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A close observation of second language (L2) readers and texts : meaning representation and construction through cohesion

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A CLOSE OBSERVATION OF SECOND LANGUAGE (L2) READERS AND TEXTS: MEANING REPRESENTATION AND CONSTRUCTION THROUGH COHESION

by

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To my family

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ABSTRACT

A critical aspect of the non-native students' academic adjustment in English-speaking countries is their English language ability, including their reading fluency and comprehension. Even when these students are considered proficient readers of English at an advanced level, they display different reading processes when dealing with the complex input of a second language (L2) text, as compared with their native English reading classmates. Despite the importance of comprehending highly sophisticated academic reading in international education, there is a lack of research in the field as to how advanced L2 readers cope with the texts with which the highly educated native speakers engage. This study, therefore, examined meaning construction processes of highly proficient L2 readers during reading the texts that vary in degree of cohesion. To describe readers' approaches to text cohesion and also recognize readers' perceptions of their own process, the study used a close observation of the reading processes of nine highly proficient graduate students at a U.S. university with the use of qualitative research methods. The students participated in two interviews - pre-reading interview and post-reading cognitive interview - and two think-aloud verbal protocol sessions. Participants read one high-cohesive and one low-cohesive text during the think-aloud sessions, and then shared the meaning they constructed from the texts and also their thinking about the texts. The data from the instruments were analyzed qualitatively using a grounded theory approach. The results of the study reveal that the readers' meaning representation processes emerging as the result of reader and text interaction display differences at the local and global levels of processing of the high- and low-cohesive text. The processing differences between the readers are most apparent in texts with low text cohesion. The low cohesive text allowed the readers, especially, the creators of meaning, to conduct more elaborative processing compared to their performance with the high-cohesive one, in which all readers attempted to create a catalogue of facts trusting the explicitly provided text cohesion features. These results have implications for theories of

text processing as well as the design of materials and instruction used for advanced L2 readers and lower level L2 readers.

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CHAPTER I

INTRODUCTION

The number of non-native English speaking college students is growing rapidly in English-speaking countries. For example, at the University of Iowa (a public university in the United States) international students comprise 12.1 percent of the Class of 2016 (http://www.uiowa.edu/facts/enrollment/index.htm). The critical aspect of these non-native students' academic adjustment is their English language ability, including their reading fluency and comprehension (Mokhtari & Reichard, 2004). Even when these students are considered to be proficient readers of English at an advanced level, they display different reading processes when dealing with the complex input of a second language (L2) text (Horiba, 2000), when compared to their native English-reading classmates. While some similarities to native readers exist, these similarities do not equate complete ease in reading texts. Despite the importance of comprehending highly sophisticated academic reading in international education, there is a lack of research in the field as to how advanced L2 readers cope with the texts that the highly educated native speakers engage with (Bernhardt, 2011), specifically how they approach the texts and what knowledge sources[1] they use. It is, therefore, necessary to examine the reading processes of advanced readers to fill this gap in the field. An in-depth knowledge of the reading processes of highly proficient readers might add new dimensions to the design of meaningful materials for advanced readers, which will increase non-native students' successful comprehension of the texts and lead to further success in academic settings. This knowledge might also bring us to a better understanding of what lower level L2 readers must do in order to become highly proficient when reading second language texts.

[1] See Appendix A for the definitions of key terms used throughout the dissertation.

Reading researchers agree that understanding a text is the result of numerous complex processes at different L2 proficiency levels (Bernhardt, 2011; Kintsch, 1998; Koda, 2005). One important process, which is the focus of the proposed study, is the reader's construction of the meaning of a text on the basis of its coherence relations (Horiba, 2000; Kintsch, 1998). This meaning representation is critical for successful reading comprehension. With this particular focus in mind along with the applied goal mentioned at the beginning of this section, this study attempted to describe how highly proficient L2 graduate students studying at a state university in the US construct meanings from texts that vary in degree of cohesion. It also sought answers to how and to what degree they benefit from discourse features contributing to text cohesion while constructing meaning from these texts. To describe readers' approaches to text cohesion and also recognize their perceptions of their own process, close observation of the reading process was achieved in this study through the use of qualitative research methods such as think-aloud protocols and interviews.

Background

The complex reading process that leads to a reader's meaning construction from a text has been characterized primarily as "psychological, cognitive and individual" (Wallace, 2003, p. 7), which means that readers must employ a complex integration of a variety of cognitive, linguistic and non-linguistic skills to be proficient and skilled readers (Nassaji, 2003). Current theories of L1 text comprehension describe reading as an interaction between the reader's text-based and knowledge-based processes, both of which involve multilevel representations of a text and its content (e.g., Kintsch, 1998). Most of the current L2 reading comprehension models are also interactive, in that L2 comprehension is considered to be a process consisting of both data-driven and concept-driven processes (e.g., Bernhardt, 2011, 1991; Carrell, Devine & Eskey, 1988; Grabe, 1991; Koda, 2005). Both the text itself (e.g., text coherence, discourse type, genre) and

the reader (background knowledge, reader skills and language proficiency) have a part to play in this process (Alderson, 2000, Koda, 2005).

Explanation of the processes which lead to understanding a text entails "a profound understanding of the cognitive processes in which knowledge is presented, processed, and used in comprehension" (Nassaji, 2003; p. 439). These processes (from recognizing letters to analyzing the syntactic and semantic structure of sentences, to generating inferences) must take place in an orchestrated manner in a discourse. The disruption of one process might influence the other dependent processes, thereby affecting the ongoing meaning construction of readers and the resulting representation of a text. This disruption is more likely to occur in L2 reading (Horiba, 1996) than in L1 reading. For example, when a particular word is unfamiliar to a reader, it cannot be integrated into a sentence as a whole, which causes further delay in connecting the sentence to a prior portion of the text.

In L2 reading, it is more likely that various processes involved in text comprehension may be disrupted because of the reader's inadequate language knowledge (Horiba, 1996; Nassaji, 2003). There is ample evidence in L2 reading research which demonstrates that limited efficiency of lower-level identification processes may cause a delay in processing higher-level syntactic and semantic information. It may also impede other text integration processes involved in the comprehension of connected L2 text (Koda, 2005; Nassaji, 2003). More proficient readers, due to the fact that they are more skilled, and have more efficient lower-level decoding skills (Koda, 2005), display better guessing and predicting ability than low-proficient readers. Such abilities are necessary for recognizing appropriate and essential textual cues (recognition of lexical, syntactic and semantic patterns of a language) in a text (Bernhardt, 1991; Carrell, 1988). In other words, information integration and conceptual manipulations is far more involved in the reading behaviors of high-proficiency learners (Bernhardt, 1991; 2011; Grabe, 2009).

Despite the conviction that general L2 proficiency is a vital prerequisite, L2 reading is a complex construct not just limited to the ability to understand words or sentences. It also requires semantic processing skills for the integration of lexical and contextual information in order to construct a coherent representation of the text (Graesser, Millis, & Zwaan, 1997). Knowledge of discourse features, including text coherence and cohesion, are important parts of this processing system (Bernhardt, 1991; Koda, 2005). Thus, it is important to understand how L2 readers who have different proficiency levels and varied knowledge bases, use these features while processing the texts.

Discourse process and its features

When explaining how text information is represented in memory, some reading researchers – especially mental model theorists - (Kintsch, 1988; 1998; Tapiero, 2000; 2007; van Dijk & Kintsch, 1983; Zwaan, Langston & Graesser, 1995) have focused on discourse processing. Mental model theorists accept that comprehension is an incremental process, involving the integration of information from different parts of a text. The construction of text meaning requires a synthesis of explicitly stated text information as well as relevant knowledge stored in long-term memory. According to these theorists, successful comprehension of a text requires building a coherent representation of the situation evoked in the text. These researchers investigated comprehension by using the explanatory power of activation and inhibition, assuming both played a part in the establishment of coherence when readers were processing a text. In particular, although activation was seen as a mandatory phase when readers process any kind of text information (e.g. text units ranging from words to texts), inhibition was assumed to occur only when a reader was faced with irrelevant information or inconsistencies (Kintsch, 1998). However, “no clear interpretation of how readers maintain coherence and presumably eliminate irrelevant meanings from their

representation has been proposed, and there is still no consensus on the exact features that define the cognitive mechanisms at play in this situation" (Tapiero, 2007, p. 86). This indicates further research is necessary to understand how coherence is tied to the underlying processes readers carry out when they read texts. In this study, my goal was to describe second language (L2) readers' processing of texts with varying degrees of cohesion. Thus, it is of importance here to describe two important discourse features, text coherence and cohesion and some of the empirical studies (L1 and L2) that have found evidence on the effect of text coherence on meaning construction process.

Text, discourse, and meaning

As stated in the previous section, discourse cannot be entirely reduced to sentences and utterances. Discourse has context, cohesion, coherence, and rhetorical structure that weaves together and transcends the sentences in a text (Graesser, Gernsbacher & Goldman, 2003). In their books discussing text, context and meaning, Halliday and Hasan (1985) also defined reading text as a "unified semantic unit" (p. 11), which means that the ideas in the text are interrelated coherently to convey a message to a reader (Meyer & Rice, 1984). Readers construct a mental model of a text by using the logical flow of these interrelated ideas (Carrell, 1982; Graesser et al., 2004) (See Appendix A for the definition of mental model as representation of text). The interrelated ideas in a text are constructed with discourse features such as cohesive devices and this construction leads to text coherence.

In his description of the "comprehension" process, Kintsch (1988; 1998) also emphasizes the importance of the meaning the text conveys in the meaning construction process rather than the single words (Kintsch, 1988; 1998). During the meaning construction phase, as readers process the first word of a text, information provided by that word activates several possible meanings. The activation level of these different meanings varies with the lexical, syntactic and semantic context. According to Kintsch,

the reader first constructs a coherent text-base (textual propositions) that corresponds to the meaning of the text. The textual propositions are related, for example, by the criterion of casual relations between the states of affairs described in a text. The reader is thought to build a casual path between the initial and final states of the text, with events and actions that describe the successive transitions between the states. In short, the process of understanding text involves a complex chain of cognitive activities, starting with access to word meanings and ending with a fully integrated representation. In this process, readers are expected to understand relationships among text elements which are signaled both explicitly and implicitly through coherence and cohesion in a text (Koda, 2005).

Text coherence and cohesion

Understanding these two important features of discourse, coherence and cohesion, is important for a better understanding of the purpose of this study, as it specifically focuses on the use of text cohesion during meaning representation and the construction process. Generally spoken, cohesion is used to refer to the surface indicators of relations between sentences in a text (Graesser et al., 2004), which contain semantic meaning relations. It is the set of possibilities in the language that allow for the text to hang together (Halliday & Hasan, 1976). Coherence, when separated from cohesion, implies that a long stretch of language is semantically and meaningfully connected. Coherence has been approached from different perspectives by different researchers. Some researchers view coherence as a linguistic, text-based entity, some others regard it as non-linguistic, that is, reader-based. Halliday and Hasan as the first scholars to elaborate on cohesion (1976) defined coherence as the logical flow of ideas, a connectivity of the surface text evidenced by the presence of cohesive devices. Coherence has also been defined as the means by which readers construct a mental model of a text (Carrell, 1982; Graesser et al., 2004). According to Graesser and his colleagues (Graesser, McNamara & Louwerse, 2003), the coherence of a text is defined by the interaction between linguistic

representations and knowledge representations. When you put the spotlight on the text, however, coherence can be defined as characteristics of the text (i.e. aspects of cohesion) that are likely to contribute to the coherence of the mental representation.

In the meaning representation process, the continuity expressed by cohesion in a text is significant based on two aspects. On the one hand, continuity shows in the discourse the points of relations or contact with what has been said before. On the other hand, the continuity provided by the cohesion helps readers to fill in the gap in the discourse, and to supply all the components of the message, which are not present in the text but are important and necessary to its interpretation.

As stated in the definitions, especially the one provided by Halliday and Hasan (1976), coherence and cohesion are important discourse features that enable a text to function as a text. Therefore, analysis of these discourse features can illuminate important features of both the texts' and the readers' contributions to the reading and understanding process (Meyer, 2003). Since this study aimed to investigate how readers benefit from text coherence during the meaning representation process, the coherence of the text and the characteristics of the text that contribute to the coherence of the meaning representation (cohesion) were both considered in the design and analysis of the study. Previous reading research studies, including L2 reading, also present the analysis of discourse features, and the effect of text cohesion and coherence on comprehension.

Text coherence and comprehension

In both L1 and L2 settings, studies have been conducted on the interaction between different levels of meaning representation during comprehension, such as the effect of text cohesion on reading comprehension (O'Reilly & McNamara, 2007), the relationship between textual coherence and reading inferences (Horiba, 1996), and the interactions of text coherence and background knowledge (McNamara et al, 1996; 2001). Most of the L1 studies examined the relationship between text cohesion and inferencing

by specifically including reader's domain knowledge (McNamara et al., 1996; O'Reilly & McNamara, 2007). In their study which investigated the role of text coherence in the comprehension of science texts, McNamara and Kintsch (1996) found that readers who know little about the domain of the text benefit from a coherent text, whereas high-knowledge readers benefit from a minimally coherent text.

In this study and its subsequent follow-up conducted by McNamara (2001), these researchers named this differential process as the "*reverse cohesion effect".* According to the reverse cohesion effect, when there is a large overlap between the text and the reader's knowledge, high-knowledge readers fail to process the information at a deep level because they do not use their knowledge to help them develop a coherent text model (McNamara, 2001). Therefore, the challenge created by a low-cohesion text forces these readers to engage more with the text, and thus improves their comprehension. In their more recent studies, O'Reilly and McNamara (2007) examined whether students' comprehension skills affect the interaction between text cohesion and their domain knowledge. They found that the benefit of low-cohesion text was restricted to less skilled, high-knowledge readers, whereas skilled readers with high knowledge benefited from a high-cohesion text, which further refines our understanding of the reverse cohesion effect.

Important questions emerge from the results of the L1 studies on this topic, including: whether these patterns found in L1 reading are applicable in L2 reading and whether L2 readers at higher levels need to depend more on their inferencing skills to build meaning as they read. Do L2 readers need an easier, coherent text to achieve a better situational understanding, regardless of their status as advanced L2 readers?

Studies examining text cohesion and coherence and their effect on text comprehension are not only limited to L1 studies. A number of important L2 studies (Degand & Sanders, 2002, Horiba, 1996; Ozono & Ito, 2003) also examined the effect of text coherence or cohesive features on comprehension. Ozono and Ito (2003) researched

connectors in texts, finding that high-proficiency L2 readers were less dependent on explicit connectors than lower-proficiency readers. There have been studies (Horiba, 2000; Dagend & Sanders, 2002) also comparing the text processing performance of L1 and L2 readers' with varying degrees of cohesion. Dagend and Sanders (2002) conducted an experiment to test the impact of linguistic markers of relational coherence (connectives and signaling phrases) on the comprehension of expository discourse in both L1 and L2. The study showed that the presence of relational markers indeed affected the text representation that readers have constructed after reading. However, they found individual differences existing in the ability to use connective devices such as logical connectors. Although they found an overall effect of the language proficiency – participants performed better in L1 than in L2 – both L1 and L2 readers benefited from the presence of causal markers during reading. Horiba (2000) examined four groups of readers (L2 intermediate, L2 advanced, L1 Japanese, and L1 English) who processed and recalled two passages that varied in degree of causal coherence. Horiba found that L2 readers paid more attention to lower-level processes and did not process differently between high- and low-coherence texts. L2 advanced readers generated both backward and forward inferences during reading, whereas L2 intermediate readers did not.

Although the studies listed here have made interesting attempts to isolate particular features (e.g. connectives, causal coherence), by and large, they lacked discussion on how highly-proficient L2 readers are approaching texts that vary in degree of cohesion. Considering the results from both L1 and L2 studies, this present study examined ongoing reading processes of highly proficient L2 readers.

Purpose of the study

An established body of reading research suggests that skilled native readers take less time to build efficient comprehension when processing texts (Kintsch, 1998). As they are able to use basic construction processes more fluently, such as text-processing skills

and knowledge, they are left with more memory resources for higher-order comprehension and inferential processes (Nassaji, 2003). In addition to basic lexical and word-recognition skills, high proficiency L2 readers (e.g. international graduate students) are decidedly capable of using higher-level text processing information (e.g. the causal structure of the text) (Bernhardt, 2011; Nassaji, 2003). These L2 readers are exposed to high-level second language texts with native readers in academic classrooms and expected to interpret the information from these texts fluently and efficiently in order to succeed.

In my study, I argued that if highly proficient L2 readers have the ability to use both lower- and higher-level processing skills while reading through a text, then they can construct a coherent representation of a text. The question this study specifically investigated was which sources are beneficial in building this representation. With this question in mind, the study aimed to describe how highly proficient second language (L2) readers construct meanings from the texts that vary in degree of cohesion, and what discourse features they use while constructing meaning from these texts. The study specifically examined two aspects: (1) whether the level of text cohesion – low vs. high - makes a difference in the readers' meaning construction, and (2) how and to what degree readers benefit from textual features contributing to text cohesion. On the basis of this main purpose, I examined the following four questions:

RQ#1: How do highly proficient L2 readers approach text cohesion and use discourse features that contribute to cohesion while processing texts written in their second language, English?

1.1 How do they construct meaning representations in low-cohesive and high-cohesive texts?

1.2 What discourse features do they use while building meaning representations from reading low-cohesive and high-cohesive texts?

RQ#2: How do these readers perceive text cohesion and its effect on their own meaning representation and construction process?

To address these questions, this study employed close observation of the reading process with the use of qualitative research methods such as think-aloud protocols, semi-structured interview, and cognitive interviewing. Previous research has compared readers across different proficiency levels using experimental procedures, with the exception one study (Horiba, 1996), which collected both quantitative and qualitative data. These studies have examined the readers' memory of a text with recall or comprehension question responses but have not attempted to illuminate the comprehension process itself. This present study aimed to fill this gap by examining the meaning construction process during reading rather than assessing the end product.

Significance of the study

This study sought to enhance the field of second language education and the second language reading in two ways: (1) investigate how and to what degree advanced second language (L2) readers benefit from text cohesion, bringing new implications for theories of text processing and further insights in L2 reading comprehension, and (2) provide a detailed description of highly proficient readers' reading processes to illuminate new dimensions to the design of meaningful materials and instruction used for advanced L2 readers. My hope was that these implications would increase non-native students' successful comprehension of the texts and lead to greater success in academic settings for these students.

CHAPTER II

REVIEW OF LITERATURE

Since this study intends to determine meaning construction processes of highly proficient second language (L2) readers, this chapter will start with a description of a broad view of L2 reading and reading comprehension process. Following the broad view of L2 reading, discourse processing and its features, including coherence and cohesion and how they affect reading comprehension will be discussed, thus narrowing the focus to the specific areas of concern to this study. Particular attention will be paid to relevant research dealing with the influence of two discourse features, coherence and cohesion, on text comprehension. Each section will conclude with unanswered questions in order to emphasize the significance of the proposed research questions.

Reading and reading comprehension process

Since researchers began to speculate a theory of reading, several different definitions of *reading* and *reading process* have been proposed. For example, using a psychological framework, Goodman (1973) proposed that reading is a selective process, which means that it is not solely a process of extracting information from the page in a letter-by-letter, word-by-word manner. According to him, good readers use knowledge they bring to reading and then read by predicting information, sampling the text, and confirming their predictions. According to Bernhardt (2011), this is a classic depiction of "top-down" reading process– reading becomes more conceptually driven as fluency develops (p. 23). Some second language (L2) researchers rehearsed most of the L1 theories in their work especially Goodman's recognition of the uniqueness of the second language phenomenon (Grabe, 2009; Hudson, 2007). For example, Clarke and Silberstein (1977) characterized reading as an active process of comprehending and claimed that students needed to be taught strategies to read more efficiently (e.g. guess from context, define expectations, make inferences about the text). Coady (1979) who reinterpreted

Goodman's psycholinguistic model into a model suited to L2 learners argued that a conceptualization of the reading process requires three components: process strategies, background knowledge, and conceptual abilities. When the three sets of sources interacted, the result was comprehension. Coady argued that process strategies ranging from concrete strategies such as word identification to contextual and lexical meaning change in proportion to each other as proficiency increased. Grabe (2009) defined reading by addressing the characteristics of fluent reading; thus, reading is a combination of different processes that can be referred to as functional components of reading or the "what" of reading. Reading is a rapid, efficient, comprehending, interactive, strategic, flexible, purposeful, evaluative, learning, and linguistics process. Although there are differences of opinion about the nature of reading among researchers as seen in the examples, there is a broad base of agreement among researchers that "reading is about constructing meaning from the text" (Pressley, 2006, p. 59) and a complex process requiring the use of different, integrated processes.

Models of Reading Comprehension

Current theories of L1 text comprehension view reading as an interaction between the reader's text-based and knowledge-based processes, both of which involve multilevel representations of a text and its content (e.g. Kintsch, 1998). Reading researchers who defined reading process as a multidimensional view (Kintsch 1998, van Dijk, 1979) assume that it is necessary to look into the information provided simultaneously from several knowledge sources (e.g. featural, graphic, phonemic, syntactic, orthographic, lexical, semantic). Most of the current models of L2 reading are also interactive in that L2 comprehension is considered to be a process consisting of both data-driven and reader-driven processes (e.g. Bernhardt, 2011, 1991; Carrell, Devine & Eskey, 1988; Grabe, 1991). The reader reconstructs the text information based in part on the

knowledge drawn from the text and in part from the prior knowledge available to the reader.

In both L1 and L2 text comprehension models (Bernhardt, 2011; Kintsch, 1998), there are several processes appear to be interacting (e.g. cognitive and knowledge-based) when the reader goes through a text. Actually, any attempt to explain the processes whereby a text is understood has a fundamental assumption that text comprehension is an instance of complex information processing, and therefore complies with general principles of cognition and requires " a profound understanding of the cognitive processes" (Nassaji, 2007; p. 79). Grabe (2009) points out that "in order to understand reading better, we also need to know how we read" (p. 16). The "how" part of reading is determined by a set of cognitive processes: lower-level processes and higher-level processes. The former includes word recognition, syntactic parsing, and meaning encoding as propositions wherein working memory is the "locus of this processing activity" (p. 21). Higher-level processes include building a text-model of reader comprehension, a situation model of reader interpretation, and "a set of reading skills and resources under the command of the executive control in working memory" (p. 39) (e.g., strategies, goals, inferences, background knowledge, comprehension monitoring). Grabe differentiates between the models of reading, the terms "text model" and situation model" on the one hand, and "metaphorical models" on the other (p. 83). Text model and situation model refer to discourse comprehension networks, whereas, metaphorical models refer to top-down, bottom-up, and interactive models of reading. Grabe states that "because of the danger of overgeneralizations and simplifications, many current discussions of reading present research in terms of more specific models of reading" (p. 90) including the Interactive Compensatory Model, and the Construction Integration Model.

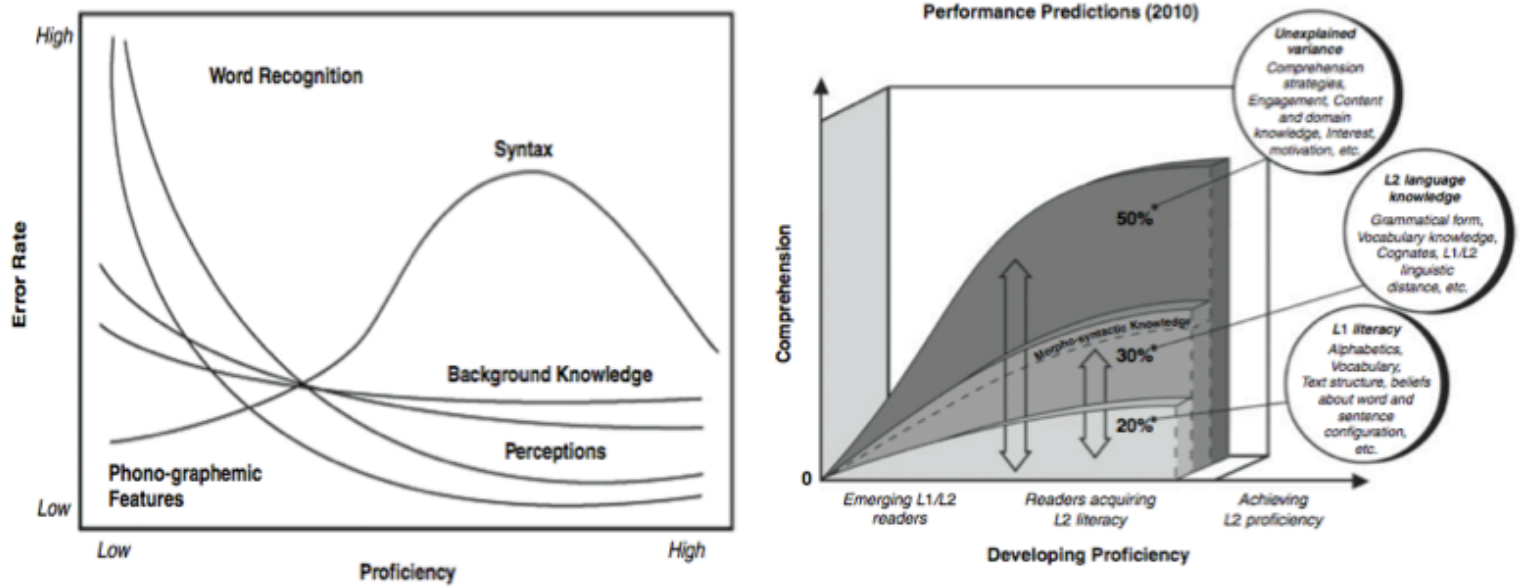
As a specific example, in her models of second language (L2) reading, Bernhardt (1986; 1991; 2005; 2010) lists the elements working simultaneously in the process of L2

reading as - phonemic/graphemic features, prior knowledge, metacognition, syntactic feature recognition, and intratextual perceptions (see Figure 2-1 for the content of Bernhardt's compensatory model of second language reading and its development).

All of her models, and especially the "Compensatory Model of Second Language Reading," demonstrate that there is an interaction between the complex text and the reader. The notion of an active reader, one who is engaged in a "top-down fashion" and who brings significant background to the reading process is integrated with notions of *text complexity*.

In this model, Bernhardt (2005, 2010) categorizes reader behaviors over texts (expository and narrative), languages and time spent learning. As readers develop their reading proficiency, they seem to experience a rapid growth in vocabulary and word recognition. However, she posits that background knowledge does not follow levels of proficiency but is, rather, "a variable linked to personal idiosyncrasy" (p. 30). In other words, readers sometimes use background knowledge and sometimes do not. Bernhardt's model does not only give information about the L2 reading process, but also explains the relation between reading development and language proficiency, which is helpful in understanding the reading process of advanced L2 readers, the target group of this present study.

Figure 2-1 Bernhardt's compensatory model of second language reading and its development



A theoretical distribution of factors involved in second language reading (1991) (left) - A compensatory model of second language reading (revised) (2010) (right)

Comprehension skill and language proficiency

As stated in the interactive model, the information processing system in reading consists of different levels of processing ranging from recognizing letters to analyzing the syntactic and semantic structure of sentences, to generating inferences. These processes work independently of one another and operate in a parallel manner (Grabe, 1991, Horiba, 1996, Nassaji, 2003). The disruption of one process might influence the other dependent processes and ultimately affect the ongoing meaning construction of readers and the resulting representation of a text. Cognitivist reading researchers who believe that efficient lower-level processes are important components of fluent reading state that readers who are deficient at processing lower-level textual information rather than at using higher-level conceptually-driven data are less skilled. Similar views have also been shared in the context of L2 reading (Bernhardt, 1991, Grabe, 1991, Koda, 2005; Segalowitz, 2000). L2 reading researchers noted that L2 reading is a complex cognitive processing skill, the learning of which includes developing an adequate knowledge of the rules governing lower-level processing, as well as developing a complex set of processing skills for comprehension.

In L2 reading, the contribution of language proficiency to comprehension of L2 texts is important because, as Koda pointed out (2005), the delay caused by the limited efficiency of lower-level identification processes may negatively influence the effectiveness of higher-level semantic and syntactic analyses. It slows down the readers' reading pace in order to allow them to process the input they receive from the text and to process it within the limits of the attentional resources available to them. L2 text processing studies (Horiba, 1996; 2000; Taillefer, 1996) similarly suggest that limited language proficiency leads to inefficient processing of the text. These studies have shown that L2 readers drew heavily on their linguistic ability to extract meaning from various L2 texts, initially parsing text into smaller units such as words, phrases, and clauses, based

on lexical and syntactic information available, and then incrementally integrating them into the larger discourse context. Even when the learners became more proficient, reliance on textual and linguistic processes did not decrease (Taillefer, 1996), but more proficient readers had the ability to shift attention to more abstract, conceptual ideas and make better use of background knowledge, using only as much textual information as needed for confirming and predicting the information in the text.

To conclude, L2 reading literature clearly shows that L2 readers need different processing skills (both lower-level and higher-level processing skills) to construct meaning from texts. In addition to word meaning recognition and syntactical knowledge, they need semantic processing to integrate lexical and contextual information. They need to integrate processing skills (making connections between ideas in the text and between the text and their background knowledge) to construct a coherent representation of the text. Knowledge of discourse features, including text coherence and cohesion are, therefore, an important part of the reader's processing system (Bernhardt, 1991; Koda, 2005).

