the English text during the position-paper task, Participant 3 also skimmed, but she skimmed most of the paragraph and made no marginal note after reading it. She made marginal notes at every paragraph while reading the German text in both task conditions and also while reading English text in the summary task condition. During the L2 position-paper task, however, she did not. When prompted by the researcher, in Excerpt 34 she explained why she had not.

Excerpt 34: *This is more like in, an overview. So I probably won't even need this so much for the essay* (P3 EP)

Evaluations of textual triviality were reported during the L2 position-paper task as well as during the summary task. For instance, when Participant 5 was asked in SR what she was thinking as she highlighted a few words in the introduction paragraph during the L2 summary task, she explained, in Excerpt 35, that she felt that only a few words were important for her purpose in that paragraph. She did not use the same technique with the German text; instead, she highlighted the introduction similarly to how she highlighted the rest of the paragraphs in the German text.

Excerpt 35: *The first paragraph is just an introduction, so I highlighted just some key words. Um, it's only about the ya um topic.* (P5 ES)

Participant 6 verbalized similar assessments of textual content based on their structure within the text as she read paragraph seven of the L2 text. She was actively highlighting and skipping information while she read, and she verbalized why as she went through the paragraph. Every ‘need’ in

Excerpt 36 below was accompanied by textual content being highlighted, and the ‘no’ was not. During SR, she was asked what she was thinking as she did that, and she responded that she was choosing the important information for her summary.

Excerpt 36: *ya, then now I need this....And this....And this....No.* (P6 ES)

Strength of argument or content was a common evaluative report during L2 tasks conditions as well. Participants tended to evaluate the author’s claims (see Excerpts 37a & 37b), data (37c), and bias (37d) frequently.

Excerpt 37a: *And it’s a strong thesis already X evidences* (P2 EP)

Excerpt 37b: *And then there are further examples on um pointless policies* (P4 EP)

Excerpt 37c: *food output have risen four percent between the 70s and the 80s. wow. That’s old.* (P3 EP)

Excerpt 37d: *Ya. That the role of the government is actually mostly not a good way or or, doesn’t lead to a good outcome.*

Although, it could be possible to to look for both, to look on both sides. This would make uh, be helpful. (P3 EP)

Participants repeatedly reported text-based elaborative evaluations in both L2 task conditions, and they also associated textual content across multiple paragraphs.

Of all the elaborative inferences in the L2 summary, the highest percentage concerned text-based associations (Mdn = 15.1%) which were the fourth most frequently reported elaborative inference in the L2 position-paper task (11.7%). While reading for both summary and position-paper tasks, participants often reported inferring links of textual content across multiple paragraphs in the English text. The reports were very similar to those made in the L1 task conditions. In illustration, while reading about the attempted reductions of subsidies in paragraph six, Participant 8 reported a link between the current clause and the reduction of soil erosion by the USA that was explained in paragraph three (Excerpt 39). Likewise, while reading paragraph six, which mentions bio fuels, Participant 10 reported that she attempted to connect this information to what she thought was

previously mentioned information in the text, but she was unable to because this information had not been mentioned previously (Excerpt 40).

Excerpt 39: *Okay. Um, what they talked about earlier that, you know, the reducing and whatever is causing erosion that's ha, has been stopped* (P8 EP)

Excerpt 40: *but I actually wonder what ah what it's about um bio products because they don't, they didn't even mention them before* (P10 ES)

While most participants stated that they did not know a lot about the topic of the English text, as they also stated with the German text, they reported background knowledge-based elaborative associations at fairly high percentages in the L2 position-paper (Mdn = 18.1%) and in L2 summary (14.4%). These reports were very similar to those that were reported in the L1 task conditions as participants linked textual information to their schemata from the media (Excerpts 41a & 41b), prior course work or texts (Excerpts 42a & 42b), and personal knowledge or experiences (Excerpts 43a, 43b & 43c).

Excerpt 41a: *yeah, well. It helps the politicians because they ya well, they want to be about X* (P10 ES)

Excerpt 41b: *Ya. Those, with those genes, I know is connected with what I always see in TV. The corn* (P6 EP)

Excerpt 41c: *I've heard before in the news that Monsanto actually buys up farms where the farms weren't able to pay for fertilisers, pesticides, special crops um and in order for the farmers to at least keep living on the land and making some sort of money, Monsanto buys these farms* (P7 ES)

Excerpt 41d: *their breeding of the crops through all sorts of things and um ya, ya, that's why I just remembered the movie with uh Julia Roberts. Erin Brokovich* (P7 EP)

Excerpt 42a: *Ya. And soil erosion. We did that in the world politics class as well, so it's not really new* (P10 ES)

Excerpt 42b: *And ya, he starts writing about the um the biofuel that I read the German text about um just before* (P9 ES)

Excerpt 43a: *I have heard only a little bit about this from my friend because she studies something similar but not a lot* (P6 ES)

Excerpt 43b: *and that the world food output has risen. Maybe we eat more. The more people there are* (P8 EP)

Excerpt 43c: *I remember, like I know, that um in Germany, like milk production used to be subsidi-, I don, don't even know if it still is. But, but it used to be subsidised* (P3 EP)

Even though most of the participants stated that they did not know a lot about the topic of the English text, they were able to elaboratively associate textual content to their content schemata, and they also elaboratively evaluated the text based on their background knowledge.

Evaluative elaborative inferences can be text-based, but they can also come from participants' background knowledge. Participants reported evaluating textual content by applying their content schemata to the text in both L2 tasks very similarly, but the frequency was much higher in L2 position-paper (Mdn = 15.8%) than L2 summary (9.4%). The following examples illustrate this point.

The final paragraph in the English text presents a solution and states that with said solution, poor farmers in poor countries will have money and incentives to farm more sustainably. While reading the final paragraph, Participant 8 commented that the assertion was probably incorrect and a poor plan. She applied what she has heard and read about coffee farmers in South America and concluded the situation for the farmers will not improve.

Excerpt 44: *that they, you know, have the money, will have the money, but I was thinking that they will not be less poor because somebody will come and, like the coffee thing, coffee trading and everything, you know, they just take. They give them some money but, you know, they're still poor* (P8 EP)

In another example, Participant 4 disagreed with the argument presented in paragraph three that modern farming techniques are harmful to the environment. Initially, Participant 4 thought she had misunderstood the argument because it was the opposite of what she knew. But, she changed her point of view at the end of the article because she often continually the textual content based on her background knowledge, and she eventually decided that the text was more reliable.

Excerpt 45: *okay. That can be proven with better crop breeding and doubling use of pesticides and chemical fertilisers. This should be inefficient. And modern farming, it's probably more environmental friendly. Modern farming flows, connected with doing good things for the planet and the environment (P4 ES)*

Moreover, in paragraph two, the text explains that higher crop yields have been achieved through several methods, including the doubling of the use of pesticides and fertilisers. When reading for the L2 position-paper task, in Excerpt 46, Participant 6 evaluated why the use of pesticides and fertilisers doubled.

Excerpt 46: *there is more pesticides taken because it's just the easiest possibility (P5 EP)*

Similarly, Participant 6 reported that she disliked several of the policies presented in the text and evaluated their validity based on what she knew or had heard about subsidies and their relationship to environmental impacts.

Excerpt 47: *um, a lot of these um policies, like um, don't make a lot of sense. Like, for example, these uh the supports of farm prices are like the protection for coal. So, like I said, the most or environment damage don't make a lot of sense with the, and without these it would just be okay (P6 ES)*

Overall, bridging and elaborative inferences were reported frequently in both L2 task conditions, and although the five inferences with the highest percentages of frequency were the same across tasks, their sequence differed greatly.

4.1.8 Summary

The overall difference of all percentages of IEs in L2 is statistically significant, two inferences were statistically significant, and two others were approaching significance. Structure analysis bridging inferences and evaluative background knowledge-based inferences differed significantly across L2 summary and position-paper tasks. There were far more structure analysis bridging inference reports in the L2 summary task condition, but background knowledge evaluations were reported at higher

percentages in L2 position-paper. Text-based associations are approaching significance and had higher reported percentages in the L2 summary task, and the majority of the evaluations tended to be task specific in that participants evaluated the information's importance or triviality specifically in relation to task requirements. Lastly, while reading for both L2 summary and position-paper tasks, participants frequently reported associating textual content across multiple paragraphs, but there were more reports of text-based associations in L2 summary than L2 position-paper, and this inference is approaching significance. It seems participants were more concerned with constructing a complete textbase while reading for the summary task than when reading for the position-paper task in L2.