L2 reading research, giving primary importance to language proficiency, has largely defined readers' processes at a specific language level or across levels. However, given the complexity of the reading process, further studies are needed to investigate L2 readers and their development at different proficiency levels. Specifically, more studies are needed of component, high proficient readers (Bernhardt, 2011; Nassaji, 2003), who are exposed to upper-register texts either in the same classes as native speakers or, at least text written with a native speaker audience in mind. To demonstrate this deficiency, discourse features and the relevant studies focusing on the features of text coherence and cohesion will be discussed further in the rest of the chapter.

Discourse processes: Meaning construction during reading

Since discourse process, which includes the reader, text and the context, influences the meaning construction processes of readers during reading, general assumptions of discourse process and representation that underlie this research are presented in this section. This discussion includes some basic ideas from the models of text comprehension - specifically mental model theories - which provide important information for the development of research questions of the present study. Later, important aspects of discourse features - text, text cohesion and coherence, which construct the discourse process, will be explained.

To explain how text information is represented in memory, some reading researchers (Anderson, 1983; Kintsch, 1988; Kintsch & Rawson, 2005; van Dijk & Kintsch, 1983) focused on mental-model theories. These researchers who focus on the constructive nature of overall language processing basically accept that comprehension is an incremental process, involving the integration of information from different parts of a text. The construction of text meaning requires a synthesis of explicitly stated text information as well as relevant knowledge retrieved from long-term memory. Actually, the basic assumption at the root of mental model theories is that what is formed in the reader's mind during comprehension transcends the literal meaning of the explicit text statements, encapsulating real world situations as the reader perceives them (Koda, 2005). Kintsch's Construction-Integration (CI) model (1988; 1998) will be discussed as a sample model in this section. This model is expected to facilitate not only the understanding of how the constructive nature of text comprehension is explicated in discourse processing theories, but also the understanding of targeted participants' meaning construction process during the analysis of collected data. Another reason to select this model is that most of the relevant studies (e.g. McNamara et al., 1996; O'Reilly & McNamara, 2007) discussed in this chapter are based on Kintsch's model.

Knowledge representation leading to meaning construction

The present study examines the meaning representation and construction of L2 readers from the low- and high-cohesive texts. Therefore, before explaining Kintsch's model, this section briefly describes how knowledge is represented in the mind and how these representations lead to readers' meaning construction.

As Nassaji (2007) stated in his article, the issue of how knowledge is represented in the mind is "a theoretically vexing question" (p. 82). The discussion of mental representation has been influenced "not only by competing and at times radically different theoretical positions but also by different epistemological and philosophical beliefs." Nassaji discusses five processes to underlie how knowledge is represented in the mind from a schema-theoretic perspective: selection, abstraction, interpretation, integration, and re-construction. Mental representations are *formed selectively*; that is; of all the information is a given situation, only that part of the information that is related to the schema is selected for the purpose of representation. Mental representations are *abstractive* in that of all the information present, only its semantic components are extracted to be encoded in memory, not its surface components. Interpretation of new information is based on the schema currently activated. Individual pieces of information cannot exist in the mind on their own either; they have to be "integrated into an organized and coherent global representation" (p. 82). Then, readers use this knowledge represented in the mind in comprehension.

In comprehension process, readers map the information from the text onto the preexisting knowledge structures. Although this basic explanation shows how knowledge is utilized in comprehension, there is still no non-problematic, clear description about how exactly knowledge is represented in the mind and how it is used in comprehension (Nassaji, 2007). It is important to note that none of the current models of L2 reading comprehension, which consider L2 reading comprehension an interactive process, specify how the interaction between the different knowledge sources takes place. Several studies

have been conducted to test the readers' reading performance and the processes of working memory during meaning construction mostly using recall protocols. However, these studies did not assess readers' elaborations and inferences about the text, which could have provided different results (Nassaji, 2007). Therefore, it is important to conduct further studies to investigate how textual properties affect readers' mental representations of texts.

L2 studies have been conducted to provide evidence for the validity of the application of Kintsch's Construction-Integration model in L2 reading (Alptekin & Ercetin, 2011; Horiba, 1996; Horiba, 2000; Zwaan & Brown, 1996). These studies provide the evidence that comprehension and recall depend on the efficacy of the text-base and the encoding of the properties of texts. Some of these studies (e.g., Horiba, 2000) however, provide support for the idea that comprehension is a process of creating a text-base that includes the textual and rhetorical features as well as a knowledge-based interpretation of the text. Based on the analysis of relevant studies on his article, Nassaji (2007) suggests that previous studies have three implications for further L2 reading research and theory focusing on mental representation and meaning construction process (p. 101): (1) it is necessary to distinguish between different levels of meaning representations in L2 reading comprehension and study these levels with reference to the different procedures involved in generating them, (2) different knowledge sources, linguistic or conceptual, may involve different processes, which may have qualitatively differential effects on different levels of representation in text comprehension; and (3) knowledge in terms of explicit awareness may not be required for text processing. In the present study, it was assumed that Kintsch's Construction Integration (CI) model, which is helpful in understanding the construction-integration view of L2 reading, might provide insights into understanding mental representations of readers from low- and high-cohesive texts. The following section provides a short description of Kintsch's model.

Kintsch's Construction-Integration Model

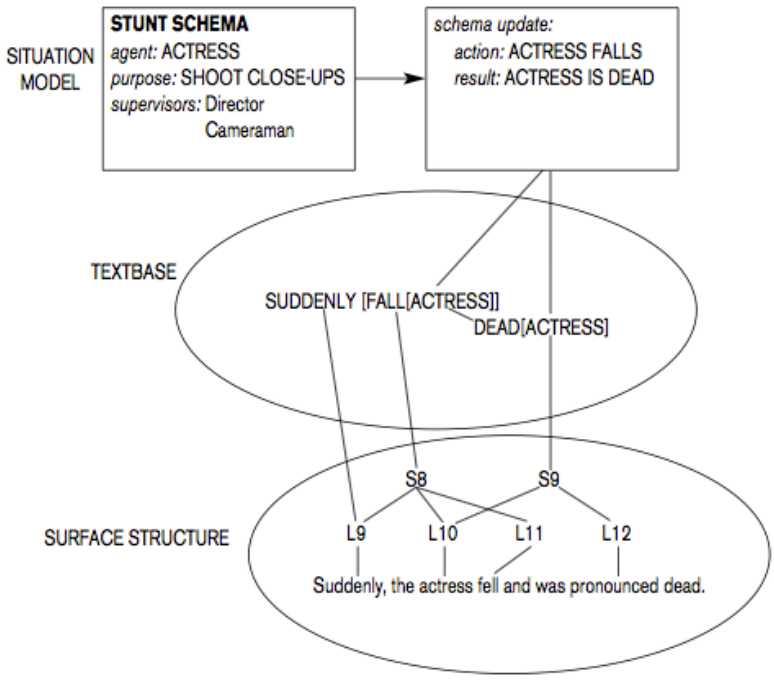
As in the theories of discourse comprehension, Kintsch's model (1998) also assumes that text information is represented in multiple levels, including surface linguistic forms, meaning-based propositional networks and conceptually-driven situation models. Each proposition, as the smallest semantic unit in the text, contains a relational term, or predicate, and one or more arguments, in the form of either concepts or other propositions. In the Kintsch model, there are two levels of text-structure - microstructure and macrostructure. The propositions generated in the text are linked together and become interconnected with both their previous and subsequent propositions, representing the local meaning relationships (or the "microstructure), and with higher-level concepts in the network, representing the more global relationships in the text (or the macrostructure).

In terms of levels of interactive processing, the reader engages first in the linguistic processing of surface-level textual features. This process gradually paves the way to the construction of a text microstructure, which further includes relating propositions that are in close proximity within the text so as to form a coherent semantic whole. When the reader combines the locally-built semantic wholes, a text-base is constructed in the form of a macrostructure. In addition to text-based procedures involving the surface code (e.g. lexical decoding, word to text interpretation, syntactic parsing), text-base construction further involves the generation of inferences necessary for discourse coherence. Figure 2-2 demonstrates the simplified form of the CI model, which was reproduced by Kintsch (2004) adapting Schmalhofer, McDaniel, and Keefe's model demonstration.

This figure was created based on a story about a movie stunt that results in a fatal accident. For the surface-level of analysis, one sentence is shown, with word units L9 to L12 and syntactic units S8 and S9. The units at the surface level are connected not only to each other but also to the propositional units at the text-base level. The propositions of

the text-base are linked, in turn, to the situation model units, which are schemas. The schema has been partly filled in with information from previous portions of the text, but it is also updated with current information from the sentence being processed: An action and a result slot are filled in.

Figure 2-2. Surface Structure, Text-base and Situation Level



Kintsch (2004) adapted from Schmalhofer et al. (2002)
L = word units; S = syntactic units

As seen in Figure 2-2, in CI model, different levels, ranging from a letter feature level to a word level to a syntactic level, then to thematic and discourse levels, are activated textually, leading to information built through reciprocal interactions occurring both within and between levels. Textual features are important part of "construction process" (Kintsch, 1998). In integration process, the constructed text-base becomes

integrated into the reader's global knowledge, forming a coherent mental representation of what the text is about or a situation model. For the construction of a situation model representation, the reader needs to have access to relevant general world knowledge and fill in new propositions and relations that are not explicitly asserted in the original text. These processes occur in short iterative cycles, in each of which a new network of textual meaning is constructed, processed, and then immediately integrated with what is retained in the working memory from the previous cycle. The integration process goes on until all of the inconsistencies in the mental representation of the text are eliminated, such that a coherent interpretation emerges.

In the model, information from the discourse representation and general world knowledge is activated simultaneously. According to Kintsch, textual ambiguities are resolved by selecting from among alternatives that have all been activated before the contextual process begins. Inferences are made as a result of activations spreading rapidly from one part of the text to another, when the reader is prompted by retrieval tasks, or when difficulties arise during comprehension.

A great strength of Kintsch's model is that there is reasonably convincing evidence for the three levels of representation (surface, propositional, and situational) specified in the model (Nassaji, 2007). However, on the negative side, situation representations of texts are not always constructed, even by individuals possessing enough relevant knowledge to do so (Tapiero, 2007).

According to Nassaji (2007), the CI model has been well researched in recent years by L1 reading researchers, and is now one of the most widely accepted scientific models of text comprehension in the literature. Although the model has been recognized in L2 reading as well, it appears that its full potential in L2 reading comprehension theory and research has not been well explored. In this study, this model was mostly utilized in the results section, when making interpretations about the way participants represented the texts. Although this present study focused on the use of text cohesion, and intended to

describe the meaning construction process of highly proficient readers, the basics of this theory might help our understanding of whether the lack of textual features in the text, which changes the degree of text coherence, creates any deficiencies in the reader's inferential meanings generated from the text.

Inference generation

Inference generation occurs in the normal course of reading and is essential competence underlying text-meaning construction (Koda, 2005), especially for proficient college readers (Alptekin & Ercetin, 2010; 2011). The process of knowledge use in which every reader must engage to properly understand a text has been characterized as making inferences in text comprehension (Kintsch, 1998). The text-base, which captures the text-internal meaning of the passage, is important for literal meaning construction. In addition to text-based procedures involving the surface code (e.g. lexical decoding, syntactic parsing), the extraction of meanings from sentences, and the gradual accumulation of meanings from processing successive sentences, text-based construction further involves the generation of inferences (e.g. bridging inferences) necessary for discourse coherence (Graesser, Singer, & Trabasso, 1994).

To address the differences between inferences, Kintsch makes a distinction between problem-solving processes when "there are premises from which some conclusions are drawn" (p. 189) (inferences) and knowledge retrieval processes in which "a gap in the text is bridged by some piece of preexisting knowledge that has been retrieved" (p. 189). Table 2-1 shows the classification system of Kintsch for inferences in text comprehension (Kintsch, 1998, p. 189).

The automatic retrieval process (including bridging inferences) that enriches the information in a text requires the activation of sufficient retrieval cues provided in the text. These cues are driven by explicit textual features, such as anaphoric references, connectives, signaling devices, and rhetorical predicates which normally bind

intersentential and intrasentential text constituents. However, sometimes the cues in the text do not provide necessary information for the reader to retrieve relevant information to bridge the gaps in the text. An extended search of memory through a "strategic, controlled, resource-demanding process" of deduction (Kinstch, 1998, p. 190) is required to retrieve what is needed to understand the text. This process, as opposed to text-based automatic local bridging, leads the reader to global bridging and requires effortful cognitive processes (Ozuru, Dempsey, & McNamara, 2009) such as integration of information located across larger distances by using logical and pragmatic resources.

Table 2-1. Classification system of Kintsch for inferences in text comprehension

	Retrieval	Generation
	A	C
Automatic processes	Bridging inferences Associative elaborations	Transitive inferences in a familiar domain
	B	D
Controlled processes	Search for bridging knowledge	Logical inferences

Inferential comprehension, in addition to literal comprehension, is also an important component of L2 text comprehension and discourse processing. Previous research shows that the discourse provided by the text (e.g. text coherence) and the reader's processing of this discourse using different knowledge sources (textual and knowledge-based) lead the readers to a proper and coherent understanding of the text. For example, the more conceptual gaps there are in text-based information, which makes a text less coherent, the more global bridging inferences need to be made in order to connect the various ideas in the text so as to generate coherent whole (Ozuru, Dempsey, & McNamara, 2009). If the reader cannot construct a proper text-base, literal meaning of the text, it is unlikely that the reader will be able to generate a coherent and deeper

comprehension of the text (Kintsch, 1998; Tapiero, 2008). L2 readers usually have propensity for text-based processing by relying heavily on surface-level features (Alptekin & Ercetin, 2011). Since L2 readers, especially lower-level readers, rarely engage in higher-level comprehension processes, they cannot adequately tackle a complex process like inferential comprehension.

Previous research (Alptekin & Ercetin, 2010; Walter, 2004) also emphasizes the interaction of working memory (WM) capacity with language proficiency. They conclude that WM capacity interacts with language proficiency in that differences between L1 and L2 reading spans are less significant in the case of proficient L2 users. Previous research focusing on the relationship between processing and storage in L2 (Alptekin and Ercetin, 2010; Stowe & Sabourin, 2005) argue that L2 readers expend their cognitive resources much more than in the L1, as L2 processing is less automatized than that in the L1. L2 processing places a heavier demand on WM, causing L2 readers to switch their attention from processing to storage task demands. In their studies examining the effects of working memory capacity and content familiarity on literal and inferential comprehension in L2 reading, Alptekin and Ercetin (2010) conclude, "with proficient L2 readers, processing the linguistic and propositional properties of a text does not present a serious challenge to their WM capacity" (p. 214). Literal understanding is essentially dependent on the level of language proficiency and surface readability features (e.g., decoding, syntactic parsing), and consequently does not impose on WM capacity. Inferential comprehension correlates with L2 processing, yet not with L2 storage. Following Koda's suggestion on WM, Alptekin and Ercetin (2010) conclude that the processing dimensions of WM capacity and reading ability are one and the same. Readers who are able to control their selective attention to suppress irrelevant items and focus on relevant ones, in relation to both existing textual content and immediate access to available prior knowledge in long-term memory, appear to be not only better readers but also to have high WM capacity.

As discussed briefly above, previous research supports the claim that inferential comprehension, which requires reasoning beyond the text while representing a satisfactory understanding of what the text says, is considerably more cognitively demanding. An extended search of memory is required for inferential comprehension, which contributes to a deeper understanding of the text (Kintsch, 1998). Although the previous L2 research discusses the relation between working memory and text processing, and emphasizes the importance of text coherence on successful text comprehension, the field lacks research focusing on how coherence is tied to the underlying processes carried out by highly proficient L2 readers, and whether the lack of textual features in the text, which changes the degree of text coherence, creates any deficiencies in the reader's inferential meanings generated from the text. The following section further discusses the role of text coherence in meaning construction by specifically focusing on the discourse features that contribute to text coherence, and also by providing the discussion of relevant research on the effect of text coherence on text comprehension.

Text coherence and its effect on the meaning construction process

As discussed in the previous section, discourse cannot be entirely reduced to sentences and utterances. Discourse has context, cohesion, coherence, and rhetorical structure that weave together and transcend the sentences in a text (Graesser, Gernsbacher & Goldman, 2003). Text provides linguistic conceptual knowledge that interrelates constituents in the discourse, such as time, space, causality, goals, and agency (Zwaan & Singer, 2003). This conceptual knowledge is constructed with linguistics features that signal how to connect constituents, such as connectives, punctuation, verb tense, and syntactic markers. These linguistic features impose meaning and structure on individual sentences that go well beyond the compositional meaning of sentences in

isolation. In short, a text is not a sequential display of isolated words and sentences; rather, it is connected meaningfully, syntactically, lexically, and semantically.

Halliday and Hasan (1985) define text as an important part of meaning construction as "language that is functional" (p. 10). "The meanings have to be expressed, or coded, in words and structures in a text but as a thing itself, it is essentially a semantic unit" (p. 11). According to Meyer and Rice (1984), "ideas in a text are interrelated in a specific way to convey a message to a reader" (p. 319). Texts are obviously more organized than simple lists of sentences or ideas, and therefore, understanding their organization can shed light on important aspects of the reading process. The interrelated ideas in a text are constructed with discourse features, such as cohesive devices, and this construction leads to text coherence. Thus, readers are expected to be able to understand relationships among text elements, which are signaled both explicitly and implicitly through coherence and cohesion in a text (Koda, 2005).

Coherence is a salient property of texts (Meyer, 1984, p. 325). A text's surface structure offers a variety of reliable clues signaling coherence relations among concepts intended by the author (Goldman & Rakestraw, 2000). There are explicit and implicit methods to achieve text coherence. Explicit methods refer to identifiable text clues, including organizational conventions (e.g. paragraph formation, topic sentence placement, and similar graphic markers) as well as linguistic devices (e.g. connectives). Some textual features contributing to text cohesion have been marked in the sample text on page 30.

To construct the meaning conveyed in this text, the reader needs to interlink propositions on the basis of (for example) argument overlap (e.g., them referring to foods), lexical repetition (foods) and other clues, such as *connectives* (though, while, yet). However, these features are only one group of devices building text coherence.

Though undoubtedly well-intentioned, this last provision is troubling, *but* not because anyone really cares about the provenance of Ban Ki-Moon's turnip greens. *Rather,* it suggests a willful *and* dangerous ignorance about the tenuous state of global agriculture, and the prospects for feeding 9 billion people *while also* addressing biodiversity loss, water shortage, *and*, yes, climate change. Organic foods are enjoying skyrocketing popularity in the US and Europe, *as* are their ill-defined sidekicks, "natural," "whole," and "real" foods. *Yet* popular notions that these foods—and the agriculture that begets them—are *at once* better for people and for the planet turn out to be largely devoid of experimental support. *Worse still*, "organophilia" tends to go hand-in-hand with technophobic skepticism towards the very sorts of scientific approaches most likely to supercharge an ailing food system while leaving our planet intact" (Extracted from Seeds Magazine).

Bold words: argument overlap Underlined words: lexical repetition *Italic words:* Connectives

Texts use a variety of other devices to signal global coherence relations which indicate how paragraphs relate to the main theme of the text and how ideas are linked across paragraphs (e.g. co-reference). All these devices are usually named as cohesive devices (see the Table in Appendix B for the list of important cohesive devices and their definitions). In addition to these identifiable text clues, there are also implicit methods used to build a text that imply conceptual manipulations such as inference and reasoning, to connect text elements. For example, in the previous sample text, the author uses the word "organophilia" in the last sentence, whose meaning is connected to the meaning the reader will get from the previous sentence. The reader who is not familiar with food and food agriculture and, specifically, the word "organophilia" might need to generate inference using the meaning s/he will construct from the previous sentence.

Cohesive devices and text coherence have been simply addressed in this sample text, but, in order to better conceptualize the purpose of this study and interpret its results, it is important to understand these two discourse features, coherence and cohesion, in depth, and how they are related but also different to a degree. Therefore, next section provides the definition of each feature.

Coherence and cohesion: A necessary distinction

Coherence has been approached from different perspectives by different researchers. Some researchers view coherence as a linguistic, text-based entity, others regard it as non-linguistic, that is, reader-based. Halliday and Hasan (1976) defined it as the logical flow of ideas, connectivity of the surface text evidenced by the presence of cohesive devices. According to Halliday and Hasan, cohesion, one of the fundamental features of texture, "enables a text to function as a text" (p. 2). Cohesive devices, through which cohesion is realized, enable language to be produced that is connected and coherent.

Coherence has been also defined as the means by which readers construct a mental model of a text (Carrel, 1982; Graesser et al., 2004). Coherence, as an information structure, guides the reader in understanding the text. For some researchers (e.g., Goutsos, 1997), neither the text alone nor the cohesive ties used in the text can account for the meaningfulness of a text. Rather, they believe it requires a number of other factors together such as organization, content of situation, and schemata of background knowledge. For example, according to McNamara and his colleagues, the notion of coherence is the degree to which text propositions are interconnected in the reader's mental representation of the text (Graesser et al., 2004; Mcnamara et al.,1996; 2001). On the other hand, cohesion refers to the surface indicators of relations between sentences in a text. Although these surface indicators are important in building text coherence, readers might make coherent interpretation of a text, which is lacking cohesive devices utilizing other factors such as inferencing and reasoning. This idea relates to the main criticism Halliday and Hasan received on their concept of cohesion as a measure of the coherence of a text.

The concept of cohesion defined by Halliday and Hasan has been criticized in the light of schema-theoretical views of text processing (Carrell, 1982). This criticism attempted to show that Halliday and Hasan's cohesion concept, which encourages the

belief that coherence is located in the text and can be defined as a configuration of textual features, fails to take the contributions of the reader into account (Carrell, 1982). However, in his theory of language, Halliday possibly did not propose that cohesion alone could account for text coherence. For Halliday, meaning results from the interplay of three main components, namely, ideational, interpersonal, and textual. The ideational component is the expression of content; it has to with the language function of "being about something" (p. 20). The interpersonal component has to do with readers' role relationships. And finally, the textual component is the part, which comprises the linguistic sources that form a text. Each of these components is further subdivided, one of which is the textual component of cohesion. Cohesion forms a system in itself, but, as pointed out earlier, is just one part of the complex set of relations that come together to form texture or coherence.

Halliday and Hasan (1976) interpret cohesion as "the set of semantic resources for linking a sentence with what has gone before," In Halliday and Hasan's definition, "A text is a passage of *discourse* which is *coherent* in two regards: it is coherent with respect to *the context of situation*, and therefore consistent in register; and it is coherent with respect to itself, and therefore *cohesive*" (p. 23). According to Halliday and Hasan (1976), the primary factor of whether a set of sentences does or does not constitute a text depends on cohesive relationships between and within the sentences, which create texture. Graesser and his colleagues (Graesser, McNamara & Louwerse, 2003) state that the coherence of a text is defined by the interaction between linguistic representations and knowledge representations. When you put the emphasis on the text, coherence can be defined as characteristics of the text (i.e. aspects of cohesion) that are likely to contribute to the coherence of the mental representation.

In all definitions provided by different researchers, cohesion that contributes to text coherence plays an important role because relationships between propositions determine the connectivity of the underlying concept, and these relations contribute to the

overall discourse theme and organization (Kintsch, 1998). The continuity expressed by cohesion in a text shows, at each stage in the discourse, the points of relations or contact with what has been said before. On the other hand, the continuity provided by the cohesion helps the readers to fill gaps in the discourse, and to supply all the components of the message, which are not present in the text but are important and necessary to its interpretation.

Taxonomies of cohesion

Considering the important contribution of cohesive devices to texture, readability and comprehensibility of a text, scholars have provided a number of taxonomies for cohesion, which share some common categories (See Table 2-2 for the cohesion taxonomies). Halliday and Hasan (1976) identify and classify cohesion into five categories: reference, substitution, ellipsis, conjunction, and lexical cohesion. The first four of these types are called grammatical cohesion. Hinkel (2001) lists features of cohesion: phrase-level connectors, sentence transitions, logical/semantic conjunctions, demonstrative pronouns, enumerative nouns, and resultative nouns.

Graesser et al. (2004) applies a language framework to cognitive reading processing theory using a computational tool (Coh-Metrix) that analyzes texts for linguistic structures (Louwerse, 2002) and includes three categories related to cohesion: syntax, referential and semantic indices, and situational model dimensions[2]. *Syntactic indices* show the structure of sentences and clauses in texts and provide information about the relationships between ideas, thus promoting cohesion. These features indicate how syntactically dense a text is, with more density potentially making a text more difficult (Graesser et al., 2004). *Referential and semantic cohesion* address repeated

[2] These categories based on the description from the Coh-Metrix website sponsored by the Department of Psychology at the University of Memphis (McNamara, Louwerse & Graesser, 2002)

words and ideas that allow readers to connect previously mentioned ideas with new information in a text. This aspect of cohesion appears when a word (noun) refers to another word or idea in the text. Finally, *situational model dimensions* refer to the words that signal logical patterns in a text. As identified before, the process of reading has been described as the shaping of a mental model from a text, and this mental model is based on the words that signal logical patterns such as those which build causal cohesion in the text.

Table 2-2. Taxonomies for cohesion

Halliday & Hasan (1976)	Hinkel (2001)	Graesser et al. (2004)
Grammatical - Reference *{personal, demonstratives and comparatives}* - Substitution *{the replacement of one component by another}* - Ellipsis *{the omission of a component}* - Conjunction *{the indication of specific meaning which presupposes present items in the discourse, such as additive, adversative, causal, and temporal}* Lexical *{the repetition of the same or relative lexical items}*	Phrase-level connectors Sentence transitions Logical/semantic conjunctions Demonstrative pronouns Enumerative nouns Resultative nouns	Syntax *{text complexity, pronouns and lexical variety, connectives, logical operators, sentence syntax similarity}* Referential and semantic cohesion *{anaphor reference, co-reference, and Latent Semantic Analysis}* Situational model *{words building causal cohesion in the text}*

As stated in all definitions, especially the one provided by Halliday and Hasan (1976), these discourse features, coherence and cohesion, are important features that enable a text to function as a text. Therefore, analysis of these features can illuminate important features of both the texts' and the readers' contributions to the reading and understanding process (Meyer, 2003). Such an analysis might help to discover the aspects of a given text which are easiest or hardest for readers to understand. Reading research, including L2 reading, is not devoid of studies presenting the analysis of discourse features. The following section discusses a few L1 and L2 studies, which all have specific areas of concern relating to the present study.

L1 studies on text coherence and comprehension

In this section of the literature review, I reported on relevant studies conducted to investigate the effect of text coherence or cohesion on text comprehension. These studies are significant in that the findings provided theoretical and methodological implications to help identify methods for the present study within a more comprehensive and appropriate structure. Note that I do not describe all the details of these studies here; instead, focus is placed on their results to guide the present study. Also I describe how these previous works led me to new theoretical constructs and to research methods.

McNamara and Kintsch (1996): Effects of prior knowledge and text coherence on learning from texts

In their studies on the role of text coherence in the comprehension of science texts, and also investigating the effects of prior knowledge on learning from high- and low-coherence history texts, McNamara and Kintsch (1996) utilized the construction-integration model of text comprehension (Kitsch, 1988) and conducted two experiments. In this study, McNamara and colleagues hypothesized that low-knowledge readers will profit from a fully coherent text, whereas high-knowledge readers will learn better with a text that stimulates more active processing. The second experiment and its results will

mostly be discussed here.

In experiment two, interactions among local and global text coherence, readers' background knowledge, and levels of understanding were examined. The researchers found that readers who know little about the domain of the text benefit from a coherent text, whereas high-knowledge readers benefit from a minimally coherent text. They argued that the poorly written text (low-coherent ones) forces the knowledgeable readers to engage in compensatory processing to infer unstated relations in the text.

According to this study, without adequate prior knowledge, students are limited in their constructive processes. A well-written, fully coherent, explicit text will allow them to form a good level of text-base understanding. However, one way to promote deeper understanding- the construction of an adequate situation model – may be to disrupt the coherence of the text at both the local level and at the level of its global organization. Especially in the case of a demanding scientific text, more is required for understanding than just the ability to reproduce the text itself. Usually, the reader must contribute information that was not explicitly stated in the text from his or her own store of knowledge. "Considerable active inferencing" (p. 3) may be required to link the text with the reader's prior knowledge.

McNamara (2001): Reading both high-coherence and low coherence-texts

McNamara conducted a follow-up study on the effects of text sequence and prior knowledge on text comprehension. Previous research (1996) has demonstrated that high-knowledge readers learn more from low-coherence than high-coherence texts. This follow-up study further examined the assumption that this advantage is due to the use of knowledge to fill in the gaps in the text. In this study, participants read either a high- or low-coherence text twice, or they read both the high- and low-coherence texts in one order or the other. He predicted that reading the low-coherence text first should force the

reader to use prior knowledge to fill in the conceptual gaps. However, reading the high-coherence text first was predicted to eliminate the need for prior knowledge to understand the low-coherence text, when the latter was presented second. As predicted, high-knowledge readers benefited from the low-coherence-only text when it was read first. Low-knowledge readers benefited from the high-coherence text, regardless of whether it was read first, second, or twice.

In both the first study (1996) and the follow up study (2001), McNamara and his colleagues named the defined process as "*reverse cohesion effect,"* such that high-knowledge readers showed better comprehension when they read a low-cohesion version of a text, whereas students with low knowledge have been shown to better understand and learn from more cohesive texts. According to the reverse cohesion effect, when there is a large overlap between the text and the reader's knowledge, high-knowledge readers fail to process the information at a deep level because they do not use their knowledge to help them develop a coherent model of the text (Mcnamara, 2001).

O'Reilly and McNamara (2007): Reversing the reverse cohesion effect

In their more recent studies, O'Reilly and McNamara (2007) examined whether students' comprehension skills affect the interaction between text cohesion and their domain knowledge. They specifically tried to determine whether comprehension skill mediates the interaction between prior knowledge and text cohesion in addition to the reverse cohesion effect found in 1996 study. They predicted that the reverse cohesion effect would only appear for less skilled, high-knowledge readers. For skilled, high-knowledge readers, cohesion should facilitate comprehension because the readers would actively process the difficult text and the more coherent text-base in the high-cohesion version should lead to a more complete text representation. They also predicted that both comprehension skill and cohesion would help low-knowledge readers because skilled

readers are more likely to use strategies and make inferences, and the increased cohesion should allow readers to "form a partial model of the text" (p. 126). They conducted the study with 143 college students from a US university using prior-knowledge tests, comprehension skills test and high- and low-cohesion texts. They tested participants' comprehension using comprehension questions including 10 open-ended questions, 5 text-based questions, and 5 bridging-inference questions. They found that the benefit of the low-cohesion text was restricted to less skilled, high knowledge readers, whereas skilled readers with high knowledge benefited from a high-cohesion text.

Studies (McNamara, Kintsch, Songer & Kintsch, 1996; McNamara, 2001; O'Reilly & McNamara, 2007) investigating the relationship between cohesion effects, coherence awareness and readers' inferencing skills are mostly conducted in L1 cases, but they provide important results that should be considered in L2 studies. Are the findings in these L1 studies applicable to the L2 reading process? Do L2 readers at higher levels also need to depend more on their inferencing skills to build meaning as they read? Do they need an easier, coherent text to gain situational understanding, even though they are advanced L2 readers with the necessary language knowledge?

L2 studies on text cohesion

Studies examining text cohesion and coherence and their effect on text comprehension are not only limited to L1 studies. A number of studies have investigated individual differences in awareness of coherence and cohesion and their relation to text comprehension (Koda, 2004). This research suggests that individual differences exist in a reader's ability to use connective devices such as coreferentials (e.g.a noun in one sentence that refer to a noun in another sentence) (Degand, Lefevre & Bestgen, 1999), logical connectors (Degand & Sanders, 2002, Ozono & Ito, 2003) and causal cohesion (Horiba, 1996). Two studies (Horiba, 1996; Degand & Sanders, 2002) will be briefly reviewed in this section because of their relevance to the proposed study.

Horiba (1996): Comprehension processes in L2 reading

In her study, Horiba (1996) examined four groups of readers (L2 intermediate, L2 Advanced, L1 Japanese and L1 English) when they processed and recalled two passages that varied in degree of causal coherence. The main hypothesis in her study was that L2 readers attempt to construct a coherent representation of a text by utilizing information explicitly presented in the text and information generated from general background knowledge. In her study, she focused on three research questions, but one is especially related to the present study: How does a text's causal structure influence the allocation of cognitive resources during reading - in particular, to the generation of inferences? The results of the study referring to the question above indicated that the degree of a textual coherence did not affect reading times for any group of readers. However, recall data indicated that the high-coherence texts were more memorable than the low-coherence texts for L1 readers, whereas this advantage was not found for L2 readers. This study showed that L2 readers did not differentiate between high- and low-coherence texts "in terms of the relative allocation of cognitive resources to various levels of processes," whereas L1 readers reported more elaborative inferences for the low-coherence texts when compared with the high-coherence texts. L1 readers detected the causal structure of a text and generated backward inferences according to this structure. However, those who were not competent were not sensitive to the causal structure of a text. As a result, they did not construct a fully developed text representation that reflected the causal structure of the original text. The findings indicate that L2 advanced readers did not generate backward inferences corresponding to the text's causal structure even on second reading. According to Horiba, one possible explanation for this seeming discrepancy is that for the advanced L2 readers the generation of backward inferences was most likely to be delayed because of the disruption in processing relevant sentences and words.

This study is important in terms of its methods and results, but especially the results describing L2 advanced readers' reactions to causal coherence. Verbal reports

collected by Horiba seemed to reflect how L2 readers were working on the construction of representation at both the propositional and situation-model levels interactively and simultaneously. L2 advanced readers first devoted much of their cognitive resources to lower-level processes that were needed for the construction of a propositional text-base that represented information explicitly provided in a text. While doing so, they were trying to construct a representation of the situation described in the text. Although they could not incorporate of all the information in the current sentence into their propositional text-base, they usually moved on to the following sentence. As they processed more sentences, their increased understanding of the situation helped reprocess the information that was left unresolved in earlier text. L2 advanced readers did not generate elaborations for the low coherence texts. Horiba explained this as follows: "Because the low coherence-texts are coherent at local levels, L2 advanced readers may have been satisfied that events were connected to each other in local discourse. In other words, they may have employed lower "standards for coherence," compared with L1 readers.

Horiba's study provides valuable explanation and interpretation on L2 readers text processing and their use of causal coherence by comparing their performance with L1 readers in this study. However, she accepted that more research is needed on both the processing of linguistic information and the generation of inferences in order for us to better understand the dynamic nature of L2 text processing. She suggested future research focusing on L2 advanced readers, examining "whether or not L2 readers maintain lower 'standards for coherence' than L1 readers" (p. 456).

In this study, Horiba collected verbal reports from L2 readers of Japanese, and she analyzed the data collected first quantitatively, (for example, providing the mean proportion of think-aloud productions) and also using pre-determined categories of statements to analyze the data. In the present study, however, different research methods

will be used to analyze the data coming from L2 readers of English, which will provide new results for English L2 readers' text processing.

Degand & Sanders (2002): The impact of relational markers on the comprehension of expository texts

In this study, Dagend and Sanders conducted an experiment to test the impact of linguistic markers of relational coherence (connectives and signaling phrases) on the comprehension of expository discourse in both L1 and L2 readers. Dagend and Sanders aimed to clarify the contradicting results from the literature in their studies. According to the researchers, there was no consensus on the exact effect of explicit discourse markers on text understanding in the literature. Markers would have a facilitating effect, an interfering effect or no effect at all. Their hypothesis was that texts with linguistic marking (connectives and singling phrases) should lead to better comprehension than the implicit versions for both L1 and L2 readers. In addition, they hypothesized that the effect of linguistic marking might be larger in L2 than in L1, unless the language proficiency is too low. Dagend and Sanders have argued that connectives and signaling phrases might be especially useful for readers who have trouble understanding the text, such as readers in a foreign language. To assess this issue, they compared reading comprehension of readers in L1 (French –Dutch) with their reading in L2 (French – Dutch). They based their experiment on the idea that the ability to process logical relationships within local contexts is a necessary but insufficient component of comprehension of such relations in extended discourse. In other words, L2 readers need an increased proficiency in order to be able to comprehend such relationships. The researchers argue that especially advanced L2 learners benefit greatly from structural markers, because "they have no trouble in understanding the connectives and other linguistic markers" (p. 743).

Readers in this study did not need specific background knowledge to understand the texts. The researchers selected texts from the popular scientific genre. While doing so, they aimed to reduce specific prior knowledge effects to a minimum in the sense of McNamara and Kintsch (1996). The researchers used the question-answering method, as it enabled them to specifically test the way in which readers have access to the target information (which was either preceded or not by a relational signal). Texts were manipulated with respect to the presence or absence of linguistic markers (causal connectives, casual signaling phrases).

The results of the study have shown that these linguistic signals do indeed influence the reader's representation *after reading*. On the other hand, the use of suitable relational markers which make explicit relations between text segments has been shown to accelerate the on-line text processing. What they found in this study was 'strikingly' different from previous findings in the literature. The literature showed that the effect of relational markers is limited to the *on-line reading process*, whereas Degand and Sander's results showed that the presence of relational markers indeed affected the text representation that readers constructed *after reading*. They believe that this difference in results may "very well be due to *the methods* used to investigate the offline effect of relational markers" (p. 752). They stated that global measures other studies used, such as free recall or multiple choice questions, were also not sensitive enough to detect the effect that signaling phrases and connectives appear to have on text comprehension. Thus, they suggest that further comparison of the methods is an important consideration for future research. For example, they suggest, "further studies, which are combining on- and off-line methods, are needed to confirm the conclusion."

Their second hypothesis was that the effect of relational markers might even be higher for L2 readers than for L1 readers. However, this hypothesis was "borne out." Although they found an overall effect language proficiency – L1 participants performed better than L2 – both L1 and L2 readers benefited from the presence of causal markers

during reading. This result did not support previous research in which it was argued that L2 readers tend to misunderstand or neglect relational markers so that they do not benefit from these signals. The researchers explained this finding in terms of the 'inter-dependence hypothesis,' which states that cognitive and linguistic skills acquired in one language can be transferred to another language. This transfer does not take place at low levels of L2 competence. Readers need to have "a sufficiently high L2 competence level" (753). Based on this finding, Degand and Sanders (2001) suggested that further research is needed "to provide further insight in the exact role of textual characteristics in L1 and L2 proficiency."

Degand and Sanders' study (2001) was conducted with intermediate L2 readers using the question-answering method. They provided results for the construction of a coherent mental representation after reading. This raises further questions about how these expository texts affect the construction of the mental representation *during reading*, which is the purpose of this present study. Considering the results of this study and researchers' suggestions on research methods, this current study examines meaning representation of highly proficient L2 readers during reading and how they benefit from textual features (not only relational markers) that contribute to cohesion. In order to examine this process closely, qualitative research methods are used, which deviate from the methods used in previous research (e.g., Degand and Sander's).

Conclusion

In this chapter, I reviewed the literature in areas that hold relevance to my study: reading comprehension process; discourse process; text coherence and cohesion; and, their relation to reading comprehension. Following the main points and interpretations from all these studies, I developed research questions and utilized research methods that extend and fill gaps in this research base. In my own study, I focused on think-aloud

protocols and interviews to gain a deeper understanding of the online text processing of advanced readers and to gain their perspectives on the benefits of textual features.

Even though many studies have emphasized the executive function of text cohesion to control the reading comprehension process, their findings seemed to fall short of being comprehensive to understand the reading process of highly proficient readers. There have been no studies specifically focusing on highly proficient L2 readers, although there are a few comparing L1 and L2 readers (e.g. Horiba, 1996). This present study aimed to fill this gap.

As Grabe (1991) claimed, a primary goal for ESL (English as a Second Language) reading theory and instruction is to understand what fluent L1 readers do, then decide how best to move ESL students in that developmental direction. Similarly, Bernhardt (2011) also mentions that there are differences across levels in comprehending the text, however, the acquisition of reading in a second language means the acquisition of native-like behaviors; i.e. "acquiring the automatic ability to process areas of the text that are critical for meaning" (Bernhardt, 2011, p. 26). Examining the reading processes of highly proficient readers who cope with extensive texts with which only the educated native speaker engages, therefore, will be helpful to understand how these readers approach these texts. As Bernhardt mentions, examining expert thought processes might bring us to a better understanding of what a novice reader must do in order to become expert at second language text processing (Bernhardt, 2011). Therefore, in this study, I examined highly proficient L2 readers, but from a different perspective and using different research methods than used in prior research.

CHAPTER III

RESEARCH METHOD

This chapter will discuss the methodology and research methods used to explore the research questions. I will start the chapter by providing an overview of the qualitative approach and the main reasons for choosing this approach. Then, I will explain each component of the research process: participants, text selection and modification, data collection, and analysis. This chapter will also discuss the purpose and outcomes of the pilot study conducted to primarily test reading texts and the research methods.

Purpose of the study

This study specifically examines two aspects: (1) whether the level of text cohesion – low vs. high makes a difference in the readers' construction of meaning, and (2) how and to what degree readers benefit from textual features contributing to text cohesion. On the basis of this main purpose, I examine the following four questions:

RQ#1: How do highly proficient L2 readers approach text cohesion and use discourse features that contribute to cohesion while processing texts written in their second language, English?

1.1 How do they construct meaning representations in low-cohesive and high-cohesive texts?

1.2 What discourse features do they use while building meaning representations from reading low-cohesive and high-cohesive texts?

RQ#2: How do these readers perceive text cohesion and its effect on their own meaning representation and construction process?

To describe readers' approaches to text cohesion and also recognize readers' perceptions of their own process, I employed close observation of reading processes in this study with the use of qualitative research methods.

Qualitative approach

Many valid reasons exist for doing qualitative research including "the nature of the research problem" (Strauss and Corbin, 1998). In my study, I used qualitative data collection techniques that enhance our understanding of the complexities in reading processes (e.g. think aloud protocol) and applied qualitative data analysis techniques, the grounded theory approach. Qualitative research is "an interpretive, naturalistic field of inquiry where researchers study things in their natural settings, attempting to make sense of, or to interpret phenomena in terms of the meanings people bring to them" (Denzin & Lincoln, 2000, p.3). In qualitative research, the researcher interprets the phenomena from the perspectives of participants. This was the key determinant in my selection of this approach for the study. In my research, I examined "what readers are doing", but also attempted to understand "what they are thinking" - the nature of readers' perceptions of their own processes.

Another reason was the lack of research in the field that uses a qualitative approach in the exploration of the effect of text cohesion on L2 comprehension process. Previous research (e.g. Degand & Sanders, 2002; O'Reilly & McNamara, 2001) has compared readers across different proficiency levels using experimental procedures. While previous studies have provided insights into quantifiable gains, they have been less informative about some of the nuances and richer interpretations that can be obtained using more in-depth qualitative approaches (Denzin and Lincoln, 2005). These studies have examined the readers' memory of a text using recall or comprehension question responses but have not attempted to illuminate the comprehension process itself. No clear interpretation of how coherence is tied to the underlying processes readers carry out when they read texts has been proposed (Tapiero, 2007). My study aimed to fill this gap by examining the ongoing meaning construction process that naturally takes place while the reader is progressing through a text, and also giving consideration to the readers' perceptions of their own processes.

Grounded theory approach

A variety of qualitative methods for data gathering and analysis techniques exists for conducting qualitative research. In my study, I used the grounded theory approach (Strauss and Corbin, 1998; 2008). In this approach, theory is derived from data, which is systematically gathered and analyzed through the research process (Strauss & Corbin, 1998; 2008). Grounded theorists (e.g. Strauss & Corbin, 1967) describe an organic process of theory emergence based on how well data fit conceptual categories identified by a researcher, by how well the categories explain or predict ongoing interpretations produced by individuals, and by how relevant the categories are to the core issues being observed (Suddaby, 2006).

In this method, instead of starting the research design with a theoretical framework that influences the direction of the research or data, the researcher examines the collected data and allows the theory to evolve (Charmaz, 2004; Leedy & Ormrod, 2005); therefore, it is crucial that the researcher approaches the study with as little bias or theoretical preconception as she could. Leedy and Ormrod (2005) warn that some researchers see these grounded theory steps as too prescribed, so that they "limit a researcher's flexibility and may predispose the researcher to identify categories prematurely (p. 141)". With this in mind, I conducted my research conscious of this warning. I allowed data to unfold and to provide direction to the study. I did not predetermine the categories; instead, I closely examined the transcripts of data coming from different data collection methods, in order to see if patterns would emerge with regards to text cohesion.

Another common misassumption about grounded theory is that it requires a researcher to enter the field without any knowledge of prior research. However, "the formulation of grounded theory was never intended to encourage research that ignored existing empirical knowledge" (Suddaby, 2006). For example, Glaser and Strauss (1967) state that although grounded formal theory can be generated directly from data, "it is

more desirable, and usually necessary, to start the formal theory from a substantive one" (Glaser & Strauss, 1967, p. 79). In this study, I discussed my review of relevant literature in Chapter 2, which was intended to provide initial direction in the process of developing new categories and properties and in identifying possible modes of integration across data generated from different data collection methods.

For this study, grounded theory was chosen as: (a) it is appropriate when the study aims to explain a process (Glaser & Strauss, 1967, Charmaz, 2004); and (b) it is more appropriate when pursuing knowledge claims about how individuals interpret reality. My study also examines reading processes and furthermore, intends to describe the participants' perspectives. As Strauss and Corbin (2008) clearly state in their book:

> Process demonstrates an individual's, organization's, and group's ability to give meaning to and respond to problems and/or shape the situations that they find themselves to be in through sequences of action/interaction, taking into account their readings of the situations and emotional responses to them. As researchers, when we analyze data for process, we are trying to capture the dynamic quality of inter/action and emotions (p. 99).

Analyzing data for process encourages "the incorporation of variation into the findings" (Strauss & Corbin, 2008, p. 100). In my study, I examined a complex reading process with a specific goal in mind, an improved understanding of the use of text cohesion in meaning construction process. Thus, while designing my study, I assumed that analysis of process might lead to the identification of patterns including variation as well. I looked for the similarities and differences in the way participants define situations and manage them. Although grounding concepts in data was the main feature of this study, I also used theory procedures flexibly and creatively when naming categories, and making comparisons. As Sandelowski (2007) stated, creativity, as an essential ingredient in grounded theory approach, "manifests itself in the ability of researchers to aptly name categories, ask stimulating questions, make comparisons, and extract an innovative,

integrated, scheme from masses of unorganized raw data" (Strauss & Corbin, 1998, p. 13).

Participants

This study aimed to describe 'highly proficient L2 readers' reading processes. Therefore, the basic criterion for the initial selection of participants was that they were international graduate students at a US university who used English actively for various purposes, including the reading of academic and daily resources, researching and teaching. However, since the study was built on the basics of grounded theory approach, the participant selection became an evolving process based on the arising patterns and categories emerging from the pilot data as dictated by the theoretical sampling procedure (Corbin & Strauss, 1998). The inclusive and exclusive criteria for participant selection were finalized after the pilot studies were conducted.

Adequacy of sample size in qualitative research is relative, as it should be neither too small nor too large for the intended qualitative product (Sandelowski, 1995, Marshall, 1996). This exploratory study also used a qualitative approach requiring in-depth analysis of the participants' reading processes. Therefore, it explored the experiences of a small number of participants that fit a typical think-aloud study (Denzin & Lincoln, 2005; Stake, 1994; Charters, 2003). This study was conducted with a total of 11 students. The flexibility of "cumulative theoretical sampling" (Strauss & Corbin, 1998, p. 203) allowed me to follow directions indicated by the data; hence, a reduction in sample size was possible by choosing the most appropriate participants (Glaser & Strauss, 1967; Strauss & Corbin, 2008). I had to eliminate two participants. One of them did not want to complete the think-aloud task. The other participant did not complete the think-aloud task successfully, as planned in the training. Finally, the data collection was completed on a small scale involving 9 participants, who were all international graduate students pursuing their degree at a state college in United States.

In order to match participants with the intended purpose of the study, I created study eligibility criteria that were inserted in the invitation letter sent to all graduate students at the university (See the IRB-approved participant recruitment materials in Appendix C). According to the inclusion and exclusion criteria, participants of the study were degree-seeking international graduate students (Masters or Ph.D.) who were studying in an academic program at the University of Iowa, and non-native speakers of English. They all used English actively for academic purposes (e.g. research, teaching and studying) as well as their personal daily usage.

Since this study was intended to include highly proficient L2 readers, I assumed that the language proficiency level of the participants was likely to affect the study results, as their reading process might vary depending on their L2 reading proficiency level. Therefore, in the initial selection of the participants, two language-level criteria were used to include and exclude the participants. Participants who scored over 100 on an Internet-based version of TOEFL (IBT Test of English as a Foreign Language) or over 600 on a Paper-based version of TOEFL (PBT) were eligible to participate in the study. Newly admitted graduate students to the university who present TOEFL scores below 100 on the IBT are required to complete an English Proficiency Evaluation on campus before their first registration for the classes. They are required to complete English as a second language (ESL) course work (typically within the first year of study) if specified as a result of the English Proficiency Evaluation. The graduate students who scored under 100 in IBT TOEFL or under 600 in CBT TOEFL, but passed The University of Iowa English proficiency reading test successfully and were not required to take ESL reading coursework were also eligible for the study. International graduate students who study in language acquisition (e.g. Second Language Acquisition) and applied linguistics programs were not eligible to participate in the study, as they might have scholarly familiarity with the study content, which could affect the trustworthiness of the study. Only one student in a language-related program (Chinese as a second language)

participated in the study. This student has been a graduate student in a non-language related field before, and was in her first semester in the language program when she participated in the data collection.

To confirm that all recruited participants met the eligibility requirements of the study, participants completed an introductory survey before signing the consent form. The survey requested information about the participant's current status as a student and their language background including TOEFL scores and English Proficiency Evaluation results (See the attached introductory survey in Appendix D). After signing the consent form (see the attached consent form in Appendix E), any screening procedures, tests, or studies were conducted to determine the eligibility.

While selecting participants, I also considered the fact that reading is a complex process, and meaning construction and mental representation processes of different readers might result in great variety. The L2 readers chosen for this study presented a range of reading experiences, and these experiences were briefly described based on the background information coming from pre-reading interviews in the results section.

Text selection and modification

In this study, participants read two different texts on the same topic, but changing in degree of cohesion – one low-cohesive and one high-cohesive text (see Appendix F for the selected and modified texts). The two texts used in the study were selected from among several texts tested in the first pilot study. The final modification of the two texts was completed after the second pilot study.

Pilot study 1

The primary objective of this pilot study was to revise and then finalize the texts and the methods that would be used in data collection. Before the first pilot study, three texts on different topics (organic foods, climate change, and human behavior) were selected. The original texts were around six or seven pages long and would take a lot of

time to read and record. Therefore, the original texts were first cut without having any structural or lexical modification that might cause simplification. The purpose of using original texts without modification in the pilot study was to test whether readers are interested in reading about the topics and to see how they approach the discourse features and text coherence originally created by the author. Before piloting the texts, each text was analyzed for its cohesion level using the program, Coh-Metrix (see Appendix G for the attached Coh-Metrix analysis measurements for the three pilot study texts).

After conducting the first pilot study with two participants, (see the Table attached in Appendix H for the pilot study data collection process), I made changes in the data collection process, methods, and the selection and modification of the texts. For example, as seen in Table 3-1, I eliminated some interview questions[3]. The eliminated ones were mostly opinion-oriented questions asking for extended information on previously posed questions and requiring extra information that sometimes ventured beyond the purpose of the study. For the successful implementation of a think-aloud protocol, I simplified the think-aloud training session by clarifying the training instructions and shortening up the training text[4] (See Table 3-1. for the complete summary of the pilot study and the final modifications conducted for the main data collection).

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[3] Data collection procedures used in the main data collection (e.g. interviews, and think-aloud protocols) will be explained in detail in the following section, Data Collection.

[4] The content of the training session and the training text will be presented in the Data Collection section.

Table 3-1 Summary of pilot study and final modifications for the main data collection

	What has been done and/or piloted?	Issues to be solved	What is planned for the main study?
Technological issues	- Camtasia free trial downloaded - H-drive space extended	- Video conversion time in Camtasia is too long, which might affect the immediate conduction of cognitive interviewing after think aloud	- Setting up Mac computer with Camtasia - 50 GB H drive + external hard disk space - The meeting was divided into two sections to gain extra time for video conversion
Text selection	- 3 texts were selected for the trial - Selections were high-cohesion texts - Texts have been analyzed in Coh-Metrix	- The length of the texts should be decided	- Text 1 was used for the main study - Another text on the same topic as Text 1 was selected - Texts were modified in terms of their cohesion levels - Coh-Metrix measures were received for high cohesion and low cohesion text
Participant selection	- Only two graduate students attended the pilot study	- Decision should be made on the creation of a homogenous group with a similar language background	- The study was conducted with graduate students having diverse background (first language and course of study).
Think-aloud (TA) protocol language	- TA conducted in English with the first participant and in Turkish with the second participant	- TA protocol report of language should be decided	- TAs were conducted in English - Precautions were planned to increase the quality of TAs (e.g. training session)
Research methods/ Data collection process	- Final post-reading interview was conducted with the first participant - Think-aloud training was modified and clarified	- Validity of cognitive interviewing should be searched and tested again with another participant	- Post-reading interview was replaced with cognitive interviewing

Text modification

Based on readers' interest and text cohesion during the think-aloud protocol, only one of the texts from the pilot study was selected to use in the main data collection. A new, second text on the same topic, but written by a different author was selected in addition to the one finalized in the pilot study. Both texts were obtained from popular science magazines (Seeds and Popular Science), concerning a popular topic – organic foods- for which everybody had some basic knowledge. The texts were originally of similar length and reading ease level.

The selected original texts were first analyzed using the program, Coh-Metrix before they were modified (See Appendix I for the Coh-Metrix analysis of the texts before the final modification). Comparison of the two texts according to the 9 indices in Table 3-3 demonstrated that although the measurements did not differ much, the text titled, "Will organic food fail to feed the world?" had scores confirming its high cohesion compared to the text, "A Natural Obsession". Therefore, I decided to modify the first text to make it more cohesive, and the latter one, less cohesive. The original organization of the text and the author's style in presenting ideas (i.e. step-by-step discussion of the text ideas) also led me to make the first text more cohesive.

Coh-Metrix cohesion measures and the text modification style of the previous relevant studies (e.g., McNamara, 2001; O'Reilly & McNamara, 2007) were two important main resources for me in modifying the texts. During the modification, I added some discourse features to the high-cohesive text, "Will organic food fail to feed the world?" to increase its cohesion level. I first shortened the text, identified the potential cohesion gaps within the original version, and then I added information that will be helpful for quick inferencing. I added sentence connectives (e.g. on the other hand, therefore etc.), and descriptive elaborations (i.e. short explanation of a technical term), inserted words to increase conceptual overlap (i.e. genetically modified products),

replaced pronouns with noun phrases, added topic headers (i.e. paragraph headings), and structurally rearranged only two sentences in the text. I omitted some conjunctions in the low-cohesive text, "A Natural Obsession" and made slight changes in the use of content words to decrease the type-token ratio. Table 3-2 below includes samples for each described modification. (See Appendix F for the final versions of the modified texts used in the study)

Despite these slight modifications, my purpose was not to change the originality of the texts or the author's presentation of an idea. Therefore, I did not attempt to make big changes in the overall text organization. For example, as seen in Table 3-4, there is no big difference between the texts in terms of their connectives. This will be explained in detail in the following section, Coh-Metrix analysis.

Coh-Metrix Analysis

Coh-Metrix is a computer tool which measures cohesion and text difficulty at various levels of language, discourse, and conceptual analysis (Graesser et al., 2004). Coh-Metrix (3.0) analysis provides 108 different indices of the linguistic and discourse representations of a text, including: *coreferential cohesion*, *causal cohesion*, *density of connectives*, *latent semantic analysis (LSA)*, and *syntactic complexity*. These values can be used in different ways to investigate the cohesion of the explicit text and the coherence of the mental representation of the text.

As stated in Chapter 2, according to Graesser and his colleagues (Graesser, McNamara & Louwerse, 2003), the coherence of a text is defined by the interaction between linguistic representations and knowledge representations. When you put the spotlight on the text, however, coherence can be defined as characteristics of the text (i.e. aspects of cohesion) that are likely to contribute to the coherence of the mental representation. Coh-Metrix provides indices of such cohesion characteristics.

Table 3-2. Sample modifications from the texts

Modifications	Low-cohesive text	High-cohesive text
Sentence connectives	Omitting sentence connectives "~~On the other hand~~, for a science-skeptical community, the knowledge that scientists are undaunted may not be comforting at all."	Adding sentence connectives But, despite minimum environmental and human health impacts of organic techniques, *the fact remains that* …
Descriptive elaborations	No explanation for technical terms and no information about cited experts "This is a technology that's pretty green," says Paarlberg. Worse still, "organophilia" tends to go hand-in-hand with technophobic skepticism	Short explanation of a technical term, and information about cited experts a major contributor to the "sixth extinction," ongoing extinction of species like plants and animals, and a perennial source of water pollution move them a little but not a lot," says biologist Nina Fedoroff
Word insertion		Words inserted to increase conceptual overlap In a bid to bring clarity to what has too often been an emotional debate
Pronouns replacement		some farmers have turned to so-called organic techniques. This type of farming is meant to minimize…/ This seeming contradiction, organic foods for healthy generation versus more foods for increasing human population,
Repeated words		Repeated words throughout the text The word "perennial" repeated six times in the high cohesive text Repeated words between the sentences … pesticides to specially bred crops genetically modified. Crops genetically modified to endure drought
Topic headers	No topic headers	Topic headers in question format How to boost organic farming? The key limit to further yield increases via organic methods appears to be nitrogen

In this study, 108 indices for each text were received, but only the measures in Table 3-3 were presented, as they were determined to be salient discourse features that contribute to cohesion based on a review of cohesion-related studies (e.g., O'Reilly & McNamara, 2007) and the original construction of the texts.

The textual features including syntactic structure of the sentences and the author's word selection such as the use of repeated technical terms in the text mattered to all participants attending to the pilot study. Thus, although 7 indices were considered in the evaluation of the texts before the first pilot study, three important measures – text easibility, syntactic complexity, and referential cohesion- were added to the analysis for the evaluation of the modified texts in terms of their cohesion levels. The complete list of Coh-Metrix measures for both texts is presented in Table 3.3.

In Table 3-4, the traditional measures of text difficulty, the number of words, Flesch Reading Ease, and Flesch-Kincaid Grade level have been presented. These numbers suggest that low-cohesion text is likely to be easier to understand than the high-cohesion text. However, there is often a reverse relation between cohesion and traditional measures of readability such as grade level and reading ease (Graesser et al., 2004). That is, as cohesion is increased, reading ease decreases, and the grade level estimates increase. This generally occurs because traditional measures of text difficulty rely on sentence length - the shorter the sentence length, the easier the text. However, increasing cohesion typically results in an increase in sentence length and thus increases text difficulty. Between the two texts selected for this study, the low-cohesive text has the lower reading ease and higher reading level than the high-cohesive text, showing that it's easier to read, but this does not mean that it is easier to understand for L2 readers.