4.2 Inference Variation across Languages

4.2.1 L1 and L2: Summary Tasks

The focus of research question 3a is whether the inferences generated by skilled, adult readers in L1 differ from the inferences generated in L2 for a summary task. The total percentages of bridging and elaborative inferences show that there were more reports of bridging inferences in L2 and more elaborative inferences in L1. Table 4.4 shows that the differences in the percentages of all types of reported inferences by skilled, adult readers in L1 summary task and those in L2 summary task are significant ($z = 2.24, p \leq .05, r = 0.709$). Only one type of inference, however, was statistically significant: evaluative background knowledge elaborative inferences ($z = 2.19, p \leq .05, r = 0.69$), and no inferences were approaching significance. Participants reported more background knowledge-based evaluative inferences while reading in L1 summary task than in L2. The remaining inference processes were similar and seem to have transferred from L1 to L2 for a summary task with expository texts.

4.2.2 Bridging Inferences

The bridging inference with the highest reported percentage across languages in the summary task condition was backward text-based and was very similar: Mdn = 13.8% in L1 and 14.6% in L2. The remaining two bridging inferences were not reported at very similar percentages across languages, but compared to backward text-based inferences, they were significantly lower. Structure analysis bridging inferences were reported in both language conditions, but there were more in L2. Background knowledge-based bridging inferences had the lowest reported percentages of all inference types, bridging and elaborative, when comparing L1 and L2 summary. Participants rarely reported attempting to apply background knowledge in either the L1 or L2 to resolve lexical or local comprehension breakdowns when reading for a summary task.

4.2.3 Elaborative Inferences

The four elaborative inferences with the highest percentages across languages in summary tasks are the same, but their sequencing is not. Background knowledge-based associations were reported at much different rates in a summary task across languages (16.4% for L1 and 14.4% for L2). In L1 summary, participants were more likely to make comments related to news reports and personal experiences such as in Excerpts 21 and 23 (above) than they were in L2 summary. Further, participants reported two other elaborative inferences at higher percentages in L1 summary than L2: text-based evaluations (Mdn = 17.0% for L1 and 10.8% for L2), and background knowledge-based evaluations (12.3% for L1 and 9.4% for L2). However, participants reported more text-based associations in L2 summary (15.1%) than in L1 (13.5%).

Table 4. 4: Descriptive Statistics for Inference Episodes for Summary Tasks in L1 and L2

Inference Types		L1 Summary			L2 Summary			Wilcoxon signed- rank Test
		<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>p.</i>
Overall IE Comparison								0.02 r = 0.70
BRIDGING								
	Structure Analysis	2.5	0.0	11.1	5.2	2.7	14.9	0.28
Backward	Text-based	13.8	3.6	27.3	14.6	0.0	23.9	0.95
	Background Knowledge	1.1	0.0	10.5	2.8	0.0	21.6	0.83
	Total Bridging	23.5	5.9	42.1	25.6	8.5	37.5	
ELABORATIVE								
Prediction	Text-based	7.8	0.0	16.0	6.0	0.0	18.6	0.79
	Background Knowledge	3.1	0.0	8.0	5.7	0.0	10.8	0.26
Association	Text-based	13.5	4	20	15.1	6.4	37.0	0.44
	Background Knowledge	16.4	0.0	34.5	14.4	2.7	34.0	0.87
Evaluation	Text-based	17.0	4	36.1	10.8	4.1	25.0	0.28
	Background Knowledge	12.4	11.1	29.4	9.4	2.7	24.3	0.02 r = 0.69
	Reaction	3.0	0.0	9.1	5.6	0.0	16.2	0.71
	Total Elaborative	76.5	57.9	94.1	74.4	62.5	91.5	

The remaining three elaborative inferences were reported at much lower percentages, but in the same sequence of most to least and at relatively similar rates across languages. Participants reported more text-based predictions in L1 summary (Mdn = 7.8%) than L2 summary (6.0%), but there were more reports of background knowledge-based predictions in L2 summary (5.7%) than in L1 (3.1%). Lastly, participants reported elaborative reactions more often in both L1 and L2 than the two least

reported bridging inferences. However, most of the reports were related to an interest in, or a lack thereof, of the topics or information from the texts as demonstrated in Excerpts 48a, 48b, 48c, and 48d:

Excerpt 48a: *Ah...and air traffic. That's interesting* (P3 GS)

Excerpt 48b: *[laugh] the international rice institute, okay, that sounds kind of funny [laugh]* (P2 ES)

Excerpt 48c: *I don't really care about that topic* (P1 ES)

Excerpt 48d: *The topic is very interesting* (P3 ES)

There were several examples of participants reacting emotionally to textual content as shown in Excerpt 49, but it was the least reported of the reactions in both L1 and L2 summary.

Excerpt 49: *That would be something that worries me* (P4 GS)

4.2.4 Summary

The overall differences in IE percentages across languages for a summary task are statistically significant, but only one specific inference was significant: evaluative background knowledge elaborative inferences. None of the other inferences were approaching significance when comparing L1 and L2 summary conditions. Participants reported a higher proportion of background knowledge-based evaluative inferences while reading in the L1 summary task than in L2. Participants tended to give evaluations on the general positivity or negativity of textual content in L1 (Excerpts 14 & 15); whereas, in L2, their evaluations tended to focus on the importance or triviality of the information in relation to the task (Excerpts 35 & 36). The remaining inference processes were quite similar and seem to have transferred from L1 to L2 for a summary task with expository texts.

4.2.5 L1 and L2: Position-paper Tasks

Table 4.5 presents the descriptive statistics and the Wilcoxon results of the reported inference episodes in the position-paper task in L1 and L2, and they were not statistically significantly overall ($z = 1.48, p > .05$). The total reported percentages of bridging and elaborative inferences show a higher percentage of bridging inferences in L2 and a higher percentage of elaborative inferences in L1. One type of inference is approaching significance, though: structure analysis bridging inferences ($z = 1.71, p < .1$). There were more reports of structure analyses in the L2 position-paper task (Mdn = 2.2%) than in the L1 position-paper task (0.0%). With a larger sample, that difference may become significant.

4.2.6 Bridging Inferences

When reading for position-paper tasks in L1 and L2, participants reported a higher total percentage of bridging inferences in L2 (Mdn = 25.2%) than in L1 (18.4%). Backward text-based bridging inferences were reported at much higher percentages in both languages (Mdn = 13.9 % L1, 19.0% L2) than structure analysis and background knowledge-based bridging inferences. The percentage of structure analysis bridging inferences in L1 position-paper was 0.0%, but it was 2.2% in L2. Participants reported more background knowledge-based bridging inferences in L1 (2.3%) than in L2 (0.7%).

Table 4. 5: Descriptive Statistics for Inference Episodes for Position-paper tasks in L1 and L2

Inference Types		L1 Position			L2 Position			Wilcoxon signed- rank Test
		<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>p.</i>
Overall IE Comparison								0.13
BRIDGING								
	Structure Analysis	0.0	0.0	5.7	2.2	0.0	7.9	0.08
Backward	Text-based	13.9	5.0	20.8	19.0	6.7	23.1	0.18
	Background Knowledge	2.3	0.0	6.7	0.7	0.0	5.5	0.41
	Total Bridging	18.4	7.1	30.2	25.2	6.7	28.9	
ELABORATIVE								
Prediction	Text-based	4.5	0.0	12.2	5.1	0.0	9.5	0.79
	Background Knowledge	4.1	2.3	7.3	6.3	1.6	10.5	0.64
Association	Text-based	13.5	9.4	23.7	11.7	6.7	19.0	0.28
	Background Knowledge	19.3	11.3	37.5	18.1	8.3	40.0	0.18
Evaluation	Text-based	17.3	10.0	31.7	18.3	7.9	30.2	0.72
	Background Knowledge	12.3	9.1	22.7	15.8	9.3	21.8	0.57
	Reaction	1.8	0.0	7.5	2.9	0.0	7.7	0.56
	Total Elaborative	81.6	69.8	92.9	74.8	71.1	93.3	

4.2.7 Elaborative Inferences.

As with the bridging inferences reported in the L1 and L2 position-paper task conditions, the reported use of elaborative inference types was similar, but the total reported percentage of elaborative inferences is higher in L1 (Mdn = 81.6%) than in L2 (74.8%). The two elaborative inferences with the highest percentages were the same across languages, but their order was inverted. In L1 position-paper, background knowledge-based associations (Mdn = 19.3%) were the most reported, and text-based evaluations (17.3%) followed closely. In L2 position-paper, text-based evaluations (18.3%) had the

highest percentage and were only slightly higher than background knowledge-based associations (18.1%)

The remaining three elaborative inferences were reported at much lower percentages in both language conditions. In L1, the percentage of text-based predictions (Mdn = 4.5%) was minimally higher than Background knowledge-based predictions (4.1%), and the reverse is true in L2; background knowledge-based predictions (6.3%) were higher than text-based predictions (5.1%). Overall, participants did not report many predictions in L1 or L2 in position-paper tasks. Reactions were the least commonly reported elaborative inference in L1 (1.8%) and L2 (2.9%).

4.2.8 Summary

The overall differences in the percentages of reported inference episodes in the position-paper task across L1 and L2 (research question 3b) were not statistically significant. Only one type of inference is approaching significance: structure analysis bridging inferences. Participants reported more structure analyses in L2 position-paper, but the results suggest that university level L1 readers with advanced L2 proficiency have similar inferencing processes when reading for a position-paper task in L1 and L2.

4.3 Results Summary

The Wilcoxon Signed Rank Results are presented together in Table 4.6. The Wilcoxon signed-rank tests revealed no statistically significant differences in the overall percentage of IEs between summary and position-paper tasks in the L1 ($z = 1.32, p = 0.18$), nor between L1 and L2 position-paper tasks ($z = 1.48, p = 0.13$). They did, however, show statistically significant differences in overall percentage of IEs between the L2 summary and position-paper tasks ($z = 1.992, p = 0.0464$), as well as between the L1 and L2 summary tasks ($z = 2.24, p = 0.024$). When reading for a summary purpose,

inferencing processes differed from L1 to L2 which does not seem to be the case for a position-paper task. The results suggest that there are task effects on inferencing processes, and these effects are stronger in L2.

Table 4. 6: Wilcoxon Signed Rank Results for All Language and Task Conditions

		¹ Task GS vs GP	ES vs EP	GS vs ES	GP vs EP
		<i>P</i> value	<i>P</i> value	<i>P</i> value	<i>P</i> value
Overall IE Comparison		0.18	0.04 <i>r</i> = 0.62	0.02 <i>r</i> = 0.70	0.13
BRIDGING					
	Structure analysis	0.10	0.01 <i>r</i> = 0.74	0.28	0.08
Backward	Text-based	0.20	0.72	0.95	0.18
	Background Knowledge	0.47	0.28	0.83	0.41
ELABORATIVE					
Prediction	Text-based	0.09	0.28	0.79	0.79
	Background Knowledge	0.38	0.72	0.26	0.64
Association	Text-based	0.79	0.07	0.44	0.28
	Background Knowledge	0.09	0.54	0.87	0.18
Evaluation	Text-based	0.57	0.10	0.28	0.72
	Background Knowledge	0.87	0.02 <i>r</i> = 0.73	0.02 <i>r</i> = 0.69	0.57
	Reaction	0.56	0.12	0.71	0.56

1:GS=German Summary, GP=German Position-paper; ES=English Summary, EP= English Position-paper

CHAPTER 5: DISCUSSION AND IMPLICATIONS

Reading was originally viewed as receptive and defined simply as taking meaning from the page (Block, 1986; Heeney, 2005; Grabe & Stoller 2002). Researchers now agree that such a definition is insufficient; it does not include different reading purposes, skills and strategies, cognitive processes, nor the differences in L1 and L2 reading (Grabe & Stoller, 2002). We are still uncertain how learners store, organize, represent, interpret and learn information from texts (Horiba, 2013; Horiba & Fukaya, 2015; Nassaji, 2007) and how second language (L2) readers differ from or are similar to first language (L1) readers (Horiba, 2000, 2013; Nassaji, 2007). This study investigated the inferencing processes of skilled readers in L1 and L2 for two academic tasks to begin to fill this gap. Based on the findings of this study, several conclusions can tentatively be drawn.

5.1 Key Findings

Academic contexts require reading as a means of information transfer, and reader purpose can affect inferencing processes (Cohen & Upton, 2006; Horiba, 1996, 2000, 2002, 2013; Rosenfeld et al., 2001; van den Broek et al., 2001). The current findings support prior research, although not completely. In all four research conditions, at least one inference was approaching significance. Overall, participants reported more inferences for the position-paper tasks (55.5%) than for the summary tasks (44.5%) which was expected as position-paper tasks require both a textbase and situational representation of a text (Kintsch, 1989, 1998). Next, participants reported a higher percentage of IEs in L2 as compared to L1 in both task conditions, albeit only slightly more: 52.9% in summary and 52.6% in position condition. Further, when the totals of bridging and elaborative inferences are compared, participants reportedly inferred very similarly in L1 and L2 summary tasks, and in L2 summary and L2 position-paper tasks. However, L1 summary had a higher percentage of

bridging inferences than L1 position, and there was a higher percentage of elaborative inferences in L1 positions as compared to L1 summary. Additionally, prediction was not a common inference with academic texts for advanced L1 readers; very few predictions were made based on background knowledge with academic texts, but predictions based on textual content were employed more often when reading for a summary task than a position-paper task in L1 and L2. Moreover, although not necessary for a summary task, evaluations based on the text and background knowledge were made at very similar rates to when reading for a position-paper task in L1; these elaborative inferences seemed to transfer across tasks with advanced L1 readers. Lastly, reactions were rarely employed by advanced readers with academic texts for academic tasks, and when they were, the majority were in relation to whether or not content was interesting, as opposed to emotional reactions such as fear or sadness. It seems the advanced readers in this study do not often react emotionally to texts.

5.1.1 L1 Summary and L1 Position-paper Inference Processes

Research question 1 focused on whether the inferences that skilled, adult readers generated in L1 differed between a summary task (textbase comprehension) and a position-paper task (situational comprehension). Firstly, that task affects L1 readers' inferencing processes cannot be said with certainty given this study's results, but there are some results suggesting that task does, in fact, affect inferencing processes in advanced L1 readers. When the percentages of all IEs were compared across L1 tasks there was no statistically significant difference overall ($z = 1.32, p > .05$), nor of individual inferences at the 95% confidence interval. However, at the 90% confidence interval ($p \leq 0.10$) there are three types of inferences that differed significantly, which suggests that with a larger sample size, they may be found to be significant. Participants differed in structure analysis bridging inferences ($z = 1.64, p \leq .1$) and in two elaborative inference categories: text-based predictions ($z = 1.68, p \leq .10$) and background knowledge associations ($z = 1.68, p \leq .10$). Further, the qualitative analysis of the TAs and

SR revealed several patterns and differences in inferencing processes across tasks in L1 that both support and contradict previous research findings.

In the present study, L1 summary included more reports of structure analysis and text-based predictions, but L1 position-paper included more background knowledge associations. This may be explained by participants focusing on constructing a complete and accurate textbase for the summary task, not unlike Horiba's (2000) study in which the majority of NSs' reports were 'in-text' when they were instructed to focus on textual content and structures. In the current study, in the position-paper task condition, participants reported fewer text-based inferences, possibly because they were more comfortable skipping unknown words and uncomprehended clauses knowing they could choose not to include those portions of text in their position essay. Skimming was witnessed multiple times during research sessions when participants had decided that some information was unnecessary; if information is deemed unnecessary, sentence integration is not required (Carver, 1997); thus, participants strategically skimmed. Further, participants attempted to infer meanings of unknown words and clauses by using textual content which aligns with Hamada's (2014) findings that in order to use context clues as opposed to structural features for lexical inferencing, there seems to be a linguistic threshold; the higher the proficiency level, the better context can be applied to make inferences.

The qualitative analysis of the TAs and SR also showed that when a content-based bridging inference failed, participants were more likely to attempt another bridging inference during the summary task than the position-paper task in L1. This seems to be because participants would strategically apply a second bridging inference if their first attempt failed to resolve the issue in the L1 summary. Participants seemed more focused on the text as a whole while reading for a summary purpose, and also reported more elaborative inferences based on textual content in the L1 summary

task. However, mainly in the L1 position-paper task, if participants skipped an unknown word, they often retained unresolved items in memory, and they verbalized later in the text if something triggered the item and they were able to infer its meaning, exactly as MB researchers have found (Albrecht & Meyers, 1998; Gerrig & McKoon, 1998; Myers & O'Brien, 1998). Under the L1 summary condition, participants usually reported considering the text more often than their own knowledge; whereas, there were more reports of elaborative inferences based on background knowledge under the L1 position-paper task. As a position-paper task explicitly requires a student to apply their background knowledge to a text, this was not an unexpected result. "There is ample evidence that L1 readers with different reading goals allocate cognitive resources differently during reading" (Horiba & Fukaya, 2015, p. 24). These results support previous findings that readers' cognitive processes differ based on task (Horiba, 2012; Horiba & Fukaya, 2015; van den Broek et al., 2001)

Given the present findings, it seems that advanced L1 readers strategically inference when reading long expository texts for different tasks. When reading for a summary task, advanced L1 readers allocated more cognitive resources to bridging inferences than when reading for a position-paper task. This is evidenced by higher percentages of bridging inferences, and the qualitative analysis showed that there were many reports of a second bridging inference attempt after an unsuccessful attempt in L1 summary. Further, while reading for a summary task, advanced readers make text-based predictions more often than when reading for a position-paper task; they seem to be more focused on the creation of a complete and accurate textbase when reading in L1 for a summary. This does not mean that they did not attempt to create an accurate textbase while reading for a position-paper task. The reported percentages of text-based associations were the same across the two task conditions in L1. Further, the reported percentages of both types of elaborative evaluations were very similar across L1 tasks. However, advanced L1 readers allocated more cognitive resources to associating textual

content to their background knowledge when reading for a position-paper task as compared to a summary task. In this way, task seems to affect the inferencing processes of advanced L1 readers.