To supplement traditional measures of readability and explain the cohesion level of the texts appropriately, I therefore offered some additional measures of text cohesion: *causal cohesion, LSA global cohesion, connectives, type token ratio, text easibility*, and *syntactic complexity measures*.

Table 3-3. Coh-Metrix cohesion measures and their definitions

Cohesion measure	Definitions
Number of words	Total number of words in the text
Reading ease	The output is a number from 0 to 100, with a higher score indicating easier reading
Reading level	The grade levels range from 0 to 12.The higher the number; the harder it is to read the text.
Text easability components	These components provide a more complete picture of text ease (and difficulty) that emerges from the linguistic characteristics of texts.
Casual cohesion	This is a ratio of causal particles to causal verbs. Cohesion suffers when the text has many causal verbs, but few causal particles that signal how the events and actions are connected.
Referential cohesion	Referential cohesion refers to overlap in content words between local sentences, or *co-reference*. Local cohesion is measured by assessing the overlap between consecutive, adjacent sentences, whereas global cohesion is assessed by measuring the overlap between all of the sentences in a paragraph or text.
LSA global cohesion	LSA shows how conceptually similar each sentence is to every other sentence in the text.
Connectives	This is the incidence of all connectives in a text such as causal connectives (because, so), logical (and, or), contrastive (although/whereas) etc.
Type token ratio	TTR shows type token ratio for all words. When the type-token ratio approaches 1, each word occurs only once in the text; comprehension should be comparatively difficult because many unique words need to be decoded and integrated with the discourse context. As the type-token ratio decreases, words are repeated many times in the text, which should increase the ease and speed of text processing.
Syntactic complexity	Coh-Metrix provides syntactic structure similarity between all adjacent sentences and all sentences and across paragraphs considering syntactical categories such as the mean number of words before the main verbs in the sentence, and mean number of modifiers per noun phrase.

Adapted from Coh-Metrix program website, 2012

Table 3-4. Coh-Metrix cohesion measures for the low and high cohesive texts

Cohesion measure	Low cohesive text	High cohesive text
Density of words	826	875
Text easibility		
Syntactic simplicity	31.92 (percentile)	71.23
Word concreteness	48.8 (percentile)	41.29
Referential cohesion	0.37	9.01
Referential cohesion		
Noun overlap	0.093 (mean)	0.197
Argument overlap	0.189	0.268
Anaphor overlap	0.039	0.015
LSA (Latent Semantic Analysis)		
Semantic overlap between sentences	0.095 (mean)	0.248
Semantic overlap between paragraphs	0.191	0.356
Lexical diversity		
Type token ratio	0.565 (all words)	0.462
	0.826 (content words)	0.623
Connectives		
Incidence score (Occurrence per 1000 words) for all connectives	89.588 (percentile)	92.571
Casual Cohesion*		
Ratio of causal particles (P) to causal verbs (V)	0.625 (mean)	0.32
Syntactic complexity		
Syntactic structure similarity between all sentences and across paragraphs	0.055 (mean)	0.066
Readability**		
Flesch Reading Ease	44.428 (percentile)	40.065
Flesch_Kincaid Grade Level	12.067	12.502
Coh-Metrix L2 Readability	5.811	7.146

Causal cohesion is measured by the ratio of causal verbs and particles in Coh-Metrix. The high-cohesion texts have a higher ratio, reflecting that the casual relations are more explicit in the high-cohesion text. Cohesion suffers when the text has many causal verbs (signifying events and actions) but few causal particles that signal how the events and actions are connected. With the exception of casual cohesion measures, all measures provided for the two texts in this study supported that the text "Will organic food fail to feed the world" has a high-cohesion level. The low-cohesive text had the higher casual cohesion level, but this was the only score showing its high cohesiveness compared to the other text. Expert evaluation of the text, along with additional measures, were considered in determining the cohesion level of the texts.

Latent semantic analysis is a statistical technique for representing world knowledge, based on a large corpus of texts. In this analysis, the conceptual similarity between any two text excerpts (e.g., word, clause, sentence, text) is evaluated by the very large corpus of texts across 100 to 500 functional dimensions. The *cosine* value between vectors is used to measure the similarity between excerpts. I provided two LSA measures for the texts, semantic overlap between sentences, and the paragraphs, which showed that the high-cohesive text has higher degree of global semantic similarity.

The type–token ratio is the number of unique words divided by the number of tokens of the words. Type-token ratios are computed for content words, and TTR scores are most valuable when texts of similar lengths are compared. When the type–token ratio approaches 1, each word occurs only once in the text; comprehension should be comparatively difficult because many unique words need to be encoded and integrated with the discourse context. In this study, the high-cohesive text had a lower type-token ratio considering all words, which shows that words are repeated many times in this text.

The *connectives* measure is an indicator of how well words and phrases are connected to one another (e.g., *when, such as, that is, consequently*). The connective

measure was a little bit higher in the high-cohesive text than the low-cohesive one, indicating that there are explicit ties used in both texts.

Finally, to support the text easibility measures, I focused on additional three measures: syntactic simplicity, word concreteness, and referential cohesion. The syntactic simplicity score was higher for the high-cohesive text, demonstrating that the text was syntactically simpler with familiar syntactic structures.

To summarize, based on Coh-Metrix results, the text *"Will organic food fail to feed the world"* had higher cohesion than the other one, "A Natural Obsession". It is necessary to note that this analysis is valid in terms of the comparison of the selected texts, and the use of only one method of analyzing text cohesion. After I modified the texts, three judges including the researcher analyzed the texts in terms of their cohesion level before the main data collection. One of the experts was a professor in the field of second language education and an expert in second language reading. The second expert was a doctoral student who is interested in meaning construction process as a researcher. They both examined the modified texts and Coh-Metrix results, and shared their ideas on the cohesion level of the text as well as their recommendations on the further modification of the texts as native speakers of English.

Pilot study 2

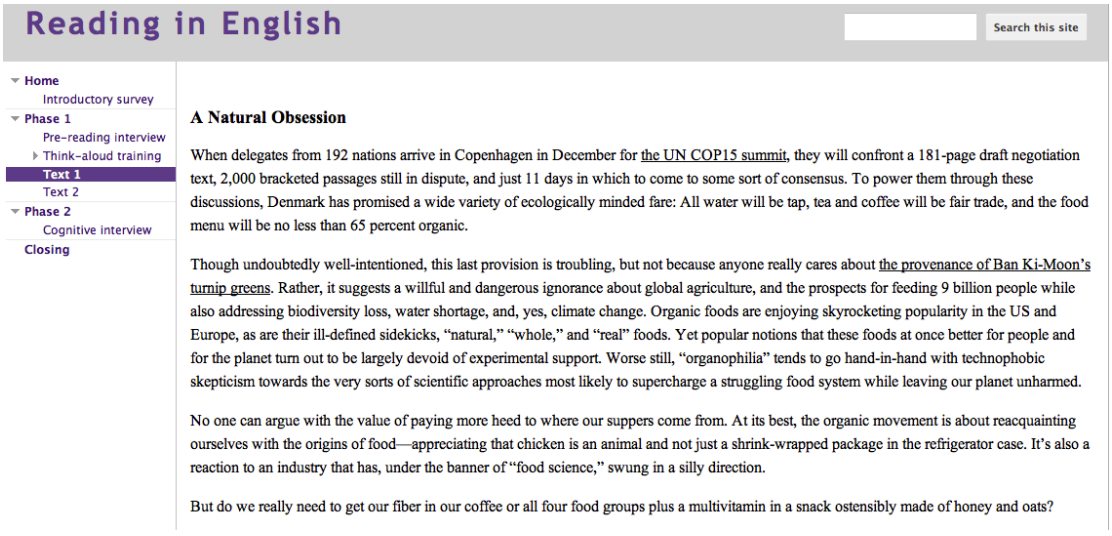
After I modified the selected two texts based on the measures received from Coh-Metrix and the feedback from the two experts, I conducted a second pilot study. Two students tested the texts and the methodology one final time before starting the real data collection with the selected participants. I made slight changes in the vocabulary selection of the low-cohesive text after the second pilot test, as the readers in the pilot study found a few words in the low-cohesive text very unfamiliar, which hindered their understanding of the text. The purpose of the text modification in this study was not to make the one text more difficult than the other one in terms of vocabulary or structure.

Thus, I replaced these words with those most familiar to and frequently by the second language readers.

Display of texts

The modified reading texts were inserted to the website designed for the study. The website included the modified texts as well as think-aloud training texts and short information about the study and the researcher (see Figure 3-1 for the sample screen shot from the website). Including all research information on a single website was helpful in terms of maintaining all materials in one location as well as for the effective transition between materials while recording the data.

Figure 3-1. Website screen shot



Data collection

Second language acquisition itself is a complex process. Because of its complexity, "it is not possible to investigate it from any single perspective" (Seliger and Shohamy, 1989, p. 22). Second language research design, the methodology used in the

research and the tools used to study specific context might vary depending on the researcher's focus.

Since I am looking at complex reading and meaning construction process in this study, I collected data from three major sources: (1) a pre-reading semi-structured interview; (2) think-aloud protocols; and (3) a post-reading task (cognitive interviewing) (see Table 3-5 for the process of data collection). As seen in Table 3-5, the study included two parts, which required two separate meetings with each participant. It took a total of 2 hours 45 minutes to complete – 2 hours for the first phase, and 45 minutes for the second phase.

Table 3-5. Process of data collection

Phase I (First meeting)	Time Period
Part I: Introduction	
1. Introduction and consent form signing	5 min
2. Pre-interview (for personal background information)	15 min
3. Think-aloud training	15 min
Part II: Think-aloud	
1. Read with think-aloud (low and high cohesive texts)	25 + 25 min
1.1. Read the text and think aloud (Verbal reports)	
1.2. Report meaning constructed from each paragraph/ every two or three sentences	
2. Active reading with think-aloud (low and high cohesive texts)	15 + 15 min
2.1. Read the text and think-aloud (Verbal reports)	
2.1.1. Underline text elements helping to make meaning	
2.1.2. Report what hinders you to make meaning	
Phase II: (Second meeting)	40 min
1. Post-reading task (Cognitive interviewing)	
1.1. Watching the readings (think-aloud products) with the researcher and reflecting back to the thoughts and actions	
1.2. Final comments on texts, text difficulty	
Total	2 hours 45 min

Table 3-5 shows the process of data collection including only the methods and timing. However, in grounded theory approach, the collection and analysis of data are

conducted almost simultaneously (Strauss & Corbin, 2008). In my study, I also conducted simultaneous collection and analysis process, but this chapter will present two important phases, data collection and analysis, separately (see Appendix J for the table that describes the process of grounded theory building in the study).

Data collection techniques

As seen in Table 3-5, in this study, multiple data collection methods were used to examine the reading process and to understand readers' perspectives: semi-structured pre-reading interview, think-aloud protocol (concurrent), and a post reading-reading task including cognitive interviewing. *The pre-reading interview* was conducted to gather information about readers' background including their second language level and use, reading interests, and language/literacy skills (See Appendix K for the pre-reading interview questions). The pre-reading interview was followed with *think-aloud protocol*, in which participants provided concurrent verbal protocols while reading the texts. In the *post-reading task*, participants watched their think-aloud recordings with the researcher to reflect back on their thoughts and actions that emerged in the think-aloud process. I asked questions to the participants using a *cognitive interviewing technique*. The cognitive interviewing technique is a verbal reporting technique similar to a face-to-face interview, but the interviewer does not always ask prepared questions and probes for other specific information relevant to the specific answer given (Willis, 2005). In this study, the purpose of cognitive interviewing was to receive further clarification on the participants' verbal reports provided during the think-aloud protocols as well as to learn about their perceptions on text cohesion.

The data from the instruments, interview and post-reading task was used to triangulate the interpretations from the think-aloud data analysis. This is intended to inform the main meaning construction processes of the readers.

Think-aloud protocol: Concurrent verbal protocols

To elicit L2 readers' processing behavior, I used a concurrent, think-aloud procedure (Bowles, 2010; Ericsson & Simon, 1996) in the study. Participants read the text for meaning and were asked to verbalize everything that was going through their minds while making sense of the texts, reporting the meaning, and making comments on their own processes.

Think-aloud protocols have been used extensively to gain insight into the cognitive processes and strategies learners use while reading in their L2 (e.g., Abbott, 2006; Nassaji, 2006). Ericson and Simon distinguish between verbal reports that require participants to verbalize their thoughts per se (non-metacognitive) and those that require participants to verbalize additional information, such as explanations and justifications (metacognitive). In the present study, I used both non-metacognitive and metacognitive verbal reports. I asked the participants to read the texts twice having two different think-aloud protocols: (1) reading with think-aloud, and (2) active reading with think-aloud. In the first reading, they read the text and only reported the meaning they got after two or three sentences or one paragraph (non-metacognitive). However, all other comments they made on the text, sentences, and structures in this first reading were also accepted as part of metacognitive verbalization. Reading for meaning is important for the effective examination of participants' comprehension process and their comprehension of discourse features (Swaffer, Arens, & Byrnes, 1991). So while asking the participants to read for meaning, I aimed to see how they link meaning and language use (e.g. discourse features).

Since this study questioned "what discourse items the participants are taking into account while constructing meaning from the texts that vary in degree of cohesion" and aimed to learn about readers' perspectives on text cohesion, it was necessary to collect more detailed, metacognitive think-aloud statements that would reveal the participants' justifications regarding the meaning construction process. Therefore, in the second

reading, I provided verbalization instructions for the participants that specify the level of detail that they were expected to provide. I asked them to read the text again and make comments on sections facilitating or hindering their comprehension. This allowed them to confirm their meaning construction with language from the text (metacognitive). (See Appendix L for the instructions used for both think-aloud protocols conducted in the study).

The quality of the think-aloud procedure for the study

Despite the frequency with which think-aloud protocols are gathered in language research, they have limitations and challenges in the implementation process such as reactivity, which might influence the validity of the study. This study used concurrent verbal reports and thus, raises potential threats to the validity of concurrent verbal reports (Bowles, 2010; Ericson & Simon, 1993,). The validity of concurrent verbal reports is questioned because it is not known whether the act of verbalizing while completing a task is reactive – i.e., presenting as an additional task and altering cognitive processes rather than providing a true reflection of spontaneous thoughts (Bowles, 2010). This challenge should be considered carefully when examining learner performance. Ericson and Simon's model (1993) predicts that verbalization of thoughts per se (non-metacognitive verbalizations) will be largely non-reactive; that is, they will reflect the nature of cognitive processes fairly accurately (Bowles, 2010), while slowing processing slightly. Furthermore, the model predicts that verbalization of justifications or additional specific information (metacognitive verbalizations) maybe more reactive, not only slowing processing but also potentially causing changes in cognitive processing. However, Ericson and Simon (1993) suggest that if the justifications or explanations that arise from verbalization would normally be produced in the process of solving the task, verbalization should not be reactive.

Several researchers questioned whether the assumption of non-reactivity is applicable to tasks in second language acquisition (Bowles, 2010; Yoshida, 2008; Bowles & Leow, 2005; Leow & Morgan-Shot, 2004). In her book, Bowles (2010) presented the results of a meta-analysis research on the reactivity of think-aloud protocols used in conjunction with verbal tasks. This meta-analysis was basically intended to answer the role of some factors causing reactivity such as (1) type of verbal report (non-metacognitive vs. metacognitive), (2) language of verbal report (L1 vs. L2 vs. combination of L1 and L2), (3) language of task (L1 vs. L2), (4) type of task (reading vs. writing), and (5) L2 proficiency (beginning vs. intermediate vs. advanced). The major findings of this meta-analysis were that thinking aloud while completing a verbal task had a small effect on post-task performance.

In her 2008 study examining the relationship between task type and reactivity of verbal reports in second language acquisition (SLA), Bowles concluded that metalinguistic verbalization lengthens the time participants need to complete the task and seems to hinder item learning. However, she stated that simply thinking aloud does not alter the basic underlying processes the study was set to investigate. Although Bowles (2010) suggested that more research is needed overall in examining reactivity, three factors she described – *type of verbal report, language of verbal report*, and *L2 proficiency* - were especially considered in the design of the current study's think-aloud protocol (see Table 3-6 for the main factors affecting the present study).

Bowles warns that performing an additional task such as thinking aloud with instructions might alter the meaning construction process. With this idea in mind, the current study used two different reading with think-aloud activities including one metacognitive and one non-metacognitive. Participants read the texts twice and were asked to have active reading with instructions in their second reading. The repeated reading with instructions in this study was designed to support and enrich the first-time reading, and also to find answers for the second research question about reader

perspectives. The present study asked readers to think aloud in their second language (L2), English. As Bowles stated, it might require more time for second language users to produce reports than it would to construct the meaning from the text. Most of the previous studies described by Bowles (2010) were conducted with either beginning or intermediate proficiency L2 learners. Thus, they can make generalizations only about the effects of thinking aloud on lower level proficiency. In the present study, the participants were highly proficient L2 readers. Therefore, it was assumed that the proficiency level of the target group might reduce the potential for possible reactivity because of language of verbal report in the current study.

Table 3-6. Factors affecting the quality of think-aloud protocols

Bowles's factors	Present study
Type of verbal report (non-metacognitive vs. cognitive)	Metacognitive and non-metacognitive
Language of verbal report (L1 vs. L2 vs. combination of L1 and L2)	L2
Language of task (L1 vs. L2)	L2
Type of task (reading vs. writing)	Reading
L2 proficiency (beginning vs. intermediate vs. advanced)	Advanced

Adapted from Bowles (2010)

Considering its possible limitations and also the results from the first pilot study, the think-aloud protocols were diversified as much as possible. The study allowed each reader to read the text aloud at first and report the meaning, and then read the text silently and make comments. There was no time restriction to complete the reading and tasks. The participants (adult and high proficient L2 readers) were able to read the text or text

segments several times if they found it helpful for their comprehension. Despite these precautions, the study does not claim that the process emerging in the think-aloud sessions is exactly the same as the cognitive and emotional processes the readers follow during their natural reading. As Ericson and Simon (1993) pointed out, the reactivity limit in this study depends not only on the instructions given, but also on the characteristics of the task and the study purpose.

Implementation of think-aloud protocol

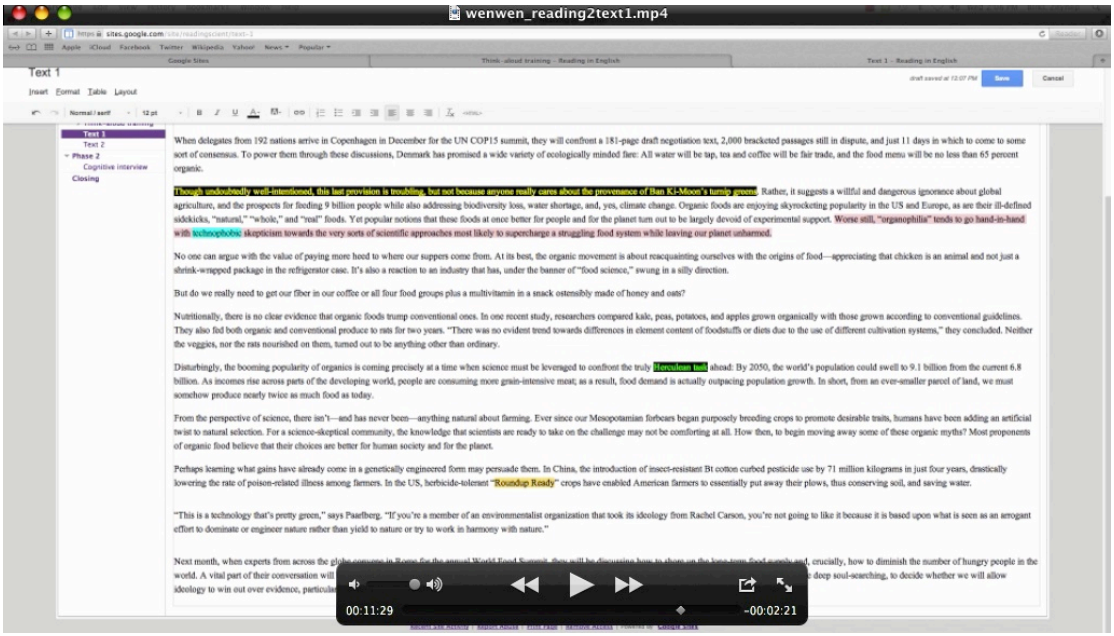
Considering the criticisms and the role of some important factors described above, this study employed the think-aloud protocol with highly proficient L2 readers. In this study, the verbal reports from the think-aloud protocols were taken as reflections of the conscious attention readers put forth during reading and indicated how they interacted with the text and text features during their comprehension process. Students read one high-cohesive and one low-cohesive text during the think-aloud protocol, and then shared the meaning they constructed from the text and also their thinking about the text.

I recorded the process using a technological research tool, Camtasia screen capture software, which allowed the recording of readers' interaction with the text including their highlights and written comments on the text. Camtasia is a tracking software program which records screen movements and all voices. It has the capability of recording and creating a movie file of each participant's computer screen, allowing one to play back the recorded session in its entirety (See Figure 3-2 for a sample screen capture from think-aloud process of a participant).

For the successful implementation of the think-loud protocol, I included a training session for each participant. For most of the participants, the think-aloud protocol is not familiar, therefore it was necessary to train them to know what they were expected to report. Bowles' (2010) data collection considerations about think-aloud were considered in the design of the training session and main data collection. Following the pre-reading

interview, participants received an explicit written explanation of the think-aloud procedure. In addition to this information, I also provided general information about how the participants' think-aloud sessions might contribute to the field of language research (Mackey & Gass, 2005). The written protocol: (1) provided a short description of what is meant by "thinking aloud", (2) provided instructions about how they should think aloud (e.g. the level of detail and reflection required in the think-aloud), and (3) included training during which participants practiced thinking aloud and had time to ask the researcher any questions about the process (See Appendix L for the excerpt of the think aloud instructions used in the pilot study).

Figure 3-2. Sample Camtasia screen capture



Post-reading task: Cognitive interviewing

In a post-reading task, the focus was on readers' perceptions of using text cohesion and textual features. I watched the recorded think aloud sessions before the second meeting to complete the cognitive interviewing. While listening to the verbal protocols of the participants, I wrote down some questions to ask during cognitive interviewing as well as highlighted the sections for which I needed further clarification from the participants (see Appendix M for a sample of prepared notes for the final task, cognitive interviewing). With the use of the screen capture software, Camtasia, I would be able to play some segments of the recordings back to the participants in the second meeting and they would be able to reflect back to their thoughts and explain their actions and meaning construction processes. For example, if there were sections for which the participants commented in detail on text cohesion, but did not explain it in the think-aloud session, then I led them to talk about it further by asking some questions. In this post-reading task, I used a verbal probing technique (Willis, 2005), one of the cognitive interviewing techniques.

Intensive verbal probing is a core verbal reporting technique that has been increasingly used by cognitive researchers (Willis, 2005). Assuming a face-to-face interview, the interviewer asks the target question and the subject answers it, but the interviewer then follows up by probing for other specific information relevant to the question or to the specific answer given. Table 3-7 presents sample probes under five categories, which are the sample questions I directed to the participants during cognitive interviewing. The first four categories were adapted from common cognitive probes by Willis (2005).

Probing is a varied and complex endeavor (Willis, 2005). In this study, I tailored specific questions to the specific content of each reader; however, a basic set of questions was also prepared before cognitive interviewing to ensure consistency among participants (See common questions section in the Table 3-7). Common questions are the

comprehension, interpretation and comparison questions directed to each reader in the study.

Table 3-7. Sample Cognitive Probes

Cognitive Probe	Samples
Comprehension/Interpretation Probe	What does the term "perennial" mean to you? What ARE the two DIFFERENT arguments the author discusses in this text?
Paraphrasing	Can you read the first two sentences of the second paragraph and tell me what you understand one more time?
Specific probe	You think that you got the meaning of this sentence but you say that the following one does not make sense to you. Why do you think that this sentence does not make sense to you? Is there something missing in this sentence or in this paragraph that hinders your understanding? While reporting what you understood from the last paragraph, and also summarizing the text, you were not sure what argument the author supports, and could not be sure if he is biased or neutral. What was the reason leading to this confusion? You skipped some words "nutritionally, disturbingly" while reading and also reporting what you understood. Why did you prefer skipping these words?
General Probes	How did you arrive at that meaning? What helped you to get the meaning in this paragraph? Could you please briefly explain the reason for the meaning you got after reading the third paragraph in the second text? Was that easy or hard to understand? I noticed that you hesitated to express your ideas on this section of the passage. Is this because you did not understand it?
Common questions	What does this last provision in the second paragraph refer to? Why does the author think that the last provision mentioned in the first paragraph, "use of organic products" is troubling? How did you find the introductory paragraph? Would you prefer to read a different introduction? How did you find the relationships between the paragraphs? Could you please compare these two texts? Do you see a big difference between the two texts in terms of your understanding?

Adapted from Willis (2005) common cognitive probes

The main goal of the post-reading task was to clarify the specific meaning construction process of the readers and their expressions during the think-aloud session. Therefore, using verbal probing, I would be able to focus on particular areas that appear to be relevant to the research problem (Willis, 2005).

Some concerns also exist for the validity of verbal probing techniques. For example, the misuse of probes may lead the participant to particular types of responses, which produces reactivity. However, it is not clear that verbal probing technique introduces any more bias than does the usual practice of asking questions (Willis, 2005). This technique helped me to delve into the think-aloud recordings. To encounter the validity issues in my study, I carefully selected non-leading probing techniques that minimize bias as suggested by Willis (2005). According to Willis (2005), probes should be characterized by unbiased phrasing. It is preferable to list all reasonable possibilities rather than suggesting one possibility that might affect the participant's answers.

Setting

Data collection including the think-aloud reading sessions was conducted in a small room in the Language Media Center at the University of Iowa, which includes a Mac computer with a network connection and the screen capture software, Camtasia. Think-aloud protocols were conducted with one participant at a time. I, as the researcher stayed in the room during the protocol, although I did not interrupt the reader nor ask any questions during the process. I preferred to remain present, as I wanted to give the instructions for each section separately and answer participants' questions. When necessary, I periodically reminded the participants to continue thinking aloud. This verification is important to ensure the validity of the studies using think-aloud protocols (Bowles, 2010). While conducting the think-aloud protocols, I opened the texts the participants were reading on my own computer and followed what they read, listened to their verbalizations, and took notes on the texts for each reader including questions to ask

in the subsequent section, cognitive interviewing. Although these notes represented impressions of the readers' text processing and were not based on formal scientific analysis, they were helpful in creating cognitive interview questions, and, eventually, in analyzing the data. They also served to help me understand and compare the process of each reader as an individual.

Transcription of the data

The data recorded from interviews (pre-reading and cognitive interviewing) and think-aloud protocols were transcribed using a transcription guideline developed for each section. The transcription was typed in the dialog format for the interviews. Table 3-8 shows the transcription format for the pre-reading and cognitive interviewing.

Table 3-8. Transcription guidelines for the pre-reading and cognitive interviewing

Turn taking	(R) for the researcher, and (student's name) for student
Pauses	(…..) 5 dots for long pause – (…) 3 dots for short pause
Overlapping speech	If the researcher and the participant speak at the same time, the researcher speech is presented brackets […] rather than using a new turn.
Non-verbal comments	[laughs] for the participants' laughs.
Font	Participants' speech in *italic* format.
Original text	Participants re-read of some sections of the original texts in the final cognitive interview are embedded in their comments in "…" in non-italic format.

Transcription included some basic marking features such as turn taking and pauses. The original textual sections to which the readers referred in their comments were also

included in the transcription of cognitive interviews by using brackets (See Appendix N for the complete example of transcribed interviews).

When I was transcribing the think-aloud protocols, my aim was to describe the think-aloud activity of the participants in detail (Charters, 2012). The participants' verbal reports were typed out as close to verbatim as possible. Transcription guidelines for the verbal protocols were developed with consideration for the think-aloud task requirements. Table 3-9 shows the transcription format for the think-aloud recordings.

Table 3-9. Transcription guidelines for the think-aloud recordings

Reread	Words, sentences or paragraphs the student prefers to reread are underlined.
Rthree	If the student reads a sentence more than twice, (Rthree) is typed in next to the sentence.
Participants comments	Participants' short comments are presented in brackets in italic format [*italic]*
High involvement and surprise	If the student displays high involvement or surprise on some specific part of the text, a word, phrase or sentence, they are presented between slashes /WORD/ or (!) exclamation point is used to mark the words
Pauses	(…..) 5 dots for the long pauses, and (…) 3 dots for the short pauses are used

As explained in detail in the data collection section, during the think-aloud protocol, each participant was required to read one paragraph or at least three sentences when the paragraph was too long to report the meaning. The verbal protocols were parsed into smaller units of meaning with consideration for the participants' pauses. These units (the readers' meaning reports and their comments) were embedded into the original text (Please see Figure 3-3 for the transcribed think aloud protocol).

Figure 3-3. Sample transcription for the think-aloud protocol

When delegates from 192 nations arrive in Copenhagen in December for the UN COP15 summit, they will confront a 181-page draft negotiation text, 2,000 bracketed passages still in dispute, and just 11 days in which to come to some sort of consensus. To power them through these discussions, Denmark has promised a wide variety of ecologically minded fare: All water will be tap, tea and coffee will be fair trade, and the food menu will be no less than 65 percent organic.

"Um.... ok, it's just an introductory sentence. I think the main thing, it's just, you know, hints that organic food is important but it's not about, I mean, all those, um ... projects and documents they're going to discuss. Ah..."