5.1.2 L2 Summary and L2 Position-paper Inference Processes

This study found that task affects the inferences generated by advanced, adult L2 readers between a summary and a position-paper task ($z = 1.99, p \leq .05, r = .62$). Not only was the overall difference of all percentages of IEs statistically significant, but two inference categories were statistically significant and two others were approaching significance. Structure analysis bridging inferences ($z = 2.34, p \leq .05, r = 0.74$), and evaluative background knowledge-based inferences ($z = 1.63, p \leq .05, r = 0.73$) differed significantly across L2 summary and position-paper tasks. There were far more structure analysis bridging inference reports in the L2 summary task condition than the L2 position-paper task. Participants seemed to be fairly comfortable ignoring lexical issues and clausal comprehension breakdowns while reading for the L2 position-paper task, but seemed much less so in L2 summary task condition. Background knowledge-based evaluations were reported far more frequently in L2 position-paper task than in L2 summary. While participants evaluated textual content when reading for the summary task, they reported more text-based evaluations than background knowledge-based evaluations, but both were reported at much lower percentages in L2 summary than in L2 position.

Statistically, this study found significant inference process differences in L2 when reading for a summary task and a position-paper task. Horiba's (2013) findings showed no significant inferencing differences across task conditions; however, L2 readers in the Critique condition made slightly more reactive and evaluative reports and fewer text-based bridging and association inferences than those in the Image condition. In the current study, the L2 summary task had a higher percentage of structure

analysis bridging inferences, and the L2 position-paper task had many more reports of elaborative inferences as Horiba (2013) found. However, the current results revealed more reports of reactions in L2 summary (Mdn = 5.6%) than in the L2 position-paper condition (2.9%). This contradicts Horiba's (2013) findings in which L2 readers reported the highest proportion of reactions in the 'read for critique' condition, and there were very few reports of reactions in the 'expression' and 'image' conditions. Participants in this study actively reported more text-based associations in L2 summary than L2 position-paper, which was approaching significance. Advanced L2 readers in this study seemed to attempt to link textual content across paragraphs when reading a long expository text for a summary task, but they were less concerned with a complete textbase representation when reading in L2 for a position-paper task, but Horiba (2013) did not find such a difference. Finally, in line with Horiba's (2013) findings, participants in the current study reported far more backward text-based bridging inferences than structure analysis or background knowledge-based bridging inferences in both task conditions. In both studies, L2 readers often chose to use the context to resolve local comprehension breakdowns far more often than employing formal or semantic textual features.

Advanced L2 readers strategically inference based on task requirements and allocate cognitive resources differently. When reading for a summary in L2, advanced readers often employ a second bridging inference when the first attempt is unsuccessful, and they will choose to use the text far more frequently than applying their background knowledge. However, advanced L2 readers allocate more cognitive resources to elaborative text-based associations when reading for a summary task than a position-paper task. They seem to be much more focused on a complete and accurate textbase representation for a summary task; whereas, under a position-paper task, L2 readers actively evaluate the text much more often and seem less concerned with a complete textbase representation. Lastly, L2

readers apply their background knowledge when reading for a L2 position-paper task more often than when reading for a summary task. Task seems to affect the inference processes of advanced L2 readers.

5.1.3 L1 Summary and L2 Summary Task Inference Processes

Research question 3a asked if the inferences generated by skilled, adult readers in L1 differ from the inferences generated in L2 for a summary task. Statistically, the overall differences in the percentages of reported inferences by skilled, adult readers in L1 summary task as compared to L2 summary task are significant ($z = 2.24, p \leq .05, r = 0.709$). Only one type of inference, however, was statistically significant: evaluative background knowledge elaborative inferences ($z = 2.19, p \leq .05, r = 0.69$), and no other inference types were approaching significance. Descriptively speaking, participants reported more evaluative inferences, both text-based and background knowledge-based, while reading in the L1 summary task than in the L2 summary task. Bridging inference patterns in L2 summary were very similar to L1 summary; readers preferred context to structure analysis or background knowledge to resolve comprehension breakdowns. However, they were less likely in L2 than L1 to strategically skip an unknown word if the first inference failed. The remaining inference processes were similar and seem to have transferred from L1 to L2 for a summary task with expository texts.

The current study produced some similarities and differences to prior research that looked at inferencing process in L1 and L2. Horiba's (2000) second experiment used expository texts and instructed participants to read 'freely', or for a Rauding purpose, and to read for coherence, which is similar to a summary task. The present study revealed more background knowledge associations and evaluations in L1 summary than L2; whereas, in Horiba's (2000) study, L1 readers reported more background knowledge-based associations and evaluations in the read freely condition. Additionally, participants in the current study tended to apply background knowledge to the text more often in L1,

which is similar to Horiba's (2000) findings that when reading an expository text in L1, skilled readers evaluated the text based on background knowledge and also reported background knowledge-based associations at much higher instances in L1 than in L2. Further, participants in this study reported more text-based bridging and text-based associations in L2 summary, but more text-based evaluations and predictions in L1 summary. This finding only partially supports Horiba's (2000) results which showed that in L2, readers employed more text-based inferences such as text-based bridging inferences and text-based evaluations than in L1 (Horiba, 2000). Lastly, in Horiba's (2000) read-for-coherence condition, L1 readers reported far more text-based backward, predictive, and associative inferences than L2 readers who reported more bridging inferences and few elaborative inferences. NSs also seemed to refrain from background knowledge associations and evaluations while reading for the coherence task with expository texts (Horiba, 2000). Neither of those patterns were found with advanced readers in the current study.

Some of the aforementioned differences may be due to language proficiency. Horiba's (2000) participants were NNSs of Japanese in their fourth year of Japanese study at a university in the U.S., but no measure of proficiency was given, nor was it mentioned if they studied through the medium of Japanese. The expository texts were fairly short (24 and 33 sentences) newspaper articles. If their proficiency were intermediate to upper-intermediate, they may have been short-circuited and focused on lower-level processes such as decoding and lexical issues which did not allow them to allocate cognitive resources to higher-level processes. The L2 readers in the present study had an advanced proficiency and most likely had fewer lower-level processing problems which allowed for cognitive resources to be allocated to higher-level processes such as elaborations. Further, as the texts were in a Japanese rhetorical structure (Horiba, 2000), perhaps the rhetorical structure differs significantly from

English and German rhetorical structures and does not foster elaborative associations or evaluations. That said, a contrastive rhetorical analysis is beyond the scope of this paper.

There are language effects when reading a long, expository text for a summary task. When reading in L2, readers allocated more cognitive resources to bridging inferences, were more likely to employ a second bridging attempt after a failed attempt, and were less likely to skip an unknown word than when reading in L1. Further, when reading in L1, advanced readers applied their background knowledge, especially to evaluate, to the text far more often than when reading in L2. Also, the evaluations made when reading for an L1 summary tended to denote textual content as pro, con, or viable; whereas the evaluations in L2 tended to relate to the importance of the information specific to the reading purpose. Predictions, although not very common, occurred across both languages, but there were differences from L1 to L2. Advanced L1 readers preferred to predict using textual features, but L2 readers used the text and background knowledge at similar percentages. Perhaps this is due to familiarity with rhetorical structure in L1. Although the participants studied through English medium and read a lot of academic texts in English, they would have been exposed to many more German texts throughout their lives, and it would stand to reason that they be more comfortable with German rhetorical structure.

5.1.4 L1 Position-paper and L2 Position-paper Inference Processes

The Wilcoxon signed-rank test results of the reported inference episodes in a position-paper task in L1 and L2, research question 3b, showed they were not statistically significantly overall ($z = 1.48, p > .05$). One type of inference is approaching significance, though: structure analysis bridging inferences ($z = 1.71, p < .1$). There were more reports of structure analyses in the L2 position-paper task (Mdn = 2.2%) than in the L1 position-paper task (0.0%). With a larger sample, that difference may

become significant. L2 readers for a position-paper task reported a higher percentage of backward text-based bridging inferences as well, and they were more likely to apply a second bridging inference if the first attempt failed in L2 as compared to L1. Interestingly, the percentage of reported background knowledge-based bridging inferences was three times higher in the L1 position-paper task condition than in L2. Statistically speaking, the inference processes of advanced L1 readers largely transferred to L2 when reading for a position-paper task. However, advanced readers reported more evaluations by applying their background knowledge in the L2 position-paper task than when reading in L1 for a position-paper task. Additionally, the qualitative analysis of the TAs and SR revealed that in L1, many of the evaluative inferences referred to the positivity, negativity, or viability of the textual content. In L2, however, many of the evaluative inferences were in regard to the level of importance of the information to the writing task. The participants seemed to engage with the text in the L2 with more of a focus on the position-paper task, but in L1, there seemed to be more of a focus on the text with minimal mention of the task condition. Furthermore, when reading for the L1 position-paper task, there was a higher frequency of text-based elaborative associations than when reading in L2 for the position-paper task. Again, this suggests that when reading in L1 for a position-paper task, participants were more engaged with the text at a discourse level, but in L2, participants were more engaged at a local level.

To the best of my knowledge, the current study has provided the first data set concerning inferencing processes of advanced readers in L1 and L2 with long, expository texts for a position-paper task. However, some comparisons to previous research are possible. The current results showed that when reading for a position-paper task in L2, advanced readers reported more bridging inferences than when reading in L1. Language proficiency affects textbase levels of comprehension (Chen & Donin, 1997; Chu et al., 2002; Parry, 1996; Koda, 2007; van Gelderen et al., 2004; Uso-Juan, 2006; Morrison,

2004) and as the participants in this study had a higher proficiency in the L1 than the L2, this is not surprising. Additionally, in the L1 position-paper task, participants were more likely to continue to read and retain unresolved items in memory, and they verbalized later in the text if something triggered the item and they were able to infer its meaning, exactly as MB researchers have found (Albrecht & Meyers, 1998; Gerrig & McKoon, 1998; Myers & O'Brien, 1998). In the L2 position-paper task, participants were more likely to attempt a second bridging inference, which was almost always structure analysis. These findings support Fraser's (1999) findings that L2 readers prefer to use the context to infer meanings of words as a first choice. Also in line with Fraser's findings, even advanced L2 readers do not often chose continuing to read as a strategy when an unknown word is encountered; they prefer to attempt a second bridging inference to resolve it.

Furthermore, participants reported a higher percentage of background knowledge-based bridging inferences when reading in L2, but there were very few overall in either language condition. Participants all reported not knowing a lot about the topics of the texts, and they did not often rely on their background knowledge for bridging inferences often. Perhaps this is related to participants having an awareness that the application of inappropriate background knowledge negatively affects reading comprehension (Carrell, 1983; Chu et al., 2002; Kang, 1992). There was a higher percentage of text-based associations under the L1 condition, which may be explained by Durgunoğlu and Jehng's (1991) findings that elaboratively inferencing across multiple sections of text is difficult for readers; participants allocated more cognitive resources to bridging inferences in L2. Perhaps the cognitive processing space was unavailable for as many text-based associations in L2 as L1. Lastly, Durgunoğlu and Jehng (1991) and Kintsch (1998) posited that there may be different types of elaborative inferences which is supported by the current study's qualitative results. The participants in this study evaluated the texts in both language conditions, but they were more concerned with the information's value to the

task condition while reading in L2. The focus of their evaluations differed across languages. In L1, they evaluated the text on its merits as a text and not nearly as often in relation to the task. This suggests that task specific inferences occur and are more prominent in L2, even with advanced readers.

The inferencing processes of advanced L1 and L2 skilled readers largely seem to transfer while reading for position-paper tasks. The only inference approaching significance is structure analysis, and this is probably due to second language proficiency specific to vocabulary size. In addition, the percentages of bridging inferences were higher in L2 for two of the three types, but participants applied their background knowledge to the texts to make bridging inferences more often in L1 when reading for a position-paper task. Associations to background knowledge seemed to be made at similar rates in L1 and L2, and this may be a task effect in that skilled readers knew they were required to do so and did in both L1 and L2. Finally, participants evaluated the texts under both language conditions, but the advanced, skilled readers in this study tended to evaluate based on task in L2. Perhaps there are different elaborative inferences that are affected by task. The skilled readers in this study appeared to strategically inference based on task expectations in L1 and L2; although, the task effect on inferences was much stronger in L2.

Largely, the results of this study support Horiba's (2000, 2013) findings, but there are some differences which may be explained by differences in participants, languages, and texts. The readers in Horiba's (2000, 2013) studies were most likely not advanced L2 readers. Some of the discrepancies discussed above may be due to language proficiency in that advanced L2 readers are better able to assert control of cognitive processes because they are not as focused on bottom-up processing as lower proficiency readers.

Languages may also explain some of the differences in the findings. Languages, while all used for communicative purposes, are not parallel. Some languages are more distant from a target language than others. Koda (2007) defines linguistic distance as “...the degree of structural similarity between two languages” (p. 27). She further categorizes linguistic distance into orthographic and morphological differences. Orthographic categorization refers to alphabetic, logographic, and Cyrillic systems; whereas, morphological segmentation distinctions include concatenative and nonconcatinative systems (morpheme based or not). Further to Koda’s (2007) definitions, several authors include contrastive analysis of rhetorical patterns in the distance between languages as a variable affecting reading comprehension (Carrell, 1987; Chu et al., 2002; Chen & Donin, 1997; Parry, 1996). The expository texts in Horiba’s studies were in a Japanese rhetorical structure, either in Japanese or translated into English. The texts used in this study, however, were written in the rhetorical pattern of the languages in which they were written. Further, Horiba’s participants were speakers of Japanese which is more distant than German to English.

5.2 Limitations and Recommendations

Although this study benefitted from the within-subject design, there are some limitations and recommendations for future research. The sample size in this study is small ($n = 10$) and was not randomly selected. Participants were selected because of ease of access at the university in Germany where the researcher had a visiting scholar role for six months. The sample is quite homogenous in academic background, L1, level of education, sex, and culture. According to Richardson (1995), there are two major types of postsecondary educational models, and they tend to be culturally based. The first follows a reproductive model in which students are taught information so that they are able to reproduce it. The second type focuses on comprehension and expects students to apply the information to problems and new contexts. North American institutions are classified within the comprehending

framework (Richardson, 1995; Taillefer, 2005). The participants all completed primary and secondary school in Germany which has a similar academic culture to North America and is classed as a comprehending culture (Taillefer, 2005); thus, notions of academic reading and writing expectations probably did not affect this sample as they may do with students from other cultural and educational contexts (Bosley, 2008; Chu et al., 2003; Kang, 1992; Koda, 2005; Taillefer, 2005).

Language distance affects L2 learning (Koda, 2007; Steffensen, Getz, & Cheng, 1999; Chu et al., 2002; Chen & Donin, 1997), and English is a Germanic language. The distance from German to English is small; orthographic and morphological differences are minor compared to Cyrillic or logographic languages. However, at the advanced levels, L1 influence decreases significantly, so this may not have affected the advanced L2 learners in the present study. Additionally, the participants in this study share cultural norms and expectations with the research methodology and researcher. Using Hall's classification of cultures, German and Canadian cultures are closer to low-context than high-context on the continuum. Low context cultures tend to be more direct and individualistic than high context. Academic tasks that require directness may be affected by cultural background. As the tasks completed in this study were from a low context culture and completed by participants from another low context culture, this probably did not affect the findings. Further, low context cultures tend to value individuality, so being recorded and observed as an individual may not have had as great an effect on participants as those who come from a high context culture. The current participants may have been more comfortable with the methodology than would students from another culture. In regard to language, L2 proficiency was self-reported, and although the university required a demonstration of L2 proficiency, future studies should have participants complete an L2 proficiency test to ensure learners' proficiencies had not decreased, and to ensure reporting of current L2 proficiency levels.

The memory effect between sessions 1 and 2 was controlled for but not rigorously. An oral report was chosen as opposed to the more common written recall because the act of writing can activate memory (Emig, 1978). The time between sessions was assumed to be long enough for participants to have forgotten anything not transferred into long term memory, but participants did complete a written summary after session 1. They may have transferred textual content to long term memory that was not activated until they began to process the texts a second time. Future research should use different but parallel texts for the tasks to mitigate possible memory effects.

The use of frequency percentages and the Wilcoxon signed-rank test, while the non-parametric equivalent for a paired sample t-test and appropriate for this study's small sample size and data parameters (Field, 2014), are not without issue. Using percentages for independent variables that are not a scale variable causes them to become interdependent at 100% which can lead to interpretative issues (Barkaoui, 2015). Generally, non-parametric tests are less precise than their parametric counterparts as they do not measure data at the interval-ratio level (Marshall, personal communication, May 4, 2016). Larger sample sizes need to be used in future research to mitigate these statistical issues.

Perhaps most importantly, participants most likely did not verbalize all of their thoughts during the TAs and the SR. Not only do TAs tend to only elicit those cognitive processes that are conscious, but participants can also be selective in the thoughts they choose to verbalize (Barkaoui, 2015). Consequently, the data cannot be considered a full representation of the inferencing processes of the participants.

At lower levels, language distance can affect the results and should be controlled, or at least analyzed, for effect because “the transferability of native language reading skills into second language

reading also depends on the degree of similarities and differences between reading in the first language and reading in the second language” (Horiba, 2000, p. 227). Future research should include participants from other language families as well as multiple L1s. All of the participants were enrolled in postsecondary studies and had completed secondary school, so for L2 learners who have lower levels of education, the findings here may not be applicable. All of the participants in this study are also female; with such a small sample size, this is not a major barrier, but future research should include males because gender can affect the findings.