Though undoubtedly well-intentioned, this last provision is troubling, but not because anyone really cares about the provenance of Ban Ki-Moon's turnip greens. Rather, it suggests a willful and dangerous ignorance about global agriculture, and the prospects for feeding 9 billion people while also addressing biodiversity loss, water shortage, and, yes, climate change. *[*"*So here they, um, again, they list all those popular ecological topics but I'm not quite getting where they are heading.*"*]* Organic foods are enjoying skyrocketing popularity in the US and Europe, as are their ill-defined sidekicks, "natural," "whole," and "real" foods. Yet popular notions that these foods at once better for people and for the planet turn out to be largely devoid of experimental support. Worse still, "organophilia" tends to go hand-in-hand with technophobic skepticism towards the very sorts of scientific approaches most likely to supercharge a struggling food system while leaving our planet unharmed.

Data analysis

In qualitative research, data collection and analysis are not chronological stages in the research process but occur simultaneously and mutually influence one another from the time research begins (Glesne, 1999). In this section, I will describe the process of analysis in light of the grounded theory approach, which led me to conduct an iterative analysis, a recursive process with theories emerging as data is collected. I started analysis relating to first set of data collected. I analyzed multiple sources of data holistically for each reader using coding procedures from the grounded theory approach. In addition to the main data sources including the interviews and think-aloud protocols, I considered the notes taken during think-aloud task while analyzing the data and creating the codes. The multiple data sources were analyzed according to Strauss and Corbin's (1998; 2008)

description of open coding, axial coding, and selective coding (See Figure 3.4 for the process of data analysis).

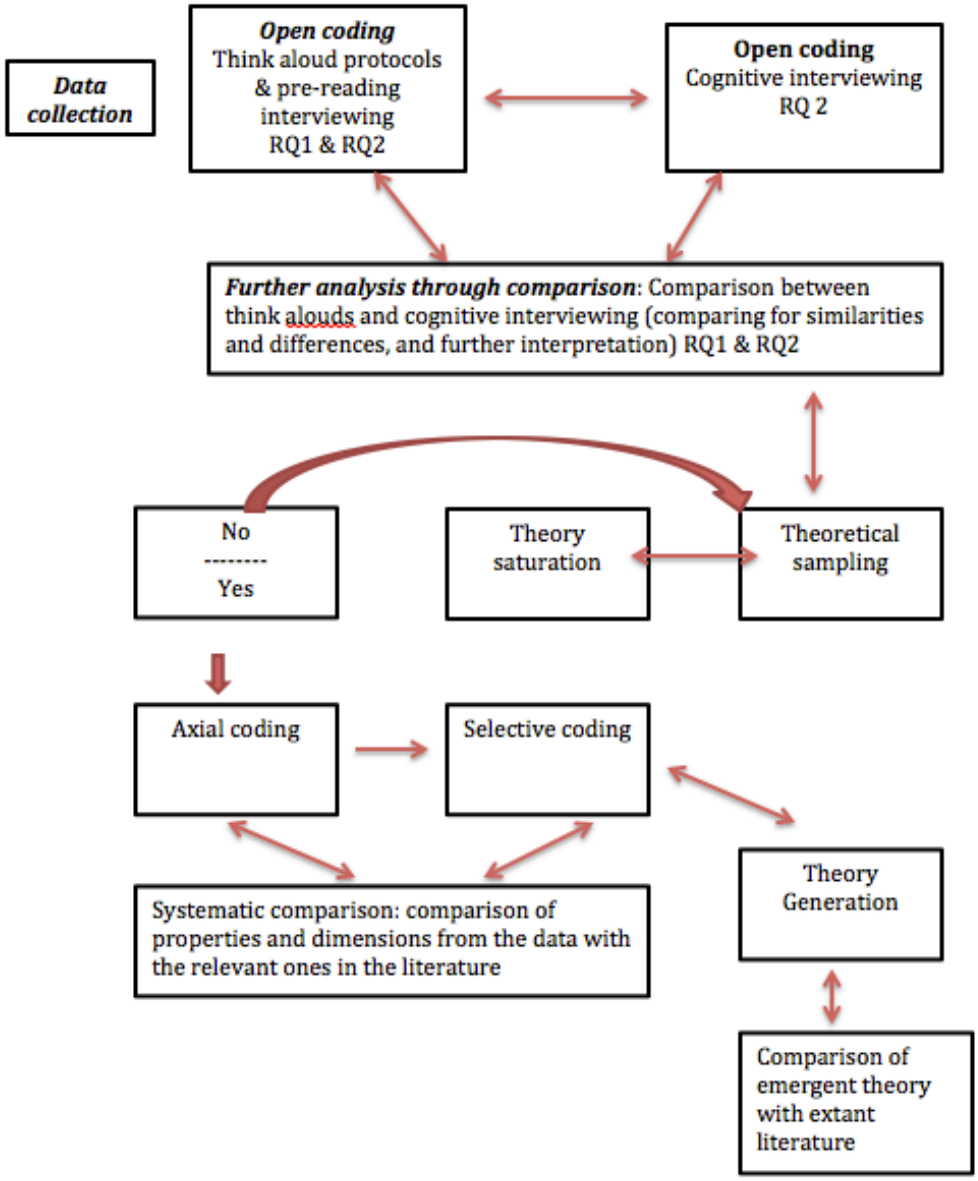
As seen in Figure 3-4, the think-aloud recordings were analyzed simultaneously with the data coming from the pre-reading interviews. After open coding was completed with the think-aloud protocols, open coding of the cognitive interview was conducted to explore readers' perceptions on their own reading processes (RQ# 2). Then, the data from all three data collection sources were further analyzed through comparison. This analysis was conducted to determine similarities and differences across the data sources and to triangulate interpretations from the think-loud analysis.

Open Coding

Open coding is the analytic process through which concepts are identified and their properties and dimensions are discovered in data (Strauss & Corbin, 2008; 1998). During open coding, I broke down, examined, compared, conceptualized, and categorized the data. Open coding began with a line-by-line analysis of the transcripts, which generated conceptual labels regarding research question 1 and its sub questions - the readers' reading process and their use of text cohesion while constructing meanings. I first identified the similar text processing activities of the readers. Conceptual names were first noted in the texts.

Line-by-line analysis was followed by whole sentence and paragraph coding using guiding questions offered by Strauss and Corbin (1998; 2008) (e.g. What is the major idea brought out in this sentence or paragraph?). Some questions turned out to be productive for me, leading to answers, and raising important issues. I also constructed questions that would lead to answers which would serve the development of theoretical formulation. After whole sentence and paragraph coding, I categorized the processing activities of the readers under a common heading by using "act of naming" (Strauss & Corbin, 1998, p. 62) (See Appendix O for the sample line-by-line analysis of the data).

Figure 3-4. Process of data analysis



Adapted from Strauss and Corbin's data analysis process description (2008)

During open coding, coded text was organized into Excel coding sheets with the code name followed by instances of the particular code labeled beneath. These sheets organized the numerous sources of data as well as facilitated the categorization of codes

into conceptual categories (See Appendix P for the sample Excel grouping extracted from the big Excel file created during open coding). I collected information about the qualitative data analysis software (e.g. Nvivo) based on scientific articles (e.g. Auld et. al, 2007; Welsch, 2002; Bringer, Johnston & Brackenridge, 2004). After learning the software, I found it useful for the interview analysis, but not for the analysis of the verbal protocols and the cognitive interviewing task that included different questions for each participant in the study. It would be difficult for me to group categories and samples in the software considering all different questions; therefore, I decided to use Excel for the holistic analysis of my data. Excel's structure, data manipulation and display features were all appropriate for the analysis of my data.

Axial coding

Once concepts begin to accumulate, during *axial coding*, I categorized the numerous initial codes and concepts into larger conceptual categories by "making connections between a category and its subcategories" (Strauss & Corbin, 1998, p. 124). This resulted in the development of broad conceptual categories describing how readers use text cohesion and whether they benefit from text cohesion while making representations of the low- and high-cohesive texts. Grouping the readers' text processing activities under a common classification during axial coding did not show that they were exactly the same. Some of them shared common characteristics, and these related meanings enabled them to be grouped. By grouping concepts into categories, I reduced the number of units with which I was working. These categories had analytic power later because they had the potential to explain and predict the processing activities of the readers (see Appendix Q for the sample Excel coding including categories created during axial coding).

Selective coding

Once I had a manageable number of broad conceptual categories, I began *selective coding* to relate the broad conceptual categories to each other in order to perceive patterns and relationships. Finally, I selected a main category or "core category" related to all other categories (Strauss & Corbin, 1998; 2008) (See Appendix R for the final Excel file created during selective coding). Using the grouping created in Excel, I selected main themes (e.g. local level of processing) and grouped these final categories with the core matching processing activities of the readers and marked the processing differences the readers displayed depending on the cohesion level of the text. These reader processing activities were the primary guide for creating the main themes of the study.

Systematic comparison technique

In addition to these analytical techniques, I also used one of the *systematic comparison* techniques Strauss and Corbin (1998) suggest to facilitate analysis-systematic comparison of two or more phenomena. This means comparing an incident in the data to one recalled from experience or from the literature. The purpose of this comparison is to sensitize the researcher to properties and dimensions in the data that might have been overlooked. The researcher compares concepts and this might be close in (similar in nature to the concept the researcher wants to explore) or far out (dissimilar to the concept under exploration). I used a comparison technique to compare concepts which emerged across multiple data sources, and also to compare emergent theory with extant literature. The comparison technique also helped with naming the categories. While naming the categories, some names arose from concepts discovered in the data, from my own perspective as the researcher, and from the focus of my research and the research questions. However, some names came from the literature such as very strong

concepts coming with established analytical meanings (e.g., inferencing). They have proven relevance to my study as having emerged from the data as well.

Issues of Credibility, and Trustworthiness

Like rationalistic studies, naturalistic studies must account for validity, reliability, objectivity and generalizability. Guba & Lincoln (1994) propose that these rationalistic terms can be translated into terms more suitable for naturalistic studies, respectively; credibility, dependability, confirmability, and transferability. This section will discuss two terms - credibility and transferability- that apply to this qualitative research study.

In order to ensure the credibility of my data analysis and interpretations, I collected and analyzed multiple data sources in order to triangulate my data and build an in-depth understanding with rich descriptions of the phenomenon being studied. Multiple data collection methods create "overlapping data" which cross-validate one another (Creswell, 2007; Guba & Lincoln, 1982). In my study, I triangulated the data as well as using the iterative, recursive process of grounded theory to assure that my findings were data driven. Peer review provided an external check of my research process. Coding was checked with a co-rater who has experience in meaning construction processes, and educational research. I also conducted member checking to assure accuracy in how participant views were represented.

To enable readers to transfer information to other settings and to determine whether the findings can be transferred, I applied several different techniques. I provided rich and thoughtful descriptions of the data collected in the study. I illustrated the findings presented in the Results chapter with numerous examples from the data. With the use of theoretical sampling in the framework of grounded theory, I could confirm whether further data is needed to support the initial results. In the Discussion chapter, I integrated my findings with previous research conducted in the field and in this way; I could provide clear connections and synthesis.

Summary

This exploratory, descriptive, qualitative study examined highly proficient L2 readers' meaning construction process from the texts with varying degrees of cohesion. My main question was: How do highly proficient L2 readers construct meaning from texts which vary in degree of cohesion and use discourse features that contribute to cohesion while constructing meaning from these texts? This main question and its sub-questions were investigated through multiple qualitative research methods and techniques, including think-aloud protocols and interviews (semi-structured and cognitive interviews). The multiple data sources were analyzed using a grounded theory approach (Corbin & Strauss, 2008; Strauss & Corbin, 1998). The data was analyzed according to Strauss and Corbin's (1998; 2008) description of open coding, axial coding, and selective coding. This led to the development of a grounded theory of the meaning construction process which, addresses the meaning representations of L2 readers from the low- and high-cohesive texts while specifically considering readers' perceptions over their own meaning construction processes.

CHAPTER IV

RESULTS

This chapter presents the results of the data analysis addressing the two research questions that guided the present study:

RQ#1: How do highly proficient L2 readers approach text cohesion and use discourse features that contribute to cohesion while processing texts written in their second language, English?

1.1 How do they construct meaning representations in low-cohesive and high-cohesive texts?

1.2 What discourse features do they use while building meaning representations from reading low-cohesive and high-cohesive texts?

RQ#2: How do these readers perceive text cohesion and its effect on their own meaning representation and construction process?

The results of the study are reported in three major parts – reader profiles, meaning representation process resulting from low- and high-cohesive texts, and reader perspectives- corresponding to the core aspects of the reading and meaning construction process: readers, texts, and processing activities addressing the interaction between readers and texts (reading situation). (See Table 4-1 for the outline of the presentation of the study results). The detailed description of the readers is presented in the first section. Then, the meaning representation process of these readers is discussed to answer the first research question (RQ#1) and its sub-questions (RQ#1.1 and RQ#1.2). Processing activities emerging in this study show that the reading process of the participants is not linear. There are interrelationships between the levels of processing, textual features, and L2 readers' characteristics. Therefore, although the writing is presented in a linear way in this chapter, the content of each section relates to the other sections. For example,

readers' perspectives on text coherence, referring to the second research question (RQ#2), are also discussed as part of the meaning representation process. Finally, participants' shared and individual perspectives on the texts and on their meaning representation process are summarized to answer the second question and provide a synthesized conclusion to this chapter.

Table 4-1. Outline for the presentation of the study results

Readers	Meaning representation process from low and high cohesive texts (RQ 1, RQ 1.1, RQ 1.2)			
Participant (L2 readers) profiles ⇒	Levels of processing	Processing differences & similarities (RQ 1.1)	Benefit from discourse features (RQ 1.2)	Reader perspectives (RQ 2) ⇐
Readers as collectors of meaning Readers as creators of meaning	Local level of processing Global level of processing Maintenance of information Integration of information Inferencing	Engagement toward building coherent representation Transformative and evolving representation Level of inferencing and integration	Explicit discourse features benefitted Implicit discourse relations benefitted Discourse features ignored or omitted	Shared and individual perspectives

Participant Profiles

Current reading theories focus on the interaction between the text and reader, assuming that the reader has a direct influence on the selection of features for processing (Bernhardt, 2011; Nassaji, 2003, Zwaan, 1996). This view is helpful toward conceptualizing how the reader accepts the input and constructs meaning, and how the mixture of both, input language and reader processor, brings about an understanding (Bernhardt, 2011). For the context of this study, the act of reading also refers to how the reader processes written text and how that processing brings about a conceptualization of

what is written. Therefore, it is important for the results of this study to describe the readers' characteristics.

A total of nine international graduate students participated in the study. Basic information regarding each participant is presented in Table 4-2. This basic information reflects each reader's current status as a student and language background based on the information gained from the introductory survey.

Table 4-2. Basic information on participants

Grouping	Name	Major	First language	TOEFL
Collectors of meaning	Ali	Pharmacy	Arabic	93
	Jessie	Biomedical Engineering	Korean	IELT
	Wenwen*	Teaching Chinese as a Second Language	Chinese	100
	Xiaolin	Educational Measurement and Statistic	Chinese	100
	Huyen	Urban and Regional Planning	Vietnamese	103
Creators of meaning	Natasha	Sociology	Russian	117
	Akash	Computer Science	Hindi	116
	Kerem	Physics	Turkish	98
	Nan	Educational Measurement and Statistic	Chinese	112

* Wenwen had been a graduate student in a non-language related program before starting her new program Teaching Chinese as a second language. This is her first semester in her new program.

As seen in Table 4-2, the study included a diverse group of participants in terms of their first language background (1 Hindi, 1 Turkish, 1 Arabic, 1 Korean, 1 Vietnamese, 1 Russian, and 2 Chinese), and their professional fields (5 students from social sciences and 4 from science field). Their TOEFL IBT scores ranged from 93 to 117 for the total test. Only one participant, Jessie, took the IELT test for her Master application which met

the admission requirements for her current doctoral program. Table 4-2 also includes the categorization of readers: (a) readers as collectors of meaning, and, (b) readers as creators of meaning, which is based on the readers' verbalized thoughts revealed during the think-aloud protocols.

Although the participants selected for the study are all advanced level L2 readers, and meet the study's participant selection criteria (e.g. TOEFL scores), the analysis of the data generated some clues that led to the grouping of the readers. The two reader categories and the characteristics of the readers determining each category are described in the following section. This section also provides profiles from each participant as a second language reader based on the information gained from the interviews in which the readers were asked about their personal reading experiences and interests.

L2 readers as "collectors of meaning" or "creators of meaning"

In this study, each participant is accepted as a person with a view. The participants are all highly proficient readers as graduate students who use academic English actively for learning, teaching, and conducting research in a US university. They all have the ability to process linguistic features while trying to comprehend content of the high-level texts in their own fields and assess the content's accuracy. However, the emerging data show that at this level, there is still diversity in approaches to the reading process.

Based on the analysis of think-aloud protocols and cognitive interviewing, two groups of readers emerged in the data: (a) readers as collectors of meaning, and (b) readers as creators of meaning (Table 4-3 on page 95 presents the summary of comparative features of two groups of readers).

Readers as collectors of meaning

All readers, including first and second language readers, are collectors of meaning, as text processing in any case involves the transmission of meaning from the author to the reader via the text. However, in this study, readers' engagement level with the text was not exactly the same across the readers. The first group, "collectors of meaning" tended to be more involved with processing what the text is telling and thus mostly drew on textual knowledge while constructing meaning. They used their own knowledge and gained knowledge from the text limitedly in the reading process. The following example is a good indicator of Ali's propensity for text-based processing while extracting meaning from the low-cohesive text: *"This paragraph, uh, is talking about the, uh, type of the farming or adding the scientists to the farming. It says scientists tried to use some artificial and they say it's not easy to make, um, organic food."* As seen in the example, the readers attempted to gain a literal understanding of the text by making connections between intersentential sentences[5] and repeating the content words from the individual sentences. Especially while reading linguistically and semantically complex sections of the texts, they attempted to make simple paraphrases of the sentences or to only identify the topic based on repeated or familiar content words. In the following example, Xiaolin attempted to build the gist of the paragraph by listing the isolated meaning units and using the content words she is familiar with. The bold words in the example are the key content words and the sentences Xiaolin copied from the text in constructing her meaning representation, which is not coherent and complete overall.

[5] The processes of readers in the collectors of meaning category differed slightly between the first time and repeated reading of the text. This will be explained in the following section, meaning representation process.

Original text	Xiaolin's representation
When delegates from 192 nations arrive in Copenhagen in December for the UN COP15 summit, they will confront a 181-page draft negotiation text, 2,000 bracketed **passages** still in **dispute**, and just 11 days in which to come to some sort of **consensus**. To power them through these discussions, Denmark has promised a wide variety of ecologically minded fare: All water will be tap, tea and coffee will be fair trade, and the food menu will be no less than 65 percent organic.	*"Hmmm in this paragraph I think I learnt that hmmm there is some* ***passages*** *doing* ***dispute*** *and there is also some sort of* ***consensus*** *and* ***Denmark promised wide variety of ecologically minded fare. The food menu will be 65% organic****".*

The extra focus of the "collectors of meaning" on understanding the individual words and sentences does not mean that these readers cannot reach the global gist of the text. The collectors of meaning could recognize the main ideas, but showed less evidence of integration in their overall representation from the text. They used less elaboration, and generated fewer inferences compared to the "creators of meaning," and their text summaries included isolated meaning units extracted from different paragraphs. The inferences they generated were mostly bridging inferences to overcome the meaning representation difficulties they have engaged with in the local level, processing of the individual sentences[6]. In the following example, Ali focused on the semantic context (e.g., the word "troubling" in the original text) to make inferencing while explaining the main idea of the paragraph. *"The author talk in this paragraph about the difficulty of the discussion or argument."* Using the negative words "troubling," "dangerous," and "rather," he could represent the negation mentioned in the paragraph, but his word-based bridging inferencing did not help him construct a coherent representation reflecting the

[6] The processing differences across the readers including their information integration and inferencing activities will be discussed in the following section, meaning representation process, in detail with further examples.

details of the paragraph. Similar processes have been detected in the creators of meaning, but rarely.

The task demands (e.g., think-aloud requirements including reading aloud and reporting aloud in English) and textual issues also influenced the comprehension level of collectors of meaning. Jessie commented on her own process while addressing the differences[7] between the two texts. *"I think the first text requires us more effort on focusing on every sentence. I mean it requires me having deep communication with the author."*

Profiles: Collectors of meaning

Ali

Ali, who studied at an English medium university in Iraq, continues his graduate study in Pharmacy in the U.S. He prefers to complete his academic readings in English. *"In my area I don't prefer reading in Arabic because you know many terms in Arabic does not give the real meaning."* He mentions that he does not have difficulty reading in English, but rather expresses difficulty in recalling information from a text rich with details. He describes himself as a good reader, but accepts that he is a slow reader compared to native speakers, as he tends to look at words in the text to ensure the accuracy of the meaning. Since he switched to a new discipline in Pharmacy in the U.S. in which he does not have much background knowledge, he also had difficulty understanding technical terms in texts.

[7] The changing representation of the readers between the two texts will be discussed in the following section, meaning representation process.

Jessie

Jessie began to study Biomedical Engineering after she completed her Master's degree in the U.S. She believes that her lack of background knowledge on neuroscience, her new field in graduate studies, negatively influences her comprehension. She prefers doing her academic readings in English, but her problem is not only understanding the text, but also explaining what she understands. She also describes herself as a slow reader compared to natives, and finds this as a disadvantage, as her reading speed leads to delayed comprehension. Skimming and making predictions about the text facilitate her understanding of texts. *"I first skim and trying to understand what is the primary purpose of the research except the difficult terminologies and then trying to narrow down to find what is specific meaning for the later."*

Huyen

Huyen did not use English as an academic language until she arrived in the U.S. to pursue a master's degree in Urban and Regional Planning. However, she possesses previous experience with academic English from conducting research and taking online courses in English. She has difficulty in reading texts with "difficult content," which she thinks affects her reading speed. She thinks that the characteristics of the text, rather than the language, also affect her comprehension. "*I think it is writing style. There are many essays so much verbal the writing style is not so concise and sometimes they use kind of so much big words, sort of in GRE words. It is kind of like literature not scientific. I want it to be more systematically organized."* She also defines herself as a slow reader compared to her native friends. She accepts that the strategies she uses (i.e. scanning) do not always help her build the meaning.

Xiaolin

Xiaolin studies Educational Measurement and Statistics. She is familiar with academic English from the college she attended in China. She prefers to complete her

academic readings in English. Especially in the courses requiring a lot of reading and interpretation, she finds that her reading performance is slower, especially compared to native English readers. She prefers to read texts with clear statements. *"I think also the structure of the paragraph if it is written very clearly then I can follow and also there is conjunction words like although but so I can just focus on that."*

Wenwen

After one-year of study in Educational Psychology, Wenwen transferred to her current program, Teaching Chinese as a Foreign Language. She describes herself as a slow reader compared to native English readers. Wenwen thinks that there are several different factors that affect her comprehension and slow down her reading, for example, structure and length of the sentences in texts, unfamiliar vocabulary, organization of texts, and her knowledge of the topic. "*So much limitation in my reading and also affect my comprehension. I always like return back to previous row, words that kind of hard to understand and sometimes it makes me like hmm easily to be distracted by other environment… And some authors, they have not this continuous explanation of the content in the specific field. They just jump from here to here so I just don't quite get the important point. It is like that after reading the book I cannot remember what I read."*

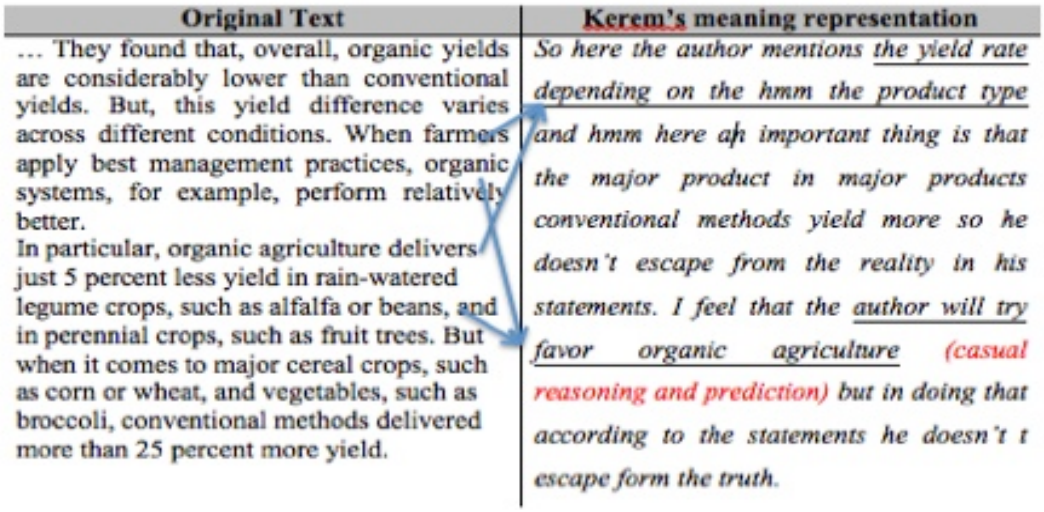
Readers as creators of meaning

The readers in this study categorized as "creators of meaning" are still collectors of meaning, as they also need to collect text input before constructing meaning. However, while making meaning representations from the texts, these readers exhibit some additional processing, which goes further than the meaning representation process displayed by the collectors of meaning. During their reading of the texts, these readers demonstrated more active negotiation with the text, which resulted in a constructed meaning. This was related to their use of different knowledge sources, including domain knowledge and experiences, in addition to the textual features and their linguistics

knowledge. In the following example, Natasha supported her text-based processing with personal questions and comments, which helped her arrive at an accurate meaning. *"They explain the nature of organic, of farming pretty clearly in the second paragraph. Ah, I think it's interesting that the usage of "is meant to" in the second sentence so they, um, let us know that it is the intention but it's not clear whether their intention is fulfilled."* This characteristic, questioning the intention of the author, was advantageous for the creators of meaning. It led the readers to look for the answer to the questions in subsequent paragraphs, which overall improved their information integration between text ideas. While constructing the meaning, these readers frequently attempted to build associations between the text knowledge and their domain knowledge. In the following example, Akash associated the text knowledge with his world knowledge (business), and constructed meaning based on his inductive reasoning.

> Probably the discussion is not solely about organic or conventional food for growing human population, but it's about management. I would like to add a word here called "management" um, this is the key word that sums up the entire paragraph.

Although all readers in the study used some reading strategies to construct the text's meaning, "creators of meaning" had better strategic control, such as retrieval strategies and activating schema to connect different parts of the text. Similar to the collectors of meaning, they also made inferences based on easy sentences or content words from the text, but they produced more original paraphrases and knowledge-based elaborations. The following meaning extraction of Kerem showed how he used inferences to integrate information between text segments. Kerem used the text knowledge from the previous paragraph to construct the meaning of the current paragraph and then made predictions about the author's argument that will be clarified in the rest of the text. When he said, "*the author does not escape from the truth,*" he meant to address the objectivity of the author in presenting the argument. In this way, he referred to the low-cohesive text's author's way of presenting the argument less objectively.



Original Text	Kerem's meaning representation
… They found that, overall, organic yields are considerably lower than conventional yields. But, this yield difference varies across different conditions. When farmers apply best management practices, organic systems, for example, perform relatively better. In particular, organic agriculture delivers just 5 percent less yield in rain-watered legume crops, such as alfalfa or beans, and in perennial crops, such as fruit trees. But when it comes to major cereal crops, such as corn or wheat, and vegetables, such as broccoli, conventional methods delivered more than 25 percent more yield.	*So here the author mentions the yield rate depending on the hmm the product type and hmm here ah important thing is that the major product in major products conventional methods yield more so he doesn't escape from the reality in his statements. I feel that the author will try favor organic agriculture (casual reasoning and prediction) but in doing that according to the statements he doesn't t escape form the truth.*

As seen in the examples, creators of meaning have not been restricted to the verbal domain in the texts while explaining their constructed meaning. They created the meaning using both the text knowledge and their domain knowledge, producing concise, but coherent summaries rather than repeating the main ideas from each paragraph.

Profiles: Creators of meaning

Natasha

Natasha did not use English for academic purposes before coming to the U.S. to study sociology. She prefers studying academic readings in English. "*So strictly speaking there is no sociology in Russia so there is no sometimes there is no correct word in Russian."* She describes herself as a slower reader compared to the native English readers in her program, but not slower than native readers out of academia. She believes that her reading rate does not influence her understanding. According to Natasha, her comprehension problems, which she rarely encounters, are related to the author's style. "*If anything impairs my understanding it is not language."* She thinks that her familiarity with the topic is important for her understanding, the lack of which would lead her to word-based processing to understand the concept.

Akash

Akash is working toward a master's degree in Computer Science. He became familiar with academic English in the college he attended in India. He likes doing all of his readings, including daily ones in English. *"I like reading in English - -- 99 percent in English – I feel more comfortable."* He describes himself as a good reader. Similar to Natasha, he thinks that the difficulties he gets in reading are not because of his language knowledge, but because of the author's text construction. *"It does but not because of the language it's more about the concept and how the author decided to present it."* He likes brevity and clarity in the texts. *"I think there are some words that represent the particular situation perfectly. For example, you are feeling disturbed there is a word - discombobulate."* He also states that the lack of knowledge on the text topic hinders his comprehension despite the appearance of key words.