The data presented in this paper only compare the frequencies of online inferencing processes while reading expository texts in L1 and L2 for specific tasks. There are other strategic cognitive activities that occur while reading such as comprehension monitoring, repetition, and paraphrasing which could be included in future research. Furthermore, the current study did not probe for any interrelationships, or any positive or negative effects of the inferencing processes to the written work completed for the tasks. Participants were required to complete the written tasks, and although the written work of the participants was collected by the researcher, the purpose of this exploratory study was to define and identify the inferences employed by readers online; therefore, no analysis of the written work was included in the study. Future research may want to frame a study with Scardamalia and Bereiter’s (1987) knowledge telling and knowledge transforming model of written discourse, or Flower’s (1990) reading-to write model to ascertain possible relationships between online inference processing and academic writing tasks as well as inferencing processes correlated to scores on the writing tasks.

5.3 Implications

Postsecondary students must be able to comprehend and demonstrate comprehension at both literal and interpretative levels in order to successfully complete many academic tasks. However, fluent and skilled reading expertise in L1 does not necessarily transfer to L2 reading (Clarke, 1980; Heeney, 2005; Koda, 2005; Macaro & Erler, 2008; Shih, 1992). Strategy instruction can improve reading comprehension in L2 learners (Allen, 2003; Anderson, 1991; Bialystok, 1985; Block, 1986; Carrell et al., 1998; Carrell et al., 1989; Fraser, 1999; Heeney, 2005; Macaro & Erler, 2008; Salataci & Akyel, 2002; Zhang, 2007), and inferences are required in reading, and although they can be automatic, they can also be strategic. Recent publications have argued for and demonstrated that strategic inferencing can be taught in L2 contexts (Beaumont, 2010; Macknish, 2011; Meyer Sterzik & Fraser, 2012).

The current findings support the contention in the literature that task affects inferencing processing when reading for textbase and situational levels of comprehension with skilled readers in L1 and L2. These findings also support prior research in that at advanced levels of proficiency, inference processes largely transfer from L1 to L2, and therefore, explicit instruction of strategic inferencing is most likely unnecessary with the advanced L2 readers in this study and any similar L2 populations. For lower proficiency L2 readers who do not have automated lower-level processing skills this is not the case, however, as they are less able to control cognitive processes and strategically infer (Horiba, 2000; Pretorius, 2005; Yoshida, 2012). Therefore, academic tasks that require global comprehension, assessment, analysis, or integration of content may be especially difficult. Lower-level processing skills are necessary for reading comprehension, but if EAP students are taught task-specific strategic inferences with level appropriate texts, their performance on academic tasks may improve because their reading comprehension would improve. The current study provided clearly

defined inferences and descriptions of which types of inferences are employed by skilled L2 readers for specific academic tasks. These could be incorporated into metacognitive strategy pedagogy in EAP classrooms to improve academic reading skills for postsecondary success.

Many EAP programs include explicit bridging inference strategy training to improve textbase comprehension. Academic tasks often require situational levels of comprehension, so EAP students should be instructed in elaborative inferences: how and when to elaboratively associate content across paragraphs, as well as how and when to apply their schemata to a text to evaluate and associate. Although the data suggest that these inferencing skills largely transfer with advanced L2 readers, the participants in this study are from a similar educational context and language family. Most EAP programs have students from multiple educational contexts with multiple L1s. If level appropriate texts are used, EAP instructors could begin to teach strategic inferencing for specific tasks at lower levels and possibly hasten reading skill development.

Multiple studies in both L1 and L2 contexts have consistently found that metacognitive reading strategy instruction improves reading comprehension (Zhang, 2008), and in regard to inferences, they are crucial for reading comprehension, and skilled readers inference ‘better’ than unskilled readers (Hamada, 2014; Li & Kirby, 2014; Zhang & Koda, 2012). However, elaborative inferences tend to be more difficult than bridging (Durgunoğlu & Jehng, 1991; Fraser, 1999; Li & Kirby, 2014; Meyer Sterzik & Fraser, 2012), especially if readers must allocate cognitive resources to lower-level processes such as decoding (Horiba, 2000, 2013; Li & Kirby, 2014). Thus, in order to allocate cognitive resources to elaboration, texts must be at a level in which readers are able to create a textbase level of comprehension fairly automatically. To illustrate, a position-paper requires a reader to employ bridging inferences and elaborative text-based associations to first create a textbase representation. In order to

formulate a response, readers need to evaluate the text and support their evaluations through the application of prior textual information and background knowledge as was shown by the skilled readers in this study. Many academic tasks require students to elaboratively inference, and if unskilled readers are instructed in the types of inferences, how to formulate them, and when and why to apply them to academic reading tasks, their reading comprehension should improve and continue to improve as their proficiency increases.

In regard to large-scale language proficiency assessments, test purpose is one of the most important factors to be considered in test creation as not every test is applicable for every purpose (Alderson, 2000; Alderson & Banerjee, 2002; Bachman, 1990; Bachman & Palmer, 1996, 2010; Banerjee & Wall, 2005; Fulcher, 2010; Fulcher & Davidson, 2007, 2009). “It is only through specifying purpose closely that we can create validity arguments” (p. 125) as “test purpose and test design are inextricably linked” (Fulcher & Davison, 2009, p. 131). TOEFL, and other large-scale assessments, are language proficiency assessments and not academic skills tests. “The TOEFL...is intended for two uses: its primary purpose...admitting applicants who are non-native speakers of English...and its secondary...for determining if admitted students need remedial English classes...TOEFL... test scores can be used along with other indicators...to make admissions decisions” (Xi, 2010, p. 156). Academic task performance is not necessarily a language proficiency issue. This study, however, supports previous findings that inferencing processes are affected by task. Large-scale assessments, then, must ensure that task instructions are congruent with the types of inferences that are required to complete reading tasks, and they should include questions that require test takers to elaboratively inference at the discourse level. However, Li and Kirby (2014) argue that elaborative inferences at the discourse level are possible only in high proficiency learners, and the lower proficiency readers in Horiba’s (2000, 2013) studies reported fewer elaborative inferences than the

skilled L1 readers. The test questions must be also be created while ensuring that a test taker's background knowledge or lack thereof will not affect their performance on the assessment (Bachman & Palmer, 1996, 2010; Fulcher & Davidson, 2009). Currently, TOEFL requires elaborative inferences that are mainly text-based (Cohen & Upton, 2006), and this seems to be appropriate for a large scale language proficiency assessment.

Large scale and classroom assessments differ in that in the former, context variables such as level of background knowledge can act as a source of evidence of invalidity; however, in the latter, the context "is not construct-irrelevant, but directly relevant to the assessment of the learners" (Fulcher & Davidson, 2007, p. 25). Further, EAP programs generally include and assess academic skills as well as language proficiency; therefore, EAP classroom reading assessments should include tasks that mimic postsecondary reading tasks. "[T]he relationship between language test tasks and tasks in the target language use (TLU) domain is crucial" (Alderson, 2000, p. 140), and "[i]f the assessment criteria used in EAP tests do not reflect the criteria against which the students' performance will be judged in academic contexts, then the scores achieved are less easily interpretable with reference to the students' ability to perform tasks in those contexts" (Banerjee & Wall, 2006, p. 54). Different academic tasks require different inferencing processes. EAP professionals need to assess their students at local and global levels for textbase and situational levels of reading comprehension. In order to effectively construct valid reading assessments, the inferences required to successfully complete each task should be defined. If a reading task requires the application of a student's background knowledge for the evaluation of textual content, it is imperative that the instructor ensure the students have enough background knowledge of the topic to successfully complete the assessment. Additionally, task instructions should be given prior to a reading assessment because reading purpose affects inferencing

processes; if students are not given a purpose, they may not read the text appropriately for the task and may not be able to complete the task successfully.

Reading assessment creators need to be aware that task affects inferencing processes, and they also need to define which inferences are required to successfully complete a task for reading assessments to be valid and reliable.

5.4 Conclusion

The results of the present study showed no significant task effects in L1. Three types of inferences were approaching significant levels at the 90% confidence interval in L1, however, and suggest that inferencing processes differ when L1 readers read a text with different purposes. In L2, strategic, task induced inferencing process differences were significant as were the differences between a summary-task in L1 as compared to L2. Clearly, more research on the inferencing processes of skilled and less skilled readers in L1 and L2 with academic texts for academic tasks is needed to increase our understanding of the "...knowledge sources, and processes that act on these knowledge sources, ...to examine specific systems and subsystems and the interactions among them" during reading (Perfetti & Stafura, 2014, p. 34) in both L1 and L2. This study has added to the body of knowledge in the inferencing processes of skilled readers in L1 and L2 with academic texts for academic tasks.

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Appendix A: English Text

Governments and management of the environment

The role of governments in environmental management is difficult but inescapable. Sometimes, the state tries to manage the resources it owns, and does so badly. Often, however, governments act in an even more harmful way. They actually subsidise the exploitation and consumption of natural resources. A whole range of policies, from farm- price support to protection for coal-mining, do environmental damage and (often) make no economic sense. Scrapping them offers a two-fold bonus: a cleaner environment and a more efficient economy. Growth and environmentalism can actually go hand in hand, if politicians have the courage to confront the vested interest that subsidies create.

The effects of government policy on food output

No activity affects more of the earth's surface than farming. It shapes a third of the planet's land area, not counting Antarctica, and the proportion is rising. World food output per head has risen by 4 per cent between the 1970s and 1980s mainly as a result of increases in yields from land already in cultivation, but also because more land has been brought under the plough. Higher yields have been achieved by increased irrigation, better crop breeding, and a doubling in the use of pesticides and chemical fertilisers in the 1970s and 1980s.

The environmental impact of modern farming

All these activities may have damaging environmental impacts. For example, land clearing for agriculture is the largest single cause of deforestation; chemical fertilisers and pesticides may contaminate water supplies; more intensive farming and the abandonment of fallow periods tend to exacerbate soil erosion; and the spread of monoculture and use of high- yielding varieties of crops have been accompanied by the disappearance of old varieties of food plants which might have provided some insurance against pests or diseases in future. Soil erosion threatens the productivity of land in both rich and poor countries. The United States, where the most careful measurements have been done, discovered in 1982 that about one-fifth of its farmland was losing topsoil at a rate likely to diminish the soil's productivity. The country subsequently embarked upon a program to convert 11 per cent of its cropped land to meadow or forest. Topsoil in India and China is vanishing much faster than in America.

The effects of government policy in rich countries

Government policies have frequently compounded the environmental damage that farming can cause. In the rich countries, subsidies for growing crops and price supports for farm output drive up the price of land. The annual value of these subsidies is immense: about \$250 billion, or more than all World Bank lending in the 1980s. To increase the output of crops per acre, a farmer's easiest option is to use more of the most readily available inputs: fertilisers and pesticides. Fertiliser use doubled in Denmark in the period 1960-1985 and increased in The Netherlands by 150 per cent. The quantity of pesticides applied has risen too: by 69 per cent in 1975-1984 in Denmark, for example, with a rise of 115 per cent in the frequency of application in the three years from 1981.

In the late 1980s and early 1990s some efforts were made to reduce farm subsidies. The most dramatic example was that of New Zealand, which scrapped most farm support in 1984. A study of the environmental effects, conducted in 1993, found that the end of fertiliser subsidies had been followed by a fall in fertiliser use (a fall compounded by the decline in world commodity prices, which cut farm incomes). The removal of subsidies also stopped land-clearing and over-stocking, which in the past had been the principal causes of erosion. Farms began to diversify. The one kind of subsidy whose removal appeared to have been bad for the environment was the subsidy to manage soil erosion.

In less enlightened countries, and in the European Union, the trend has been to reduce rather than eliminate subsidies, and to introduce new payments to encourage farmers to treat their land in environmentally friendlier ways, or to leave it fallow. It may sound strange but such payments need to be higher than the existing incentives for farmers to grow food crops. Farmers, however, dislike being paid to do nothing. In several countries they have become interested in the possibility of using fuel produced from crop residues either as a replacement for petrol (as ethanol) or as fuel for power stations (as biomass). Such fuels produce far less carbon dioxide than coal or oil, and absorb carbon dioxide as they grow. They are therefore less likely to contribute to the greenhouse effect. But they are rarely competitive with fossil fuels unless subsidised - and growing them does no less environmental harm than other crops.

In poor countries, governments aggravate other sorts of damage. Subsidies for pesticides and artificial fertilisers encourage farmers to use greater quantities than are needed to get the highest economic crop yield. A study by the International Rice Research Institute of pesticide use by farmers in South East Asia found that, with pest-resistant varieties of rice, even moderate applications of pesticide frequently cost farmers more than they saved. Such waste puts farmers on a chemical treadmill: bugs and weeds become resistant to poisons, so next year's poisons must be more lethal. One cost is to human health. Every year some 10,000 people die from pesticide poisoning, almost all of them in the developing countries, and another 400,000 become seriously ill. As for artificial fertilisers, their use world-wide increased by 40 per cent per unit of farmed land between the mid-1970s and late 1980s, mostly in the developing countries. Overuse of fertilisers may cause farmers to stop rotating crops or leaving their land fallow. That, in turn, may make soil erosion worse.

The probable effects of the new international trade agreement

A result of the Uruguay Round of world trade negotiations is likely to be a reduction of 36 per cent in the average levels of farm subsidies paid by the rich countries in 1986-1990. Some of the world's food production will move from Western Europe to regions where subsidies are lower or non-existent, such as the former communist countries and parts of the developing world. Some environmentalists worry about this outcome. It will undoubtedly mean more pressure to convert natural habitat into farmland. But it will also have many desirable environmental effects. The intensity of farming in the rich world should decline, and the use of chemical inputs will diminish. Crops are more likely to be grown in the environments to which they are naturally suited. And more farmers in poor countries will have the money and the incentive to manage their land in ways that are sustainable in the long run. That is important. To feed an increasingly hungry world, farmers need every incentive to use their soil and water effectively and efficiently.

Appendix B: German Text

Biologischer Zündstoff

Die moderne Zivilisation auf einen nachhaltigen Weg zu bringen, gleicht mehr und mehr dem Versuch, einen Deich zu halten, gegen den die Flut drückt. Hat man gerade noch mit bloßen Händen den einen Riss gestopft, tun sich daneben schon die nächsten auf. Der jüngste Fall: Pflanzen als Energiequelle der Zukunft. Vor zwei Jahren noch gepriesen, vergeht nun kaum ein Monat, in dem nicht Umwelt- und Entwicklungsorganisationen vor dramatischen Konsequenzen für Klima, Umwelt und Ernährungssicherheit warnen.

Energiegewinnung aus Pflanzen führt, so die Annahme, zu einer ausgeglichenen Kohlendioxid-Bilanz. Die Idee klingt bestechend: Anstatt fossile Energieträger wie Kohle und Erdöl zu verbrennen und damit zusätzliches Kohlendioxid in die Atmosphäre zu blasen, könnte man Energie und Kraftstoffe aus Pflanzen gewinnen. Die Lösung wäre klimaneutral, weil dabei nur das CO₂ freigesetzt wird, das die Pflanzen für ihr Wachstum zuvor der Atmosphäre entnommen haben. Anders als das endliche Erdöl wachsen Pflanzen nach. Und aus Bauern könnten "Energiewirte" werden, die eine neue Einkommensquelle erschließen. Eine Win-win-Situation – für Umwelt, Verkehr, Wirtschaft und Arbeit.

Die Verwendung von Nahrungspflanzen zur Energiegewinnung verknappt das Angebot an Nahrungsmitteln. Der erste Imageschaden kam mit der sogenannten "Tortilla-Krise". Weil die USA für ihre ehrgeizigen Bioethanol-Pläne mehr Mais benötigten, als sie selbst produzieren konnten, wurde in Mexiko dazugekauft – woraufhin dort die Preise anzogen und Tortillas aus Maismehl, die Grundlage der mexikanischen Küche, in kurzer Zeit immer teurer wurden. Aus Biokraftstoffen wurden "Agro-Kraftstoffe", landwirtschaftliche Erzeugnisse, die eigentlich auf den Teller gehören, aber im Tank landen.

Fachleute warnen im Zusammenhang mit dem Anbau von Energiepflanzen vor einer nicht wiedergutzumachenden Schädigung der Natur. Dazu kamen Berichte, in Malaysia oder Brasilien – das schon seit Jahrzehnten im großen Stil Bioethanol aus Zuckerrohr herstellt – weiche der ohnehin schon bedrohte Regenwald neuen Monokulturen aus Energiepflanzen. Einmalige Lebensräume der Erde, die eine schier unvorstellbare Vielfalt von Arten beherbergten, würden im Namen von Ökologie und Klimaschutz vernichtet. "Biokraftstoffe sind ein Angriff auf die Biodiversität", wettete die Umweltkoryphäe Ernst Ulrich von Weizsäcker.