Nan

Nan studies Educational Psychology. She prefers to read the academic texts in English, especially if the author of the text is native English speaker. She also describes herself as a slow reader compared to native English readers. "*The native speakers need to read one time but for me I need to read it like three or four times to understand."* She believes that the organization of the text, vocabulary, and examples set by the author are important aspects influencing her understanding. *"I cannot follow something if I don't understand what he is talking about."* She prefers brief and clearly written texts, rather than verbose ones. *"You can describe the things in one sentence. Sometimes you should stop."*

Kerem

Kerem studies Physics. He prefers doing his academic readings in English, as this has been how he studied Physics for years. Although he mentions his high level understanding ability, he emphasizes that native English readers understand the texts

better than him, not only faster. He states, *"It is motivated intuitively I mean when they say that word hmm some intuitive background is in the process for natives. That doesn't exist in me."* He thinks that the comprehension difficulties he experiences in reading are mostly related to the topic and the author's style. *"If I find an explanation better it is because the author understood it well so this is not directly related to English or language differences."* He states that authors' overestimation on the readers' knowledge of the topic also diminishes his comprehension. "*They sometimes they assume that you know some stuff and that's the problem. And moreover which part is more important differs from person to person."*

Table 4-3. The summary of comparative features of two groups of readers

Processing activities	Collectors of meaning	Creators of meaning
Text-based processing	More involved with processing what the text is telling	Text-based processing enriched with experiences and knowledge based elaborations
Information integration	Less information integration leading to less efficient overall understanding	More information integration leading to more efficient and coherent overall understanding
Inferencing	Less knowledge based elaborations, and fewer inferences, mostly local level bridging inferencing to overcome linguistics difficulties	More text-based inferencing ability and knowledge-based elaborations
Paraphrasing	More restricted to the text domain, and more repetitions	Less restricted to the text domain, more efficient summarizers
Causal reasoning	Limited use of causal reasoning and generalizations based on gained knowledge	More causal reasoning mostly leading them to coherent meaning constructions
Using domain and gained knowledge	Use of domain knowledge, and gained knowledge limitedly	More use of world knowledge and gained text knowledge
Accuracy of expressions	Sometimes false interpretation of complex expressions, and inferences	Mostly accurate paraphrasing and inferencing

Table 4-3 summarizes the basic contrasts between the two groups of readers in this study. (See Appendix A for the definitions of key terms presented in Table 4-3 and throughout Chapter 4). The table first lists the processing activities the readers displayed while reading the texts and then shows how these activities differed across the two groups of readers, which overall led the development of the categorization between the participants of the study. Similar processing activities and emerging differences across the readers will be discussed in detail in the following section, meaning representation process.

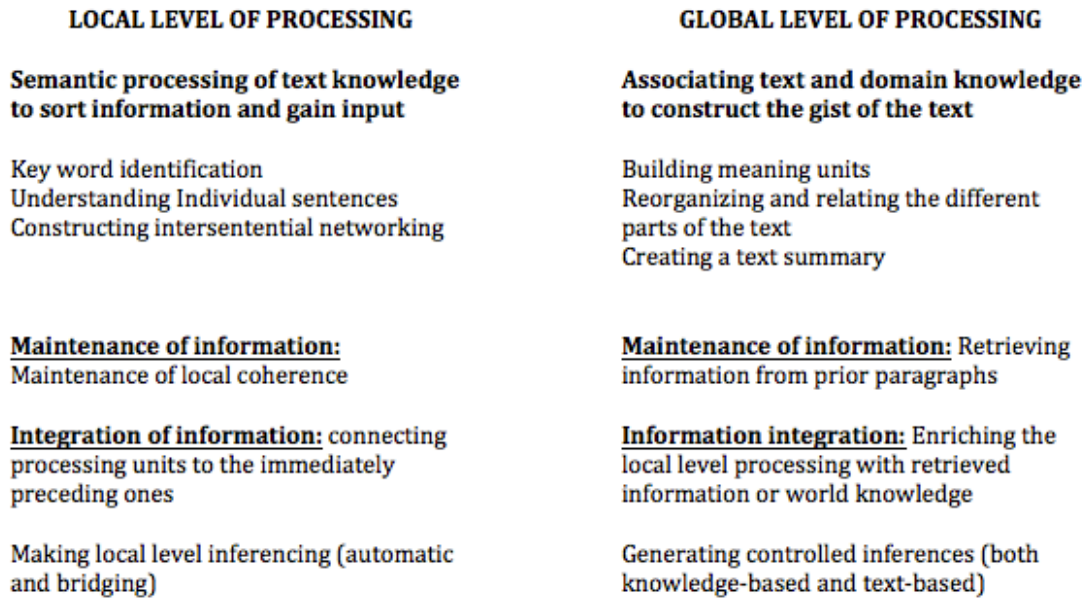
Meaning Representation Process

Addressing the first research question of the study (RQ#1) and its first sub question (RQ#1.1), in this section, the meaning representation process of the L2 readers participating in the study will be described considering the interrelationship between the readers' characteristics described above and the cohesion level of the texts. As described in Chapter 2, most researchers who investigate text comprehension talk about multiple levels at which readers mentally build meaning representations (Graesser, McNamara, & Louwerse, 2003; Kintsch, 1998; Kinstch & Rawson, 2005). Kintsch (1998) describes text comprehension specifically as an involving processing at different levels. With some consideration of these previous text processing models and the emerging categories in the data, two main levels were developed to explain the meaning representation process of the L2 readers in this study: *local* and *global level of processing*. Figure 4-1 illustrates the meaning representation process emerging in two different levels as well as providing sample-processing activities L2 readers displayed for each level.

The L2 readers' processing leading to meaning construction was a *nonlinear process* that differed across the readers depending on the reader factors and the text cohesion level. There were interrelationships within the parameters of *local level processing* and *global level processing*, and the network of created meanings -

integration process. There were two basic processing activities emerging in both the local and global levels as the readers attempted to build meaning: maintenance of information, and integration of information supported with inferencing.

Figure 4-1. Levels of meaning representation process described in the study



Local level of processing

As stated above, the two levels, local and global levels of processing, are not entirely different representations of the text content. The local level of processing was fundamental and necessary for the successful transition to the global level of processing. However, each level had its own distinguished features as well. The local level of processing in this study implied the linguistic and semantic processing of the text, including key word identification, establishing local level causal relationships, understanding individual sentences, and skimming for important information and prediction.

Keyword identification

Although the think-aloud task in the study asks the readers to read the entire paragraph or at least three consequent sentences before reporting the meaning, most of the readers, except Natasha, Kerem, and Nan, tended to first understand the key words that make up the text, and individual sentences, and then build intersentential networking using semantic components (i.e. content words) they selected. In the following example, Jessie's meaning construction from the second paragraph of the low-cohesive text includes content words in the original text. For example, she uses the words "trouble" and "problem" similar to the content word "troubling" in the original text.

Original Text	Jessie's meaning representation
Though undoubtedly well-intentioned, this last provision is **troubling, but not because** anyone really cares about the provenance of **Ban Ki-Moon's** turnip greens. Rather, it suggests a willful and **dangerous ignorance** about global agriculture, and the prospects for **feeding 9 billion people** while also addressing biodiversity loss, water shortage, and, yes, climate change.	*"So there is something they have a* ***discussion*** *about* ***trouble*** *I mean they discuss about the* ***problem*** *but* ***this is not the because of Bankimoon the important reason*** *we* ***ignore*** *the and we* ***ignore the dangerous*** *like* ***feeding 9 billion people****".*

She also sticks to the connectives (e.g. rather) while identifying the argument in the paragraph and shows this argument in the meaning she constructed. In this way, she implies that she understood the oppositeness between the two ideas discussed in the succeeding sentences. However, the overall meaning she constructed from the paragraph does not include activation of associations between the content words, which finally hindered her full understanding of the section.

The readers' processing of the surface features in the text content, especially in the introductory sections of the text, was likely, as they might have the purpose of sorting

information and gaining input about the text before constructing the gist of the text. Other readers' meaning representations were not exactly the same as Jessie's, but all readers used the key words to construct their own meaning. In the cognitive interviewing following the think-aloud protocols, the readers emphasized the importance of key words in their understanding. Nan said, "*The vital part of organization maybe key word for me."* Unlike collectors of meaning, creators of meaning used these words as an active part of their inferencing process (This will be explained and sampled in the "inferencing" section).

Causal relationship establishment

In addition to the use of content words, the readers also used logical implications especially *causal relationships* to establish connections between text segments at the local level. They directly reflected the textual propositions that are causally related in their meaning representations. In the following example, Akash used the intersentential text constituents to extract the meaning in the high-cohesive text. Akash created his meaning by combining the two sentences causally related in the text, but reorganized the causal reasoning existing in the text using a new causal cohesive link "since."

Original Text	Akash's meaning representation
" A simple solution is unlikely…Instead the best farming practices will vary from crop to crop and place to place. Given the current precarious situation of agriculture, we should assess many alternative management systems, including conventional, organic, and possibly hybrid systems to identify the best options to improve the way we produce our food."	*"Okay so it says that* ***since*** *there is no quick fix solution, that we should, uh, solve the problem by case on case basis and many alternative management systems could be used…"*

Skimming for important information and prediction

Especially while reading the introductory sections, all readers traced certain semantic components in the text, but three readers from the creators of meaning group, Kerem, Natasha and Nan, did not go into the full understanding of the introductory section. They automatically ignored the irrelevant concepts, but emphasized the ones helping them establish local coherence. Natasha said, "*The first sentence ah has too many numbers so it prevents, I mean, it impairs understanding. And I don't know what COP15 is so the entire first sentence just, you know, is not legible. It's just an introductory paragraph. I think the main thing, it's just, you know, hints that organic food is important that it will be something about organic food.*" As seen in Natasha's example, other creators of meaning, Kerem, Nan and Akash, also used the introductory section to make predictions about the following sections of the text. These readers maintained their approach of skimming important local textual constituents for the rest of the text to be able to identify the topic of each paragraph, but also establish connections between the opening theme and the other text units.

Understanding individual sentences

Unlike other creators of meaning, Akash preferred to give more details about each paragraph using more textual knowledge, but did not spend an extended amount of time processing individual sentences. However, the readers, Ali, Xiaolin, and Wenwen, spent a longer time with understanding the words, and they tended to report the meaning from individual sentences. Huyen also focused on individual sentences, but her meaning representation at the local level was including fewer repetitions from the paragraph than the other collectors of meaning had.

Global level of processing

This level is named as global level processing, as the readers begin reorganizing the text ideas they extracted in the local level into a global structure that will account for

the gist of the text. As the readers process through the text, they all attempted to build meaning units (i.e., important themes or topics) from different segments of the text. During their ongoing reading or after reading summaries, they tended to relate these larger meaning units into a topical structure. However, the level of relations and the accuracy of the constructed relations were not exactly the same across the readers. Several readers from the collectors of meaning could not construct a coherent and complete meaning from some segments of the texts because of the textual complexities (e.g., structurally complex presentation of the statements) and their lack of knowledge on the topic. The following example shows how Huyen had difficulty in reorganizing and relating the different parts of the text because of her false interpretation of the expressions in the text.

> I mean that the organic food is good in terms of is, ah, is, um, is famous for, ah, healthy and, ah, a-and environmentally friendly food, but, ah…ah, the the the result and the, ah, people's interaction with the new, um, using organic food is, ah, quite unexpectable...And, um…..says that, um…people are, um, afraid of, of ah…..people may think that, ah…organic food is not the ultimate answer for, um, maybe for a kind of sustainable agriculture of, a sustainable food for the future.

All readers could report the gist of the whole text, but, Ali, Xiaolin, and Wenwen attempted to list the larger units of the text (the main themes they identified from each paragraph) with limited relations, especially in their process of reading the low-cohesive text. This list of isolated larger units has been more explicit in the collectors of meaning group, but not in all readers' summaries. Jessie provided a short summary of the text by isolating the essential units of the text without providing strong associations. Huyen had a long summary, but with more integrated and relevant units. On the other hand, creators of meaning could coherently summarize the main idea argued in the text by following causal relations set in the text or sometimes developing their own casual relations between the text ideas. In the following example, Natasha summarized the text shortly, emphasizing the main argument in the text:

> And now the overall, you know, meaning of the text is about this argument and obviously the author thinks that umm obsession with the this natural obsession ah that gave the name to the text ah is just a myth and is based on myths and should be, you know, should be ignored while solving an actual problems of feeding people.

The summaries from the creators of meaning were not all as concise as Natasha's, but Kerem and Akash also addressed the network between idea nodes in the text. Kerem reported:

> Okay so the author seems to be against the usage of organic food or the organic movement because he thinks that there are more crucial problems of the on earth people face in the future the most important example the author is giving is the population increase we should focus on that instead of insisting on replacing the conventional food with organic foods and he gives some several examples to support.

Rather than providing all the details of the text in his summary, Kerem first addressed the main argument the author presents, and then used the essential knowledge he extracted from the text to support the argument. In their final discussions following the think-aloud sessions, the creators of meaning also mentioned that they found the low cohesive-text weaker in terms of its organization, but as seen in the examples, they could crystallize the organization of the text ideas as they read along the low-cohesive text, which emerged in their summaries as meaningful and integrated text units.

Unlike the local level of processing, in which readers connect processing units to the immediately preceding ones, in the global level of processing observed in this study, several readers tried to access the distant information to build a global representation. All readers drew automatic inferences necessary based on available information, but if the local information was not sufficient (i.e. presented implicitly) in the text, the readers called on strategies to comprehend the text. Specifically, the creators of meaning tended to make connections between distant units and incorporate them into their own representations. In the following example, Kerem used the text title, "A Natural Obsession" to express his interpretation from the middle section of the text.

> What the author is meaning and so and also hmm when the author mentions in the middle of the second paragraph hmm that ill defined side kicks natural and whole real foods it is like the author is hmmm oppressing I mean uses a language that oppresses the opposite side the people who thinks in favor of organic food actually also a natural obsession title is an example of such an attitude.

As shown in Figure 4-2 on page 97, there were two basic processing strategies the readers displayed during their ongoing reading, which resulted in two different layers of meaning[8] (literal and inferential meaning) for the readers: maintenance of information, and integration of information enriched with inferencing.

Maintenance of information

As defined in Chapter 2, reading text is a "unified semantic unit" (Halliday & Hasan, 1985, p. 11) that presents interrelated ideas to a reader. While processing the text, the readers need to maintain text information over successive sentences or paragraphs, which will lead them to a constructed coherent meaning. The present study showed that this activity might emerge in both the local and global levels of processing, and the way the readers approached information maintenance with texts of varying degrees of cohesion might lead the readers to a meaning construction that varies in degree of coherence and accurateness.

In this study, maintenance of information emerging in the readers' performance was not exactly the same across the readers, or between the texts. All readers maintained the local level of processing for each paragraph, but especially creators of meaning enriched local level processing with information integration. As explained in the readers'

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[8] The layering networks of meaning in this study address the two layers of meaning (literal and inferential) constructed by the readers from the texts. The readers maintain the text information using different processing strategies (e.g. inferencing), which therefore led them to different global structure in terms of coherence. Instead of focusing on the constructed literal and inferential meanings, the study focused on the process, and therefore, the results of the study described how the readers maintained the information, and what strategies they used for the maintenance of information.

profile section, creators of meaning made sense of the texts by actively using their general knowledge and strategies. One example of how they made strategic use of their knowledge was through elaboration, which directly helped them maintain the text information in the global level. While processing the text, three readers, Natasha, Akash, and Kerem, attempted to determine the causes and consequences of the actions in the texts by retrieving information from prior paragraphs. This explanatory reasoning the readers displayed helped them achieve the coherence in understanding at the global level. In the following example, Kerem referred to the previous ideas in the text and created causal links while expressing the meaning from the current paragraph. "*So the author proposes another reason to enhance this food problem. He thinks that this problem won't be choosing organic* farming (main idea from the previous paragraphs) *but rather the problem is whether we waste."* This continuity of the topic revealed more in the process of the low-cohesive text than the high-cohesive one. This might be caused by the organization of the high cohesive text, each section of which provided the explicit information the readers would need to build the meaning. Nan, as a creator of meaning, could rarely retrieve information from sentences at a distance during her reading, but could make connections between the beginning of the text and the final sections in her summary of the texts. Other readers, Ali, Jessie, Wenwen, and Xiaolin, mostly applied the relations of local coherence in different paragraphs and rarely used the text knowledge from the previous sections to build the meaning.

All readers got lost on the local level, sometimes in the sentence level because of the unknown technical terms and the lack of associations between the content words, but this did not influence the maintenance of information for all readers. In her final discussion, Jessie stated the weak link between content words as one reason for her incomplete understanding of the low-cohesive text. She said, "*I had some difficulties to understand the meaning because when I meet the vocab I don't know the meaning I*

cannot connect between other words in the sentence, overall after my second reading I understand better what this article tells us about."

For the most part, the readers did not return to the problem areas of the text segments during their first read-through, but did spend more time doing this during their repeated reading. As stated in Jessie's comments above, repeated reading facilitated readers' sorting out information and even integrating information better in some segments when they got lost. All readers mentioned the difference emerging in their repeated reading. This is likely related to their benefit from the information already accumulated in their first reading.

The readers' ongoing reading and post-reading summaries showed that all readers experienced coherence breaks between text constituents in both texts at the local and global level, which also hindered their representations. For example, all readers complained about the lack of relation between the sentences in some paragraphs, which did not provide a basis for them to relate the current sentence with the one that preceded or followed it. Jessie said, *"and some sentences I cannot really understand the meaning what author is trying to tell us tell me and what is the relation to the article*." Creators of meaning also had breaks hindering their cross-text elaboration. Referring to the low-cohesive text, Akash said, "*So it marks a small point that is, that I can't see a direct relation with the rest of the text."* However, regardless of the distance or coherence breaks, creators of meaning could achieve coherent representation by maintaining text topics.

Integration of information

The analysis of the data showed that information integration is an important step for the readers to achieve the global coherence. In this study, the integration of information was achieved locally by maintaining information over successive sentences and globally by retrieving information from prior sentences at a distance. Sometimes it

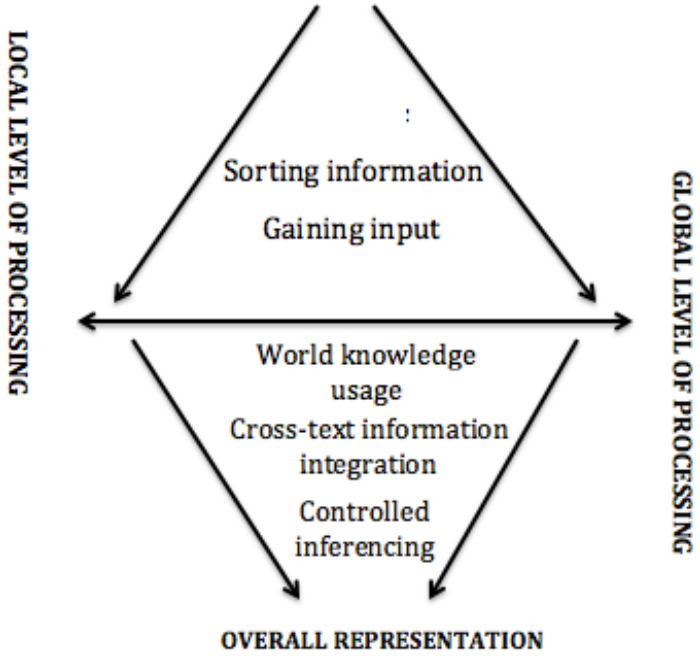
revealed as the association between the text knowledge and the reader's world knowledge.

As stated in the previous sections, all readers in the study went into text-based meaning construction in which local and global levels of processing have been highly involved. In addition, the readers attempted to integrate information provided by the texts with their relevant prior knowledge. This representation has been achieved, especially when the readers went into deeper processing of the texts depending on the task and their reading time. As explained in the previous section, the readers, especially creators of meaning, retrieved the information from the previous sections and integrated it with the new information provided. All readers attempted to use their domain knowledge to extract the meaning. For example, the readers could identify the topic of the text (organic foods), and establish associations between their knowledge about organic foods as a general concept and the information provided in the local context. However, the creators of meaning group did not only make inferences about the organic foods, but established associations between their knowledge, their inferences about the functioning of producing organic foods, and the part of the text they are reading. They were able to transfer that constructed information into their final representations. In the following example, Natasha was mostly interested in the pragmatic function of the meaning she would be building by integrating knowledge and also exploiting the shared knowledge. "*Ah, so here they discuss, like, flipsides of this genetic modification that, that can be ah both commercial obstacles and scientific obstacles… So, they question the business practice, I guess, of food producers."* Natasha retrieved the information from the previous paragraph about the "genetically modified crops" and then established a network between the two paragraphs to build the meaning of the current paragraph. She also built an association between the text knowledge "private sector" and her world knowledge "business practice" to construct the meaning. Although there was no explicit use of a casual cohesive link between the segments in the original text, she could interpret

the discussion of an idea against the previous one as the result of information integration. The use of the word “flipsides” is the explicit indicator of the oppositeness she constructed based on the integrated information.

To sum up, the processing activities of the L2 readers in this study show that the readers experience the local and global level of processing, but their meaning representation processes differ depending on the processing strategies they applied during their reading and the cohesion level of the text. Figure 4-2 and 4-3 summarize the meaning representation process of the two reading groups to show the main differences emerging.

Figure 4-2. Meaning representation process of creators of meaning



As the figures show, all readers experience local level processing. Two arrows over the horizontal arrow show that the input increases during the first part of the reading

process. However, Figure 4-2 shows that the meaning constructions of the "creators of meaning" are enriched with retrieved previous text information, inferences based on both textual knowledge and world knowledge. Two narrowing arrows under the horizontal one show that the effect of text knowledge reduces while creators of meaning process through the text. They start to reorganize the text ideas relating the different parts of the text and integrating text knowledge with their world knowledge. They attempt to apply strategic controlled inferences to access meaning.

Figure 4-3. Meaning representation process of collectors of meaning

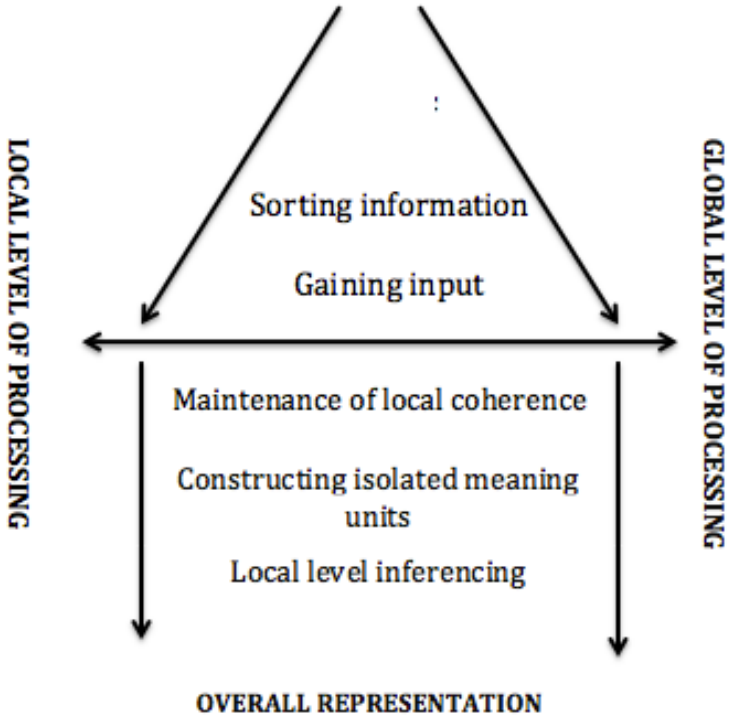


Figure 4-3 demonstrates that the collectors of meaning maintain the local level of processing and build an overall text representation including the list of isolated text units.

Two straight arrows under the horizontal one show the maintenance of local coherence different from text processing of creators of meaning. Collectors of meaning are faced with the challenge of building a coherent global understanding of the text, as they attempt to apply local level inferencing to access paragraph-based or sentence-based meanings.

Two important aspects of meaning construction, information maintenance and information integration, are experienced in the local level by the collectors of meaning, but the distance between the focal statement and prior text sources is restricted mostly to relating information from adjacent sentences. The following section discusses the inferencing activity displayed by the readers as part of information integration, which also differs across the readers and depends on the text cohesion level.

Inferencing

The analysis of the data showed that inferences made by the readers (both automatically formulated and strategically controlled bridging inferences) constitute an important distinction between text meaning, as determined by the text knowledge representation and text interpretation, as determined by the association the reader establishes between the text-based and knowledge-based constructions.

All readers in this study made inferences during their meaning representation process, but not all readers generated controlled inferences at all times. All readers made automatic and bridging inferences that require the fast processing of the local information provided. For example, they used the semantic context to guess the meaning of a contextually important word. All readers utilized from repeated words or repeated semantically related ideas in the texts especially in the high cohesive text to form text-based inferences. Wenwen followed the repeated word "perennial" in the high-cohesive text and used the adjacent sentences to guess the meaning of the word. *"Okay I think the perennial this vocabulary appears many times in this paragraph but I don't quite get the meaning of that one … but I think I guess the perennial one means it can be raised more*

than one time in one year." All readers attempted to use bridging inferences, but Ali, Wenwen, and Xiaolin mostly had trouble in forming an accurate bridging inference, especially when they are reading linguistically and structurally complex text segments.

Jessie and Huyen as collectors of meaning rarely demonstrated problematic bridging inferencing. The creators of meaning could make more contextually appropriate inferences, both knowledge-based and text-based inferences. In the following example, Kerem makes a causal inference based on text-knowledge and also makes predictions about the rest of the text by using forward inferencing. *"I feel that the author will try favor organic agriculture so here the investors side is highlighted I mean something that is profitable that is good for humanity may not always be thing that is chosen."* All readers made backward inferencing, mostly by inferring causal antecedents to construct the meaning. Natasha relates the meaning she extracts to the idea stated in the previous paragraph. *"Ah, so they ... ah answering the question they put in the previous paragraph. Ah, whether Organic agriculture can feed the world."* Making predictive inferences has been limited across readers while especially reading the low-cohesive text.

Processing differences and similarities between the texts

This study does not only investigate the meaning representation process of the L2 readers, but also examines how these readers make their representations from the texts that vary in degree of cohesion. In this section, the processing differences and similarities between the two texts will be discussed under three subcategories: (a) engagement toward building a coherent representation, (b) transformative and evolving representation, and (c) level of inferencing and information integration.

Engagement toward building a coherent representation

As an important part of their reading process, all L2 readers in this study attempted to identify and associate themselves with the topic of the texts, although their engagement level differed during their process of the low- and high-cohesive texts.

According to the view and performance of the readers, the type of the text (i.e., scientific), and the author's way of presenting the ideas described in the text mattered to all readers. According to the readers, the authors should be explicit and direct in presenting the statements by providing strong evidence to support their ideas. All readers agreed on the more implicit way of presenting ideas in the low-cohesive text. They criticized the low-cohesive text because of its weaker text organization and the overload in the surface level (i.e. less use of repeated words or semantically related sentences). In his final discussion, Akash said:

> Uhm, I mean sometimes he just goes to organic food and how it's good or not, and then he goes to genetic engineering, and then he goes to the source of the food. So he goes a little bit back and forth and the point that he is trying to make is not clear.

In the following example, Kerem addressed the author's word selection.

> I see that here, maybe that, I got its meaning, but it makes me stop for a second, a little bit. Ah, if you use secondary versions of, some easy words, I find that the frustrating words decreasing my comprehension.

The readers had to put more effort to engage with the low-cohesive text, finally to understand the text. In the following example, Natasha struggled to connect the nodes between different aspects of meaning in the low-cohesive text. "*So here they, um, again, they list all those popular ecological topics but I'm not quite getting where they are heading."* The lack of idea organization the readers mentioned in the low-cohesive text emerged as a challenge in their meaning representation process as well. The readers demonstrated confusion at the local level because of the weak relation between the ideas or the increasing lexical diversity in the paragraph-based level. All readers could summarize the argument discussed in the low-cohesive text, but the readers, Nan, Huyen, Xiaolin, Wenwen and Jessie, could not state appropriately what side the author stands for the described argument. These readers could not find explicit text-based evidences supporting their meaning construction. The following example shows how Nan felt confused while explaining the author's argument based on text knowledge. "*Well I think*

the author does not think organic food is not better than the standard food so and maybe we should think about more ideology to win hmm we don't want ideology to win over. We want evidence maybe he thinks standard food is better."

The weak relations with expressions in the low-cohesive text also hindered the readers' engagement with the text and their meaning representation. For example, while trying to identify the ideology supported in the text, most of the readers tended to use expert opinions and the examples, but they all had confusion due to the lack of information about the experts cited, and the examples they found did appropriately fit to the content. While making meaning from a paragraph including expert opinion, Akash said:

> Once again, I do not understand this particular paragraph. It's because I don't know what's Rachel Carson. Because it is based upon what is seen as an arrogant effort so what do you mean by it: Does it mean the environmental organization, the ideology or the technology? So, this is a little bit complicated.

Unlike the high-cohesive text that provides an introduction with explicit text topic, the introductory paragraphs in the low-cohesive text did not provide direct textual clues (e.g., an introductory topic sentence, topic related explicit examples) for the readers that will help them make predictions about the main idea of the text. The readers' identification of the text topic and argument the author built in the low-cohesive text was, therefore, late as well. The readers also identified the organization of the introductory section as a main reason for their late topic identification. When Natasha compared the two texts, she described the organization of the introductory section in the high-cohesive text in following words, which differentiates it from the low-cohesive one. *"And the first…paragraph they, they start from, you know, from wha-from, from the essence of the matters so they explain everything logically."* In her final discussion, Jessie mentioned the importance of the early idea identification. "*Everybody has their own idea about organic food so if he* [referring to the author of the low cohesive text] *mentions earlier I*

can maybe my position will be pro or against. I can prepare myself. I could make guesses."

Despite its organizational weakness the readers mentioned as a challenge, the readers' meaning representation process showed that the low-cohesive text, which required readers to put forth extra effort for interpretation, led the readers to conduct more elaborative processing compared to their performance in the high-cohesive one. Creators of meaning made better strategic use of their knowledge through elaboration in the process of the low-cohesive text than the collectors of meaning. Akash's following meaning representation is a good sample of how his elaborations improved his comprehension. *"I would like to add a word here called "management in the entire discussion of organic versus conventional. So this is the key word that I associate myself in my mind like if someone asks me to summarize all this paragraph in one word, it would be management."*

All readers agreed on the clearly stated ideas of the high-cohesive text, which facilitated their understanding of the text. They could easily recollect the information by utilizing the explicit links between the text ideas and also signaling devices. For some readers, the easy recollection of the ideas was not only related to the text organization, but to the authors' assumption about the readers' knowledge. Natasha said, *"So, it explains everything and it expects the reader will be completely unaware of the topic so they present it in simple you know logically connected sentences and they explain basically everything they talk about."* However, the readers' think-loud performance revealed that this step-by-step writing style led the readers to absorb the text information without questioning its accuracy, and thus, to experience less elaboration and inferencing.

Transformative and evolving representation

The knowledge gaps in the low-cohesive text led the readers to construct their own arguments by transforming different viewpoints presented in the texts and relating

them to their own domain knowledge. In the following example, Natasha first created a content-world knowledge link and then built her representation based on her argument schema. She even created a new word "farming business" to summarize the text idea, although this business practice was not explicitly discussed in the text. "*So, they question the business practice, I guess, of food producers. So, here they list advantages that we have. Agricultural science has already ah brought to…you know, to farming business and all of us basically."*

The creation of this type of representation varied across readers related to their understanding of the text knowledge and to what degree they associated their domain knowledge with the gained text knowledge. Creators of meaning, Natasha, Kerem, and Akash, preferred to express and justify their own opinions through a constructive process of arguments presented in the low-cohesive text. However, in the high-cohesive text, all readers preferred to create the catalogue of facts instead of transforming the gained text knowledge and searching for the evidence. Ali and Huyen from the collectors of meaning also tended to transform some explanations, but mostly to overcome the linguistic difficulties they experienced. The collectors of meaning have not experienced this situation consistently during their process of the entire low-cohesive text. Their meaning representation evolved into more accurate and coherent representations when they read along and in their repeated readings. While readers read along the text, all readers' information integration and use of personal knowledge increased.

Level of inferencing and information integration

All readers attempted to create source-content links by making inferences when they read both texts. While processing the high-cohesive text, most of the readers developed less elaborative inferences compared to the ones that emerged in the low-cohesive one. The following example of Nan is a typical instance of inferencing that almost all participants developed in the process of reading the high-cohesive text. She

predicted the text content using text knowledge. *"I see some negative words like supplanted or some thing leading cause to deforestation so some negative effects on the environment."* The creators of meaning especially tended to develop more knowledge-based elaborations by linking their automatic inferences to the causal consequences they extracted from the text. In the following example, using inferencing, Akash created his own coherent and accurate meaning from the text segment. *"I didn't understand what "organophilia" means, but I can figure out organo plus philia means love for organic food. Aa, technophobic skepticism I think is like hatred of technology. So more people are like crazy about the stuff of organic food but they don't care for the larger value being that there are people who are very hungry as well."*

The collectors of meaning used inferences mostly to overcome the comprehension difficulties they experienced. While processing the same paragraph as Akash, Wenwen developed inferencing focusing on the word "supercharge" in the final sentence of the paragraph, which however, did not lead her to the accurate meaning. "*Maybe I guess this sentence means this organic food is very like like costy, although they leave our planet unharmed."* In her comments, Wenwen highlighted this text segment as the section she had difficulty with because of its complex structure.

All readers' inferences and information integration began to emerge as they read the text. After her repeated reading of the low-cohesive text, Jessie *said, "so the overall after my second reading I can even I don't know every word of meaning I can assume that what is general idea and then the meaning in each paragraph."* The increasing number of inferences, as well as searching for detailed knowledge, guided all readers to make more associations between text segments in their repeated reading.

Benefit from discourse features

Referring to the sub-question (RQ#1.2) focusing on the L2 readers' use of discourse features during their reading process, this section discusses whether the readers

of the study benefitted from the components of cohesion in their meaning representation process.

Benefit from explicit discourse features

As explained in Chapter 3, each text in the study includes cohesive textual features (i.e. logical connectives), and each text is cohesive to some degree. However, compared to the low-cohesive one, the high-cohesive text has different text organization with the extra use of signaling devices, increased number of repeated words, and explicit links between the text segments.

Text organization

The meaning representation process of each reader showed that the readers utilized the textual features that explicitly contributed to the cohesion level of high-cohesive text (e.g., paragraph headings, examples fitting to the content, repeated content words, etc.) while building the meaning. In their final discussions, all readers also mentioned text organization as an essential component facilitating their understanding. Only Nan and Huyen found both texts equally organized if evaluated with the author's purpose, although they mentioned that they could understand the high-cohesive text easily. Other readers also associated the text's organization with the author's way of presenting the ideas. In the following example, Natasha states her familiarity with the style of the high-cohesive text. Natasha said, *"I like it because I think it's ah stuff familiar with me about evidence and, you know, formulations are pretty familiar from scientific literature."*

All readers benefitted from the examples provided in both texts while constructing meaning at the local and global level. After having challenges in interpreting the main idea of the low-cohesive text, Akash discussed the importance of an example in the text through which he could be able to confirm the accuracy of the vague meaning he built. He said, *"The specific examples of China and US drive the point home very well. It*

helps me understand what he is trying to say." Kerem, Ali, Xiaolin, and Wenwen specifically mentioned that the examples in the high-cohesive text fitted to the content more appropriately, although Wenwen, Xiaolin and Nan tended to ignore the information in one example in the high-cohesive text due to the useless repetition of the idea. Kerem criticized the examples in the low-cohesive text, as they barely supported the scientific claims in the text. He said, *"The examples that he gave are somewhat too narrow to cover I think the whole scientific thing."* While comparing the two texts in terms of their organization, Ali also added, *"I understand he try to defend his idea giving example but I think he need just type of maybe more, more consistent."*

While all readers found the low-cohesive text to be less organized, they mentioned that the organization of the text become clearer as they went along and in their repeated reading. Kerem said, *"I mean, it wasn't very clearly organized, I can say this. But, um, passing from paragraph to paragraph after, um, reading it for some time, I started to guess."* Unlike the process of the low-cohesive text, the readers could reorganize the high-cohesive text coherently after their first time reading by using their gained text knowledge. They had been satisfied with the gained knowledge and its accuracy, and therefore, in their repeated reading, the readers did not need to seek confirmations for their meaning representations as they did for the low-cohesive one. This might be related to the fewer inclusions of implicit meaning gaps in the high-cohesive text.

Relational markers

The readers benefitted from relational discourse markers in both texts, especially the coherence relations that contribute to the causal and relational cohesion of the texts. The explicit use of these links in the high-cohesive text facilitated and speeded up their meaning representation. Although most of the readers used the explicit cohesive links in both texts (e.g. logical connectives) to build the referential meaning at the local level,

they utilized these links, especially the contrastive cohesive links, to integrate their interpreted meanings. In the following example, Akash reported the gist of the paragraph using the negative connectives from the text. *"There's a difference that I can see okay, one hand is conventional farming of knowledge of only limited stuff, whereas on the other hand, there the organic farmer should know everything about, uh, ecosystem."* The readers also tended to make an inference about the causal reasons or consequences of the actions described in the text using relational markers. For example, by using the contrastive cohesive link "but," Nan predicted the meaning of the segment. *"He introduced organic technics and says -but also- here you see the but there is some bad things some negative facts so also I am sure the author is trying to see some negative effects of the conventional agriculture."* The explicit use of cohesive links sometimes led the readers to accept the conceptual relations directly, making less inferencing. In the previous example, Nan confirmed the action described using only the conjunction "but also."

The explicit use of headings in the high-cohesive text facilitated the construction of causal path by the readers. All readers mentioned the importance of questions the text is including, which helped them to form expectations about the content of the segments. Jessie said, *"And in personal I could understand this second text a little bit easier because the subtitles really helped to assume what the author will talk about."* Only Ali criticized the content of one paragraph in the text, as it did not match with his expectations based on the heading. *"Sometimes he maybe doesn't give good explanation or good answer or clear answer because the author maybe doesn't have the answer. he try to be in the middle but I can see his favor to the organic."*

The presence of relational markers improved especially the ongoing processing of the readers. While reading the second paragraph in the high-cohesive text, Wenwen highlighted the first sentence and also the referential cues, and said, *"This sentence has a lot of transfer from the first paragraph which try to describe the severe pollution of the*

environment and the author tries to move us into the next to the one like the organic technics the farmers use."

Although all readers processed and understood most of the relational markers automatically, the collectors of meaning benefitted from the explicit markers in the low cohesive text mostly to make inferences on the linguistically and structurally complicated sections. In the following sentence, Huyen focused on the intersentential connective "worse still" to make a quick match between the meaning of the connective and the meaning of the content of the segment. *"Um…this "organophilia" sentence, the sentence will be, ah, much more, um…is have the same idea to the previous one but with, ah, ah, stronger."* Not all connectives, however, led all the readers to the accurate and coherent meaning at the local level. In the low cohesive text, even in the sections including explicit cohesive links, the readers, except Natasha and Akash, had difficulty expressing the main idea and tended to make simple sentences independent of the signals.

Word-linked semantic analysis

For all L2 readers, getting familiar with the vocabulary of the text was important for their textual understanding. All readers commented on the appropriate selection and use of content words by the author in their discussions. The repetition of the important content words in a related context and the semantic information associated with these words helped the readers to identify the meaning of the word and understand the segment better. All readers tended to guess the meaning of the word "perennial" using the semantic context. Akash guessed its meaning by creating a link between the contextual knowledge and his domain knowledge. *"For example, like wheat* (the sample following the word perennial), *it doesn't grow, uh, twelve months; it grows in particular season."* Most of the readers, especially Natasha, Kerem, Wenwen, and Nan, mentioned the importance of short explanations following the technical terms in their meaning

construction. Kerem said,*"There is no need to be implicit while writing a scientific text."*

Benefit from implicit discourse relations

As discussed in the previous sections, both texts include implicitly expressed meanings, but the coherence relations in the low cohesive text (i.e. cause-consequence, problem-solution relations) are provided in a more implicit way that require the reader to fill up the local and global meaning gaps. The think-aloud data show that more implicit presentations of the causal relations in the low-cohesive text slowed down the readers' integrational process. Despite the readers' obvious benefit from the explicit features, this implicit construction of the low-cohesive text, however, did not negatively affect the readers' meaning representation overall. The implicitness led most of the readers to the deep processing of the text to figure out the relationships. The readers returned to previous sections of the text or moved to the following sections to make meaning. In the high-cohesive text that has predictable information presentation, the readers did not to return to the previous sections so often. In the following example, Akash stated how the gaps in the text affected his meaning construction:

> Once again it says that OK, the big picture is good but what should we do? This is again not clear. So, uhm, there are a lot of gaps that he could have filled in. It is I mean if you look at the bigger picture, you can slightly figure out that he's talking about focusing on the more important problem but as you go in uhm, he goes a lot of back and forth and you see that what one would expect is missing.

This challenge emerges rarely in the local level processing of the high-cohesive text.

Discourse features ignored or omitted

All readers suppressed automatically some surface text elements, which they found irrelevant and unnecessary in the meaning content they created. This suppression was an individual process based on the reader's decision, but also showed similarities across the readers. The suppression of relational markers at the local level did not differ

between the reading of the two texts. While making meaning from the second paragraph in the low-cohesive text, Jessie just suppressed the conjunction, *undoubtedly well intentioned*, and explained this in her discussion *"Well actually this expression is really unfamiliar for me I accidently ignored that."* All readers tended to select key words while constructing their own meaning and to ignore the ones they found unnecessary for their constructed meaning. In her ongoing reading, Huyen did not even read the phrase *"from the agribusiness giant Monsanto"* aloud, and while expressing the meaning from the paragraph, she replaced the word Monsanto with "the big company." Several readers, Akash, Natasha, and Kerem, preferred to ignore some cohesive links totally, as these links caused unnecessary verbosity in the text and more confusion in their meaning representation. Referring to a link in the high-cohesive text, Akash said, *"Again, in a bid to bring clarity, I skipped this entire part. I went directly to environmental scientist."* In his discussion, he commented on the same paragraph: *"There is a lot of verbosity in this paragraph and it makes a little bit harder to comprehend that other parts of the text."*

Summary of benefits

To sum up, the data show that all readers processed logical relationships within the local context, accepting their necessity in building meaning. However, according to the readers, this was an automatic process at times, and not a sufficient component of their meaning representation in the extended discourse. While comparing the low- and high-cohesive texts, Natasha made a metaphor, which also emphasizes the inefficiency of the cohesive devices themselves.

> I mean, imagine a cloth, for example a dress, right? So, the second text (high cohesive text) is like the dress. Like sleeves, you know, the front part, the pack part, like, fa-fabric, fa-fabric se-sewn together. This text (low cohesive text) is decorations. When you have a dress, decorations are good. When you don't have a dress decorations are just, you know, you cannot even imagine [laughs]…if you couldn't see the dress and see just the decorations you cannot even tell whether it is a dress or it is a short ah ah pants or skirt.

Readers' perspectives: Comparing the low- and high-cohesive text

The previous sections describing the meaning construction process of the readers included samples reflecting the readers' perspectives. Therefore, this section will summarize the readers' shared perspectives on the texts and then present each reader's short views.

Shared perspectives

All readers in the study found the high-cohesive text more organized, well structured, and easy to understand. Only Nan and Huyen found the texts equally organized if considered in terms of its style as an argumentative text. There was only one section in the high-cohesive text with which all readers expressed difficulty, which resulted from the lack of relational coherence at the local level. All readers except Natasha mentioned using "fancy" language and "big words" as one reason for the meaning confusion and coherence breaks they experienced while processing the text. Most of the readers found the author of the low-cohesive text more biased in presenting his ideas, although all readers thought that the use of explicit statements in the high-cohesive text facilitated their understanding by also increasing the author's objectivity as typical in scientific texts.

All readers mentioned that the author of the low-cohesive text goes back and forth in presenting the ideas rather than following a linear way as the high-cohesive one they would prefer to read. All readers stated the lack of appropriate information on the experts cited in the low-cohesive text and addressed this as one reason for their meaning confusion. All readers commented on the examples provided in both texts, and mentioned their importance in revealing the main idea.

According to all readers, the introductory section of the low-cohesive text lacked textual clues necessary to interpret the main idea of the text. Most of the readers

explicitly mentioned that the title of the low-cohesive text, “a natural obsession”, has contributed less to their understanding of the text topic.

There were common textual features all readers found helpful for their comprehension in the high-cohesive text such as the relation constructed between the paragraphs, as well as the paragraph headings in question format. All readers mentioned the importance of the relational markers for their quick understanding of the text, but their comments on the ignorance of some textual information including relational markers differed across readers as revealed in the previous sections.

Individual Perspectives: Creators of meaning

Natasha: Natasha found the presentation of the ideas in the high-cohesive text clearer and more “logical.” According to Natasha, the smooth reading she experienced was not only organization related, but also related to the author style and author’s expectations from the readers. Despite her easy collection of the information from the high-cohesive text, according to Natasha, the low-cohesive one would be more interesting and eloquent for the readers who are familiar with the topic.

Kerem: Kerem criticized the author’s writing style in the low-cohesive text in terms of the language used by the author, which differed from the perceived transparency of language in his field. He said, “*I just want to be, everything to be clearly given, stated.”* While discussing the importance of appropriate headings, Kerem described his own meaning construction by giving an example. *“If you’re approaching something to understand it, you also at the same time start to construct the problem. So, that’s why I, when I’m reading a scientific text I’m not first reading to think and then going back. I am at the same time constructing the problem. And then if I do not get the picture I go back.”*

Akash: While commenting on the idea organization in the low-cohesive text, Akash explained what he expects from the text as a reader. *“Yes, I mean, um, I won’t say*

it was completely lucid, like jumping from one idea to other, but at least I was expecting that I should know what to expect next."

Nan: Although Nan mentioned the increasing clarity during her ongoing process of the low cohesive-text, she stated her preference on the high-cohesive one, as it was more scientific way of writing for her. Comparing the two texts, she said, "*I think the author's opinion is pretty clear (HCT) so I can guess everything pretty much about the supporting this opinion but for the first one (LCT) I need to know what he is exactly talking about."*

Individual perspectives: Collectors of meaning

Huyen: For Huyen, the high-cohesive text was easier to understand despite the equal difficulty she experienced in terms of vocabulary identification. Huyen mentioned her familiarity with reading texts providing ideas explicitly, and addressed the use of "hidden ideas" in the low-cohesive text as a reason for the extra effort she used on the individual sentences. *"They use, um, some kind of, um…some, um, some me-hidden meanings um, that you might have to read between the lines. I just limit myself to the idea of surrounding sentences."*

Ali: Ali would prefer to receive simple and clear statements that will rarely lead him to go back and forth between ideas as he experienced in the low-cohesive one. He said, *"Each paragraph (HCT) is simpler itself. Try to give enough explanation and example in each one. It doesn't make its like weak or depend on the second one."* Referring to the low-cohesive one, he said, "*Um, he used some new vocab for me, but as I say the organization doesn't help me a lot in the first one (LCT) to find the meaning because it was jumping from idea to idea.*"

Jessie: Jessie was neutral on evaluating the texts in terms of their idea presentation or organization. "*I think both explain the information what they want to say but I think the first text has more personal opinion."* Unlike other readers, her comment

on the idea organization was a good indicator of increasing information integration while reading the low cohesive-text. She said, "*These titles helped me a lot I don't really have to read the sequentially the second text but I have to follow the sequentially in the first text. I have to sit down and read carefully, pay attention."*

Wenwen: Wenwen especially emphasized the importance of the examples in the high-cohesive text. "*The author always gives out any specific phrases and examples to describe to explain the very abstract concepts."* She also talked about the assumptions of the low-cohesive text's author about the reader's knowledge and how this affected the text organization. "*I mean author suppose like assumption of the author of the reader is different maybe in the previous one (LCT), he tried to write an article to some very academical reader which is inside in this field, specific field."*

Xiaolin: Xiaolin especially mentioned the negative effect of the "missing concepts" in the low cohesive-text and the weak relation between the text segments in her comprehension. "*The key words are helpful, but the connection is not very obvious. There is something missing. I understand there is something bad but cannot understand what is really bad."*

Summary

The readers' meaning representation processes emerging as the result of reader and text interaction displayed differences at the local and global levels of processing of the high- and low-cohesive text. The readers' text processing activities (maintenance and integration of text information, inferencing attempts, and their engagement with the text) differed across readers, especially in the process of reading the low-cohesive text. The challenges the readers experienced during their meaning representation process did not always differ across the readers. They also displayed meaning representations sharing common challenges related to the text cohesion level, for example, in their utilization from the cohesive textual features.

All readers went into the local level of processing by conducting semantic analysis. However, in their reproduction of the meaning, the collectors of meaning group tended to understand the individual sentences and words more so than the creators of meaning. All readers approached the text to identify the topic of each paragraph, and tended to relate the larger meaning units into a topical structure, but the level and accuracy of the constructed relations differed for collectors and creators of meaning. The list of isolated larger units has been more explicit in the former group. All readers maintained the local level of processing for each paragraph, but the creators of meaning group enriched their process with more retrieved and integrated information. The information maintenance and integration mostly revealed in the process of the low-cohesive text despite having fewer connected idea units provided in this text. All readers made inferences during their meaning representation process, but not all readers in the collector of meaning group generated controlled inferences at all times like the creators of meaning group did. The readers' information integration, inferencing, and use of personal knowledge increased when they read along the texts and in the repeated reading. The collectors of meaning group's use of situation representation were more task and reading-time related.

All readers agreed on the usefulness of the more explicit and clearly stated ideas of the high-cohesive text, which speeded up and facilitated their meaning representation. Although all readers complained about the weak idea organization in the low-cohesive text, the use of knowledge gaps in the text led the readers to construct their own arguments by transforming different viewpoints in the text. All readers tended to create the catalogue of facts in the high-cohesive text instead of transforming the gained knowledge and making inferences.

All readers processed explicit logical relationships constructed within the local context, but according to the readers, these relationships were not sufficient component of their meaning construction in the extended discourse. Each reader tended to use textual

devices mostly contrastive and causal links and ignored some textual devices including some content words and conjunctions.

CHAPTER V

DISCUSSION

> Language has been studied and analyzed for centuries. Philosophers, linguists, logicians, and others have accumulated a rich store of knowledge about language. What has emerged, however, is not a uniform, generally accepted theory but a rich picture full of salient details, brilliant insights, ambiguities, and contradictions (Kintsch, 1998, p. 93).

The results showing the meaning representation process of highly proficient L2 readers were presented in Chapter 4. In this chapter, these results will be discussed in relation to the literature reviewed in Chapter 2 considering especially the two main findings which emerged from the data: (1) the levels of representation L2 readers displayed during their meaning construction process, and (2) the processing differences emerging across L2 readers and their relations to the text cohesion level. The relevant implications will be considered for theories of text processing, the teaching of second language reading, and the design of reading materials for second language readers. Finally, the implications for further research, and the limitation of the present study will be described.

The data collected for this study focused on one central research question: How do highly proficient L2 readers approach text cohesion and use discourse features that contribute to cohesion while processing and constructing meaning from texts written in their second language, English? The analysis of the data from the participants showed that all readers followed *a nonlinear process* with the texts. In this process, all readers engaged in a local level of processing by conducting a semantic analysis of the local segments of the texts (e.g., words, phrases and sentences), and also attempted to relate different parts of the texts to each other to construct a global representation. However, despite their similar language proficiency, the readers differed in how they constructed meaning from the texts and especially in how they constructed relations between the text ideas they extracted from the low-cohesive text.

Given these differences, the participants were categorized as "collectors of meaning" and "creators of meaning" in this study. For creators of meaning, the process was enriched with more retrieved and integrated information. The discourse features contributing to the cohesion level of the text mattered to all readers. The readers agreed on the usefulness of the more explicit and clearly stated ideas within the high-cohesive text, however, the knowledge gaps in the low-cohesive text allowed the readers, especially the creators of meaning, to construct their own arguments by transforming different viewpoints in the text.

Meaning representation process: Interactive processing of multiple levels of discourse and knowledge

The findings related to RQ#1 and RQ#1.1, how L2 readers construct meaning representations in low- and high cohesive texts, indicated that L2 readers followed a nonlinear process with both low- and high cohesive texts, which revealed in different levels of processing- local and global. This nonlinearity appeared especially in the process of reading the low-cohesive text. The model used to describe the meaning representation processes of L2 readers in this study has shared features with Kintsch's Construction-Integration Model (CI) (1988; 1998), which also describes text understanding as a "cyclical process" (van Dijk & Kintsch, 1983, Kintsch, 1998). The results of this study also suggest that there is no single representation of a text that is appropriate for all purposes (Kintsch, 1998; Kintsch & Rawson, 2007). Instead, different levels of representations must be distinguished at the linguistic level, the level of meaning, and the level of the situation, though at times additional levels need to be considered. In this study, the participants constructed different levels of representation, which were titled as local and global levels of processing similar to Kintsch's categories of text-based constructions (microstructure) and knowledge-based constructions (macrostructure). The L2 readers in the study also displayed processing activities similar

to the ones described by Kintsch and previous L1 studies using the CI model (e.g., O'Reilly & McNamara, 2007). For example, at the local level of processing, most of the L2 readers repeated the sequence of relevant actions in the text to get input. The processing activities conducted at the global level touched upon whether and how the information was maintained throughout the reading process. Similar to the proposition overlap described in the CI model, in the linguistic and semantic analysis of the text at the local level, the L2 readers produced overlap among the sentence elements such as content words and phrases (e.g., the content words "organic" versus "genetically modified foods" constructing the opposite arguments in the text), and then they created coherence via the reprocessing of these elements. In Kintsch's CI model, macroprocessing is described as the level at which readers attempt to organize information into a coherent sequence of propositions, with some propositions superordinate to others, depending on their importance. In this study, the readers also proceeded through the texts, built meaning units by applying relations of local coherence, and then reorganized these local meaning units into a coherent global structure.

Inferencing and integration towards the construction of the situation model

The findings of the study related to RQ#1.1, how readers construct meaning representations in low- and high cohesive texts, and RQ#2, how readers perceive the effect of text cohesion on their own meaning representation, revealed differences between readers' (collectors of meaning and creators of meaning group) text-based and knowledge-based constructions, depending on the text cohesion level. L2 readers' text processing activities (e.g. maintenance and integration of text information, inferencing attempts, and their engagement with the text) differed across readers, especially in the process of reading the low-cohesive text. The two levels of representation, text-based (local) and knowledge-based constructions with situation model (global) (Kintsch, 1998),

were not entirely different and separate mental representations of the text content for these L2 readers. They displayed processing activities which had some feature of both levels (Kintsch, 1998; Tapiero, 2007). However, the transition from the text-based construction to the situation model was problematic for several L2 readers participating in the study, especially for collectors of meaning who had a limited ability in incorporating their domain knowledge into their mental representations and establish connections between text segments.

As explained in detail in Chapter 4, the main differences observed between readers were their processes of information maintenance and integration and use of inferencing during local and global processing of both texts. Despite their shared characteristics as high proficient L2 readers, the differences across the L2 readers (e.g., their engagement with the texts, and inferencing level) led them to a final reproduction of the text that was different in terms of accuracy, completeness, and coherence. For example, at the local level, all readers experienced coherence breaks, but these breaks especially affected the global understanding of the low-cohesive text among the readers in the collectors of meaning group.

As Kintsch suggests (1998), readers' overall representation is influenced by several different factors including text structure and reader (e.g., readers' skills or knowledge level). The processing activities of L2 readers emerging in this study support the underlying assumption in Kintsch CI model, which state that understanding a discourse is not intrinsic to the semantics of the words; in other words, comprehension is not limited by the ability to construct a mental representation of text content, but is a function of the reader's familiarity with the situations described, gained through the reader's own interactions with the world (i.e. pragmatic knowledge). This level of representation is necessary to account for comprehension as a whole and, in particular, for inference generation (Kintsch, 1998).

Similar to Kintsch' observations, the analysis of the data showed that global processing, including more information integration and inferencing, reduced the readers' reliance on text-based information, and readers tended to generate inferences based on their pre-existing cognitive schema that varied depending on their purpose. However, creators of meaning generated different types of inferences, including both automatic bridging and controlled inferences which required more use of cognitive resources (both text knowledge and domain knowledge). Collectors of meaning demonstrated frequent use of local level bridging inferences.

The L2 readers in this study also showed the same differences Kintsch proposed for skilled and less-skilled readers. In particular, while reading the low cohesive text, they attempted to incorporate previous experiences. However, not all readers could hierarchically organize ideas into a coherent sequence of propositions by identifying the essential text units. The meaning constructions of all readers included instantiations of general knowledge of the situations in the text as Kintsch (1998) claimed, but collectors of meaning kept focusing on text-based information throughout their processing. The creators of meaning, like skilled readers, could make more effective transitions than the collectors of meaning to the situation model with the use of distant transitions between the text units.

According to Kintsch (1998) effective transitions to the situation model help readers' comprehension process. "A strong situational model can help the reader to overcome difficulties within linguistics relations and support coherence where it would otherwise fail" (p. 233). This claim explains the L2 readers' differing transition to the situation model and also why some failed to make the transition. Despite their high language proficiency level, the L2 readers still had to deal with the textual and linguistic challenges (e.g., identifying the unknown technical words, and the complicated and less connected structure of some sentences and paragraphs) while building their meanings. The readers, therefore, tended to develop strategies to overcome the text challenges

mostly caused by text cohesion level, and each reader built in a direction that affected the understanding of the rest of the text. However, their method of dealing with these challenges differed. For example, collectors of meaning used inferencing and background knowledge to overcome difficulties, but creators of meaning were closer to the direction Kintsch described, in which "they could build the necessary "macrostructures" for the coherent break of meaning they are about to form."

The findings of the study indicated that collectors of meaning's information integration and inferencing increased in their repeated reading of the low-cohesive text or during the final discussion task in which the researcher asks them some specific questions about the text. However, as discussed above, creators of meaning developed strategies to deal with the coherence breaks in the low-cohesive text during their first time reading. This finding is tune with memory aspect reading researchers (e.g., Kintsch, 1998; Alptekin & Ercetin, 2010) focused on in explaining the differences between the skilled and less skilled readers. They state that readers who are able to control their selective attention to suppress irrelevant items and focus on relevant ones, in relation to both existing textual content and immediate access to available prior knowledge in long-term memory (LTM), appear to be not only better readers but also to have high working memory (WM) capacity. Less skilled readers may need some sort of help to bring their text-LTM associations (Kintsch, 1998). This is related to the collectors of meaning groups' increasing information integration and inferencing in their repeated reading or during the final discussion task (post-reading task).