Beim Anbau verschiedener Energiepflanzen entsteht ein Gas, das den Treibhauseffekt verstärkt. Für einen weiteren Kratzer im Lack sorgte jetzt die Wissenschaft. Der niederländische Chemie-Nobelpreisträger Paul Crutzen hatte mit Kollegen die Emissionen von Lachgas (N₂O) untersucht, die durch den Einsatz von Kunstdünger auf Biospriffeldern entstehen. Lachgas ist fast 300-mal treibhauswirksamer als CO₂. Ergebnis: Die Treibhauswirksamkeit von Biodiesel aus Raps sei 70 Prozent größer als die von fossilem Diesel, bei Mais seien es 50 Prozent. Nur Zuckerrohr schneide besser ab. Die Studie ist zwar umstritten; Kritiker werfen Crutzen vor, von veralteten Düngemethoden und Rapsorten ausgegangen zu sein. Doch nun befand auch eine OECD-Studie, die USA, Kanada und

die EU könnten ihre verkehrsbedingten Treibhausgasemissionen bis 2015 mittels Biosprit nur um 0,8 Prozent senken.

In der Nutzung von Pflanzen, die nicht der Nahrung dienen, sieht man die grösste Chance für die Bioenergie. Einen Ausweg könnte das Verfahren "Biomass to Liquid" (BTL) bieten. Bei diesem Verfahren gelingt es, Biomasse in Gas zu verwandeln und dessen Moleküle dann in die des gewünschten Kraftstoffs. So entsteht etwa synthetischer Diesel, der dieselben Eigenschaften wie Diesel aus Erdöl hat. Weil anders als bei Biodiesel oder Pflanzenöl keine Nahrungspflanzen benötigt werden, spricht man von "Biokraftstoffen der zweiten Generation". BTL verwertet vor allem Holz, Stroh und andere Biomasse. Das verwendete Holz kommt zum Teil als sogenanntes Restholz aus dem Wald oder wird von schnell wachsenden Bäumen wie beispielsweise Pappeln gewonnen. Bei diesem BTL-Kraftstoff fallen laut einer Schweizer Studie 40 bis 60 Prozent weniger Treibhausgase an als bei fossilem Diesel; wird Waldrestholz verwendet, ist die Bilanz noch günstiger.

Für die Herstellung von ausreichend synthetischem Flugbenzin benötigt man eine riesige Anbaufläche. Gerade für die Luftfahrt wäre der BTL-Kraftstoff eine Alternative, da herkömmliche Biokraftstoffe in Flughöhen mit Temperaturen um minus 50 Grad zähflüssig werden. Das BTL-Verfahren ermöglichte aber synthetisches Kerosin mit den gleichen Eigenschaften wie das bisherige herzustellen. Um damit den weltweiten Flugverkehr im heutigen Umfang aufrechtzuerhalten, wäre allerdings eine Fläche für den Holzanbau von 120 Millionen Hektar nötig, dreimal größer als Deutschland. Deshalb setzen Flugzeughersteller wie Boeing auf Kerosin aus Algen, die neuerdings als Klimaretter und unerschöpfliche Energiequelle gepriesen werden.

Ein begrenzter Anbau von Energiepflanzen kann zu einer teilweisen Eigenständigkeit in der Energieversorgung führen. Eine Patentlösung für Bioenergie aus Pflanzen gibt es nicht. Was in Europa ökologisch machbar ist, kann sich anderswo als fatal erweisen. Wenn etwa in Afrika Energiepflanzen für den Export in großen Monokulturen angebaut werden sollen, verknappt dies weiter das Trinkwasser auf einem ohnehin trockenen Kontinent. Sogar eine genügsame und nicht essbare Pflanze wie die Jatropha, die seit Kurzem als Energiepflanze für südliche Breiten Schlagzeilen macht, wird zum Problem, wenn internationale Konzerne sie plötzlich im großen Stil auf fruchtbarem Ackerland anbauen wollen. Richtig genutzt könnte Jatropha aber als regionaler Energielieferant die Abhängigkeit von Ölimporten lindern. Außerdem verbessert sie in ausgelaugten Böden nach einigen Jahren den Wasserhaushalt.

Appendix C: Informed Consent Form

Study name: Going Beyond the Text: Reading for Academic Tasks in a First and Second Language

Researcher: Angela Meyer Sterzik; PhD Candidate, Department of Languages, Literatures, and Linguistics, S561 Ross
York University, 4700 Keele Street, Toronto, Ontario, Canada, M3J 1P3

Purpose of the research: The purpose of this study is to investigate the cognitive processes of undergraduate students while reading academic texts for academic tasks in both their first and second languages. The study will provide a clearer understanding of how students read expository texts for academic tasks. The findings will be detailed in my dissertation and disseminated in conference presentations and journal publications for language teachers and academics.

What you will be asked to do in the research: You are asked to consent to read texts in German and English and to complete a short written task for each one while being audio recorded. The time commitment is expected to be approximately 5 hours over three sessions over one semester. The first session will be 1.5 hours in which you will complete a German language reading comprehension assessment. The remaining 3.5 hours will be divided into 2 sessions of approximately 1.75 hours each.

Risks and discomforts: We do not anticipate any risks or discomfort from your participation in the research. However, I recognize that being audio recorded can cause nervousness, and assessment of your academic work is private. Thus, anonymity will be maintained through the random assignment of participant numbers in lieu of names.

Benefits of the research and benefits to you: The potential benefits of the study are that they will increase our knowledge of how people read in academic contexts and similarities and/or differences between first and second language reading. This may positively influence the teaching and assessment of reading in a second language which will benefit you as both a student and a second language user who may need to demonstrate proficiency for future professional goals. As a thank you for your participation, you will be given a free, one-hour English tutoring session given by the researcher.

Voluntary participation: Your participation in this research is completely voluntary. You may stop participating in the study at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researcher, York University, or any other group associated with this project, and will not affect your invitation to the workshop. In the event that you withdraw from the study, all associated data collected will be immediately destroyed wherever possible.

Confidentiality: All information you supply during the research will be held in confidence, and no identifying information will appear in any report or publication of the research. The data will be collected through hand written notes, digital voice recordings, and your written work. Your data will be stored in a locked facility accessible only by me. The voice recordings will be kept for a period of two years after the research is completed and will then be deleted. Written transcripts of the recordings will be kept in my password protected personal archive. Confidentiality will be provided to the fullest extent possible by law.

Questions about the research? If you have any questions about this research or about your role in the study, please feel free to contact me or my Graduate Supervisor, Prof. Dr. Carol Fraser, either by phone or by email. You may also contact my Graduate Program, Linguistics and Applied Linguistics, S567 Ross. This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University’s Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, you may contact the Senior Manager and Policy Advisor for the Office of Research Ethics, 5th Floor, York Research Tower, York University.

Legal Rights and Signatures:

I _____ consent to participate in “Going Beyond the Text: Reading for Academic Tasks in a First and Second Language” conducted by Angela Meyer Sterzik. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature _____
Participant: name

Date _____

Signature _____
Principal Investigator: name

Date _____

Appendix D: Summary Task Instructions

Read the article on the environment that follows so you can write a summary that is approximately 250 words in the same language that it is written.

- Report only the main ideas and major points from the text.
- Do not include your opinions or thoughts of the article.

As you read, please THINK ALOUD, **THAT IS VERBALIZE WHAT YOU ARE THINKING**, in **German, English** or A COMBINATION OF BOTH. Read and mark the text as you normally do.

- You may make short notes and/or highlight/underline portions of the text.
- You may refer back to the text when writing the summary.

Please note, while I am Interested in what you note/underline, I am more interested in WHAT YOU ARE THINKING AS YOU UNDERLINE/MAKE NOTES.

Questions?

Please turn the page to begin when you are ready.

Appendix E: Position-paper task Instructions

Read the article on the environment that follows so you can write a short essay (approximately 400 words) in which you take a position on the major theme presented by the text. Your essay should

- Be written in the same language as the text
- Include information from the text
- Explain why you agree or disagree using support from your personal knowledge and/or experiences.
- Introduction and conclusion paragraphs are not required

As you read, please **THINK ALOUD, THAT IS VERBALIZE WHAT YOU ARE THINKING**, in **German, English** or A COMBINATION OF BOTH. Read and mark the text as you normally do.

- You may make short notes and/or highlight/underline portions of the text.
- You may refer back to the text when writing the essay.
- Spelling and grammar will not be graded.

Please note, while I am Interested in what you note/underline, I am more interested in WHAT YOU ARE THINKING AS YOU UNDERLINE/MAKE NOTES.

Please turn the page to begin when you are ready.

Appendix F: Think Aloud Instructions and Practice

In this experiment, I am interested in what you are thinking as you read the articles to complete the task. In order to find out what you are thinking, I am asking you to THINK ALOUD as you read.

What I mean by THINK ALOUD is I want you to say everything that you think to yourself as you are reading. Just act as if you are in a room alone and talking to yourself. You may THINK ALOUD in German, English, or both.

Practice: As you complete the math problems below, THINK ALOUD. It does not matter if you get the correct answer because I am only interested in what you are thinking. You may THINK ALOUD in German, English, or both.

1. $2+5+63-9$

2. $2(X) + 10 = 18$

3. Angela wants to travel to Asia next summer. She needs to save \$3575. She earns \$12.50 per hour. How many hours does she need to work to save the money for the trip?

Do you have any questions before we begin?