However, the processing activities of the L2 readers were not as diversified in the high-cohesive text as in the low-cohesive one. They attempted to create a catalogue of the facts described in the high-cohesive text by using less information integration and controlled inferences. This indicates that the reader's domain knowledge of the text topic or their reading ability cannot be the only factor influencing meaning construction process, as Kinstch stated for skilled readers, and other factors including the reader's

familiarity with the text design and language issues should be considered. Text familiarity is a "communication channel" level (Graesser et al., 2003) the L2 readers also experience during their representation process (p. 88). Such acts of communication normally require a global theme, message and purpose in writing the text. So when L2 readers who are mostly familiar with texts which have specific ground rules (e.g., scientific academic texts including clear and step-by-step statements) are exposed to texts that have a different design, like the low-cohesive one in this study, they may find them challenging.

Unlike the skilled and less skilled readers described in the CI model, the processing differences observed in the L2 readers of this study (e.g., the weak transition of collectors of meaning into the situation model) might also be related to a continuing reliance on the language issues, and a habit of building a literal meaning from the texts similar to what is typically experienced during second language reading instruction. Focusing on individual words and sentences and the relations between them, the readers might be attempting to use the situation model just to overcome local level linguistic difficulties.

Considering these possibilities, in the following section the emerging differences related to RQ#1, RQ#1.1 and RQ#2, will first be compared with the results of previous L1 and L2 studies. They will then be evaluated in the light of L2 studies that take L2 proficiency and linguistics ability as an important component of L2 reading development.

Text cohesion and meaning representation

This study not only investigates the meaning representation process of the L2 readers, but also examines how these readers make representations from texts that vary in degree of cohesion. Thus, it is important to discuss the results considering previous research focusing on the effect of text cohesion on reading comprehension. Despite the

methodology and purpose differences, L1 and L2 studies help in conceptualizing the processing attempts of L2 readers and the emerging differences between them.

L1 studies: the effect of text cohesion on reading comprehension

According to the "reverse cohesion effect" described in McNamara and Kintsch's studies (McNamara & Kintsch, 1996; McNamara, 2001), high knowledge readers show better comprehension when they read a low cohesion version of a text, whereas students with low knowledge have been shown to better understand and learn from more cohesive texts. The low-cohesive texts force the knowledgeable readers to engage in compensatory processing to infer unstated relations. Inferences improve the situation model for individual sentences, but the reader is generally unable to generate the knowledge-based inferences necessary to make connections between separate ideas in the text (McNamara, 2001). The results of the present study only partially support these conclusions. Although the present study did not examine the relation between text cohesion and domain knowledge specifically, it revealed L2 readers' attempts to use their domain knowledge more when processing the low-cohesive text. None of the readers in the present study were expert on the text topic "organic foods", but they had some idea about it generally. However, creator of meaning group's use of domain knowledge was more contextually appropriate than the collectors of meaning group, similar to the high knowledge-readers in McNamara studies. As concluded in McNamara's study (2001), inferences generated by collectors of meaning in the low-cohesive text improved the situation model for individual sentences and phrases, and these readers usually constructed a summary which included isolated text units.

The similarities between knowledgeable readers and creators of meaning, however, do not indicate that their better transition from the text-based construction to the situation model using high-level strategies such as inferencing and information

integration results from a high knowledge level. Therefore, the present study can also be compared to the final series of McNamara studies (O'Reilly & McNamara, 2007) for two reasons: (1) The target group was college students in this study, and (2) the researchers included the comprehension skills of the students as a variable in the explanation of the relation between text cohesion and the readers' domain knowledge. Despite these similarities, the results of the present study differed to the 2007 study. In contrast to O'Reilly and McNamara's observations, the benefit of the low- or high-cohesion text was not restricted to one group of readers. They found that the benefit of the low-cohesion text was restricted to less skilled, high knowledge learners, whereas skilled comprehenders with high knowledge benefited more from a high-cohesion text. In the present study, all readers attempted a deeper processing of the low cohesive text using more inferencing and integration. But some readers failed to process the low-cohesive text completely and coherently. Moreover, in contrast to O'Reilly and McNamara's results, the L2 readers did not need an easier and more coherent text to gain situation understanding. Their situational understanding increased more when they were reading the low-cohesive text. For the collectors of meaning, comprehension failed mostly at the global processing level, but their situational understanding helped them decipher individual sentences.

Although the design of this study makes it difficult to discern the precise nature of by which comprehension skill helps readers, the comparison of the results with L1 studies indicates that comprehension skill might be primarily a function of readers' effective use of knowledge and strategies (O'Reilly & McNamara, 2007). Highly proficient L2 readers may have shared characteristics with native English readers, and some of their expanded reading comprehension skills may help them in extracting meaning from the low-cohesive text. However, this comparison to native English readers is not sufficient in conceptualizing the reason for the differences between highly proficient L2 readers; for

example, the less efficient integration by collectors of meaning while reading the low-cohesive text.

To examine the differences between readers from the perspective of text cohesion (related to RQ#1.1, RQ#1.2, and RQ#2), in the following section differences in processing will be discussed considering a comparative L1-L2 study (Horiba, 1996) on text coherence.

L2 study: L2 readers' reactions to text coherence

Similar to the L2 advanced readers in Horiba's study in which she described readers' (L1 and L2) reactions to causal coherence in terms of the text cohesion effect, the collectors of meaning in the present study devoted much of their cognitive resources to lower level processes that were needed for the construction of a propositional text-base that represented information explicitly. They could not incorporate all the information in some paragraphs into their propositional text-base, and they usually moved to the following paragraph during their processing. As the readers processed more segments, their increased understanding of the situation helped reprocess the information that was left unresolved in earlier segments (Horiba, 1996). Similar to Horiba's study, the readers in this study also tended to focus on single words or individual sentences more when they came across a cognitively complex text segment on which they had less background. However, while they were reading the high-cohesive text on the same topic, they did not experience the same language challenges as in the processing of the low-cohesive text. This suggests that the discourse features (e.g., signaling devices, relational markers), which increased the coherence level of the text, might help readers process high-cohesive texts faster and interpret text knowledge more appropriately.

In Horiba's study, advanced L2 readers did not differentiate between high and low coherence texts "in terms of the relative allocation of cognitive resources to various levels of processes," whereas L1 readers reported more elaborative inferences for the

low-coherence texts. As with L1 readers, the L2 readers in the present study also produced more elaborative inferences (e.g., global bridging inferences) for the low-cohesive text. While reading the high cohesive text, the readers did not produce as many controlled inferences and elaborative explanations as for the low-cohesive one.

Similar to L2 readers in Horiba's study, the generation of the main ideas was delayed for readers of the low-cohesive text, but this did not destroy the creators of meaning's representation of the general situation described in the text. The collectors of meaning who had less concise and coherent text summaries were not as sensitive to the causal structure of the low cohesive text as L2 readers in Horiba's. Horiba explains the lower sensitiveness of the L2 readers as follows: "Because the low coherence texts are coherent at local levels, L2 advanced readers may have been satisfied that events were connected each other in local discourse. In other words, they may have employed lower "standards for coherence", compared with L1 readers." This might also be one reason why the collectors of meaning's summaries were built with isolated and less integrated text ideas. Their low standards for coherence, differing widely as a function of their skill level and reader goals (Horiba, 2013), might have affected their desire to grasp the referential and logical antecedents to the information in the paragraphs, and leading them to create less connected meaning units.

As both L1 and L2 studies have shown, inferences and knowledge elaborations, which have been generated by the readers, are contextually related. Therefore, the present study supports the claim in L1 studies that an increase in integration processing when reading low cohesive texts leads the readers to use more elaborations and inferences. However, the question "What hinders readers from using elaborations and inferences to create coherent representations" still remains. Therefore, the following section focusing on L2 proficiency and linguistics ability brings a different perspective to the discussion of L2 readers processing differences.

L2 proficiency and linguistic ability

The purpose of this study was not to compare different proficiency levels. But differences emerging between readers raised the possibility that language knowledge may have a continuing impact on high proficiency L2 readers' text processing performance.

Although the participants of the present study were all linguistically proficient readers, the impact of L2 reading proficiency did not disappear entirely. They drew on their linguistic ability when they were reading texts (Horiba, 1996, 2000, Taillefer, 1996; Alptekin & Ercetin, 2011). They initially parsed text into smaller units such as words, phrases, and clauses, based on the lexical and syntactic information available, and then incrementally integrate them into the larger discourse context (Taillefer, 1996; Horiba, 1996; 2000). All readers found the low-cohesive text more complex to process, and during their meaning representation they tended to use their linguistics abilities more extensively. On the other hand, the readers' meaning constructions were close to each other during processing of the high-cohesive text, which might confirm the effect of text coherence on the process.

The collectors of meaning group in the present study attempted to decode individual sentences and sometimes words and phrases, but they also used high level processing skills such as inferencing to guess the meaning of an unknown word in the text or whole paragraph. This indicates that lower-level processing skills might still be integral components of fluent and skilled reading as well (Nassaji, 2003). The present study supports the view that higher level (e.g., syntactic and semantic processing) and lower level processing (e.g., word recognition, orthographic processes) performance can discriminate skilled from less-skilled readers (Nassaji, 2003), yet the findings suggest that the role of lower level skills should be considered with other important factors in highly advanced L2 reading, including the textual factors (e.g., text cohesion level, text genre, author's style) and additional reader factors (e.g., the habits and skills the L2 readers bring to the situation, and their motivation and interest). In other words, the

findings of the study do not support the claim that creators of meaning performed more efficiently on all the tasks than those who were grouped as collectors of meaning because they were skilled readers.

The findings of the present study corroborate Koda's (1994; 2004) statements on language proficiency, yet her statements do not explain completely the processing differences emerging in the study. Koda states that more proficient readers, due to the fact they are more skilled, may also have more efficient lower-level decoding skills than less proficient readers. It may be this efficient lower-level processing that makes syntactic and semantic information available for them to use. It is not possible to conclude from the results of the present study that creators of meaning have more efficient lower-level processing skills than the collectors of meaning, but it is conceivable that limited efficacy of lower level skills may cause a delay in processing higher level syntactic and semantic information and also limit other text integration processes for some readers. This delay might also be the reason for the readers' slow reading pace which may be necessary to deal with the input they receive from the text and to process it within the limits of the attentional resources available to them (e.g., content words and cohesion components).

To sum up, as many L2 studies (e.g. Alptekin & Ercetin, 2011; Horiba, 1996, 2000; Taillefer, 1996) have pointed out, L2 readers may tend to become more involved with processing the text literally, such that they fail to call on higher-level conceptual processes of reading. This propensity for text-based processing stemming from inadequate language proficiency might lead to excessive focus on surface- and propositional-level features (e.g., lexical decoding, syntactic parsing, coreferencing) in the texts. However, this was not the situation for all L2 readers in the present study. Reading proficiency alone does not make readers more skilled. Reading is purposeful and readers, especially highly proficient readers, have designated purposes for texts with different styles. The readers of the present study themselves did not think that the

challenges they experienced in processing the low-cohesive text was the result of low linguistic abilities but rather due to the complex presentation of ideas by the author, text organization and their low background knowledge of the topic.

Without moving away from the effect of text cohesion overall, the following section provides a discussion on the effect of specific cohesive features on meaning representation in light of the Construction-Integration (CI) model, and relevant L1 and L2 research.

Textual cohesive features for coherent text representation

The findings related to the second sub question – RQ#1.2 concerning what discourse features L2 readers use while building text representations from reading low- and high-cohesive texts, indicated that all readers process explicit logical relationships constructed within the local context, but according to the readers, these relationships are not sufficient component of their meaning construction in the extended discourse. As Kintsch (1998) suggests, readers' processing and determining direct and indirect links in the text (i.e., textual relations between the facts or events described in the text) influence the accuracy and coherent level of their meaning constructions. If readers cannot understand these relations, in a local or global fashion, they can come up with less coherent or incomplete meanings. The findings of the present study also support the view that the existence of discourse features is important especially for readers who are weaker in using their domain knowledge to fill gaps (Kintsch, 1998; Tapiero, 2007). The use of content-related propositions and explicit text cohesion features help readers activate a schema, and sometimes to predict the rest of the paragraph and the text. Readers represent meaning quickly and appropriately using cohesive features (Kintsch, 1998). For example, when the L2 readers had difficulty in understanding a word, sentence or paragraph in the present study, they confirmed their schema with selected content words like "organic" or "genetically modified."

This was also true for the cohesive devices such as connectives. As Kintsch (1998) suggests, sentence discourse features like connectives open up a new argument for the rest of the text. They indicate a parallel action in the two text segments they connect, which is essential for meaning representation. In the present study, sentences starting with contrastive or causal connectives played an important role for the L2 readers. The readers could predict the contrasts or the degree change of the situation even if they could not understand the entire sentence or paragraph.

The readers in this study read expository texts written to inform about ideas. There are many different types of relations that improve the coherence of expository texts including headers, sub-headers as well as referential, causal, and logical relations (Graesser, McNamara & Louwerse, 2003). These reduce conceptual gaps, which is important for L2 readers when reading informative texts to get new information. The L2 readers in the present study could also recognize the organization and purpose of the high cohesive text very quickly using these explicit coherence relations in the text. The readers preferred to use these links (e.g. headings) both in the local level of processing and for building a global understanding.

L2 studies examining the effect of text cohesion usually focus on the impact of specific cohesive components like connectives and signaling phrases. In their studies, Degand and Sanders (2001) compared the reading comprehension of readers in L1 with their reading in L2. As in the present study, they found that the use of suitable relational markers making coherence relations between text segments explicit speeded up on-line text processing. However, in contrast to the findings of this study, the presence of relational markers indeed affected the text representation that readers have constructed after reading. In the present study, knowing the function and purpose of the explicit links did not always facilitate meaning construction. Despite accurate processing of the conjunctions by all readers, the surface features of the text helped some readers predict the rest of the text, but creators of meaning group held more pragmatic, and cognitive

functions. Several readers from the collectors of meaning benefitted from these features at the local level of processing. Creators of meaning especially preferred to use the contrastive and causal links in their meaning reports and overall summaries to link the text ideas. In other words, similar to what Kintsch (1998) stated, the present study showed that explicit links helped readers in terms of constructing local coherence, and determining the coherent reorganization of the text, but when it came to global coherence, the links themselves were not sufficient to construct a coherent and complete overall meaning.

The previous discussion of L1 and L2 studies and processing models suggested that the L2 readers of this study not only had characteristics of advanced level L2 reader, but also had shared characteristics with L1 readers. Their challenge of building a coherent representation, therefore, has been related to the reader characteristics, and their ability in processing surface language as well. The L2 readers may have extra trouble in making meaning from the texts for several different reasons, including both textual and reader factors. Language issues might be an important factor even for high-level L2 readers. As L2 readers, they have to deal with new or unfamiliar words and sentence structures and this may limit their ability to determine what is relevant and irrelevant to overall meaning. On top of processing pure surface language, the reader is faced with the challenge of building a situation model, as they are supposed to decode aspects of meanings, and identify the functional value of text items simultaneously. Considering all the similarities and contradictions emerging from the comparison of the results with the relevant literature, the following section focuses on the implications of the present study for L2 text processing, L2 readers, and texts.

Implications

This study focuses on core aspects of the reading process: the reader, text, and the interaction between them. The findings have implications not only for theories of text

processing but also for the design of materials and instruction used for advanced L2 readers and lower level L2 readers.

Theories of text processing

The results of this study have been discussed in light of interactive models of L2 reading comprehension and multi-level models of text processing. This discussion raised some questions that have not been addressed in previous studies and theories. Therefore, this section proposes an alternative L2 reading model that can explain the inconsistencies in the findings of L2 text processing and discourse processing studies.

As revealed in this study, L2 meaning construction is not a single-phase process; it requires the use of multivariate skills by the readers during their interaction with texts. Kintsch's Construction-Integration model (CI) offers an example of this process. However, the findings of this study show that the CI model does not fully explain how L2 readers conceptualize the meaning of a text. In addition to pointing to the importance of the social aspects of reading comprehension, Kintsch's CI model also identifies the cognitive aspects of reading, which are essential to the L2 reading process. However, its cognitive aspects were developed to explain L1 readers and therefore, should be adapted in L2 reading theories built on the CI model.

The present study also supports the claims of most of the current interactive models of L2 reading comprehension (e.g., Bernhardt's compensatory model of L2 reading, 2010), wherein the role of lower level processes is also highlighted. But it also reveals their lack of attention to the impact of textual issues on L2 readers' meaning representation process. For example, Bernhardt's compensatory model of second language reading (2010) addresses the interaction between the readers and the texts, and emphasizes how text is constructed during the reading process. A big role is allocated to reader factors in her model. The important themes identified by the present study – engagement, comprehension strategies, text content and domain knowledge- are defined

as unexplained variances in the model. The focus on text-based construction processes and the principles underlying the integration processes in the CI model should be combined with ideas from interactive models of L2 reading comprehension to understand and explain the entire meaning construction process including the knowledge-based constructions not explained adequately in the current L2 models.

In his review of L2 reading research, Nassaji (2007) offered an alternative perspective, a construction-integration model of discourse comprehension to account for the role of knowledge and knowledge-based processes in L2 reading comprehension. Nassaji praised schema theory for explaining the constructive nature of the reading process and the role of background knowledge in reading. But, considering the failure of L2 schema theory, his focus was on "how background knowledge and the principles underlying its use and interaction *with other sources of information* should be conceptualized in L2 reading comprehension" (p. 81). According to Nassaji, one powerful and central insight of the CI model is "the idea that the knowledge that guides the comprehension system is not outside the text nor does the processing system proceed by generating top-down expectations and hypotheses and checking then against textual information" (Nassaji, 2007, p. 91). This central insight of the CI model externalizes the complex interaction process between the text and the reader that was found in the present study. The findings of this study also suggest that there are many factors that can make the construction-integration processes more complicated for L2 readers. Thus, when applied to L2 reading, a CI model that is supplemented by interactive L2 reading models could explain many of the inconsistencies in the findings of L2 text processing studies. This might be a new model whose focus is not only the readers or the texts, but on the process L2 readers follow during their interaction with different L2 texts. Adapting the construction-integration model to the L2 setting could help develop a deeper understanding of how highly proficient L2 readers process different texts with different structure and content, why they still have challenges caused by the lack of L2 knowledge,

and how these challenges can be reduced with a different L2 reading instruction and materials provided in the lower L2 reading levels.

Design of meaningful reading materials and instruction for L2 readers

By examining how L2 readers process different kind of texts, this study reveals how readers benefit from low or high cohesive texts, and why they might prefer reading academic texts with a specific design. This specific focus on text design brings the question of the similarities and differences between the materials used in second language reading instruction settings and the original authentic texts used in academic settings.

The participants of the present study were graduate students who were mostly exposed to academic readings in their own fields, and thus, it was not surprising that they were familiar with a specific text design, for example, scientific articles that present ideas clearly and logically. However, when these readers are exposed to texts with a different style, as with the low cohesive text in this study, they may have processing challenges. The results of the present study revealing the impact of text cohesion in meaning representation, therefore, suggest that in the design of enhanced/modified texts used for L2 reading instruction, the cohesion level of the texts should be considered, and the readers' awareness of these textual features should be increased to promote superior comprehension. This can be achieved by diversifying the reading materials used for lower level readers, which will expose readers to different texts with varied discourse features and cohesion levels they would experience in the higher levels. Along with increasing diversity of the reading texts, the reading activities and the reading strategies taught in the L2 reading instructional settings should be diversified.

Recently, second language reading research has focused on a process-oriented approach to comprehension (Grabe, 2009). This is mainly based on interactive models of reading wherein "reading comprehension is achieved through an interaction among

multiple knowledge sources, such as text, the reader's language proficiency and reading strategies, and the background experiences the reader brings to the text (Bernhardt, 2011). Most of these interactive models (Bernhardt, 2011; Grabe, 2009) have implications for ESL and bilingual education especially the emphasis on higher-order thinking skills and the role of discourse knowledge and vocabulary knowledge. As process oriented research, this study also categorizes highly proficient L2 readers according to their activities while processing low- and high-cohesive texts, and demonstrates some challenges these readers encounter in constructing meaning. Considering the differences observed between the two groups of readers, the present study proposes that training readers in specific methods of text processing might increase their reading comprehension. For example, when readers learn how to use different information simultaneously and effectively and how to select essential and relevant information, they may more easily construct meanings from texts with low cohesion levels. Once they are taught how to deal with knowledge gaps, they may use reading strategies more appropriately and produce more coherent meaning representation from texts with coherence breaks.

As an important part of the language-learning context, teachers undertake the selection, production, evaluation and adaptation of reading materials in many settings. Therefore, to increase the efficiency of reading instruction, teachers should understand L2 reading research specifically how readers represent meaning from texts that have different cohesion levels. The results of this study may better serve L2 teachers by highlighting the interactions between the L2 readers and the texts, and this may lead teachers to select materials matching with the readers' needs and goals.

Implications for further research

This study provides insights and details for second language reading and text processing, but also raises some questions, contradictions and ambiguities that will require further research.

Process studies

The use of multiple data sources in this study allowed better access to the target group's reading process and discourse. The use of screen-capture software allowed the recording of readers' interaction with the text including their highlights on the text. In the analysis of this detailed data from multiple sources this study used grounded theory, which helped in developing a comprehensive understanding of L2 readers' meaning construction process and their reflections on the process. However, to reveal deeper information on the impact of text cohesion and reader factors on the meaning representation process, discourse analysis might be used to analyze and code the data from the interviews and think-aloud protocols, and also to conduct a systematic and detailed analysis of the texts. The "meaning" constructed by the readers, and the process to reach the constructed meaning require deep explanation of the interaction between the reader and the text. As the present and previous studies show, several different factors influence the interaction process. Adult readers are not only readers but also "personal and social actors" (Shiffren, Tannen, & Hamilton, 2001, p. 354), and text is not just something composed of words or sentences the reader is ready to receive, it is a social structure with which readers need to interact. The complex interaction between the reader and the text can, therefore, be revealed in mode detail using discourse analysis which requires a deep critical analysis of the text itself, and both the meaning the readers extracted from the texts, and their comments on these constructed meanings and the text. Closer attention to texts might help to give firmer grounding to the conclusions (Fairclough, 1992).

Replication studies

As the purpose of the study was to see how graduate level L2 readers build meaning from the high- and low-cohesive texts, the participants were exposed to only modified/enhanced informative and argumentative expository texts on a specific topic. However, a study with a similar target group, who are exposed to a different text genre like "high-register" literary texts as Bernhardt suggests (2011, p. 81) might provide results supporting the present study or further explanation of high level L2 text processing. As high-register texts have "the implicit knowledge structures, and the unstated cultural heritage that all learners need if they are to develop usable, authentic language skills" (p. 81), the readers' processing of both expository and literary texts might be compared to show the basic challenges they encounter and how they deal with these challenges using textual and domain knowledge. High proficient L2 readers are not exposed only to scientific texts with a specific text design during their academic studies or careers. They read different kinds of texts including opinion essays, novels, and discussion articles written in reply to a specific scientific theory. Therefore, future research may need to examine the meaning construction process of L2 readers at different proficiency levels and expose readers to different text genres constructed with different textual structures (e.g., cohesive discourse features). With this kind of follow-up comparative research, the unanswered questions the present study raises like why there are processing differences among L2 readers at the same level of proficiency might be answered.

The participants in this study were L2 readers with different backgrounds-having different first language and reading experiences, and studying in different academic programs. Conducting the study with more homogenous groups might allow comparisons and lead to a better understanding of the processing differences across L2 readers.

Limitations

This research has several limitations. First, this study was a qualitative study involving 9 participants. Although multiple procedures were used, including theoretical sampling in the framework of grounded theory, achieving triangulation as integrated use of multi methods in data collection, and finally using comparative literature analysis, the results cannot and should not be generalized to the population of L2 readers as a whole. However, as the procedures above provide possibilities for context-specific generalization, the results may allow insights into specific situations similar to the context of the present study.

A second limitation is related to the main task used in collecting data. The study used think-aloud protocol to demonstrate the meaning construction process. However, despite the frequency with which think-aloud protocols are used in process research, this method has limitations and challenges in the implementation process. The validity of concurrent verbal reports may be questioned because it is not known whether the act of verbalizing while completing a task counts as an additional task and alters the cognitive processes of the readers. Although the present study attempted to increase the quality of the think-aloud protocols using some techniques proposed for successful implementation, the present study accepts that there may be factors causing reactivity in think-aloud protocols.

Conclusion

In conclusion, this study presents results obtained from a close observation of the reading process of highly proficient L2 readers to specifically describe the meaning representation process with the texts that vary in degree of cohesion. By focusing on the process of the readers and examining this process with the use of multiple research methods, the study was able to evaluate L2 readers' ongoing interaction with the text as well as their perspectives on the process that lead them to the final meaning construction.

With this detailed examination of the complex interactional process, the study provides results that show the development of two main processing levels at which these L2 readers build meaning representations, the local and global level of processing. The distinction between the global and local level of processing as well as the interactive relationship between them shows that meaning construction takes place in interaction with the text and its cohesion level in addition to the readers' factors.

Despite their similar L2 proficiency and exposure to the target language in similar situations, L2 readers approached the meaning construction activity differently depending on what the text provides and what they bring to the activity. Results showed that the processing differences between the readers were most apparent in texts with low text cohesion. Despite its organizational weakness, the low-cohesive text led the readers to conduct more elaborative processing compared to their performance with the high-cohesive one, in which they attempted to create a catalogue of facts trusting the explicitly provided text cohesion features. The differences between the readers also confirmed that the coherence established from a text depended not only on two processing levels, but also on strategies related to the establishment of an information hierarchy and the relationships between the concepts. For example, for the readers categorized as creators of meaning, meaning construction was a problem-solving activity in which the readers attempted to discover the sequence of idea units in the text, and connected them by creating associations between the idea units; and between the text content and their own experiences.

The results of this study and their discussion in light of previous L1 and L2 processing models and research suggests that we need more reflection on how to improve L2 text processing models, reading materials and teaching strategies that will balance the relationship between text content and readers' skills.

APPENDIX A: DEFINITIONS OF KEY TERMS

DEFINITIONS FOR CHAPTER 1, 2 & 3

Text cohesion: the degree to which the concepts, ideas, and relations within a text are explicit (O'Reilly & McNamara, 2007)

Text coherence: The effect of text cohesion on readers' comprehension (O'reilly & McNamara, 2007)

Text-base: a list of propositions that represent local meaning of a text

Mental representation: Kintsch (2004) defines mental representation is some change in the way the mind views the world as a result of reading a text, that is, some sort of trace of the text read, including indirect effects, cognitive as well as affective ones—perhaps a tendency to act in a certain way or to feel good or bad about something (p. 1271). A text is encoded in a mental model that contains representations of only those individuals and events that are relevant to the interpretation of the text in question. Such models are constructed on-line in response to cues in the text and with reference to knowledge about the world.

Knowledge sources: These are sources readers utilize during the reading process, meaning construction or word recognition etc. The sources are featural, phonemic, syntactic, orthographic, lexical and semantic sources.

Textual features (cohesive devices, aspects of cohesion): Based on Graesser and his colleagues' (2004) definition of cohesion and coherence, textual features are defined as the aspects of cohesion, characteristics of the text that are likely to contribute to the text cohesion, namely the coherence of the mental representation. Some of these cohesion characteristics are anaphoric references, connectives, and transitional phrases.

Upper-register texts: Texts such as commentaries and essays, which require profound syntactic and semantic knowledge, advanced cognitive and metacognitive skills, and even subtle pragmatic differences for fluent processing.

Global coherence: Global coherence is achieved if the incoming sentence can be connected to the text macrostructure (i.e. major message or point) or to information much earlier in the text that no longer resides in working memory. It is achieved when the reader use world knowledge to construct a representation of the situation described in the text (Graesser et al., 2001)

Local coherence: Local coherence is achieved if a reader is able to connect the phrase or sentence that is currently being read with the contents of the immediately preceding sentence. Text devices that explicitly mark how one section of text (e.g. connectives) is related to another also facilitate local coherence.

Signaling devices: Signaling devices are discourse markers in a text. For example, Connectives are one important class of signaling devices for particular categories of cohesion relations in text (Halliday & Hasan, 1976) (Sanders, 2006) Linguistic markers may be used to explicitly indicate the coherence relation that holds between the

segments (e.g. they are connectives like and, also, next, and furthermore and lexical signaling devices like In addition, Another aspect is, That is not all, and Other things can be added to this.)

DEFINITIONS FOR CHAPTER 4 & 5

Representation and construction: Representation is an essential part of the reading process by which meaning is produced and constructed.

Knowledge-based elaborations: Knowledge-based elaborations are inferences or explanations some readers display while constructing the meaning from the texts. They are usually derived from reader's knowledge structures that are relevant to textual content, requiring them to reason beyond the text in order to generate new information.

Retrieval strategies: The readers use retrieval strategies by activating their prior knowledge or previous text knowledge (retrieved information) to build meaning from the focal text segment.

Cross-text elaboration: This is related to retrieval strategies. The reader uses the gained text knowledge to construct the meaning of the focal text segment. It might be from the prior sections or the forward sections.

Bridging inferences: These inferences are sometimes called as automatic bridging inferences or local bridging. If there are associations around the expressions that took place in a text, the reader picks up the strain, for example if the meaning in the expression is "example", and then form a bridging inference when the word "example" occurs. Bridging inferences require establishing local coherence between subsequent sentences, and those inferences based on accessible text knowledge are usually made automatically by proficient and skilled readers (Trabasso and Magliano, 1996)

Controlled inferences: Unlike automatic inferences, controlled inferences are proper text-based inferences, which lead to global bridging. They require the integration of information located across larger distances and relying on controlled operations that tap logical and pragmatic resources (Ozuru, Dempsey & McNamara, 2009). Causal, predictive and elaborative inferences are examples for controlled inferences and mostly dependent on strategic processes determined by the comprehender's goals.

Causal reasoning: This occurs when the reader forms expectations about the casual consequences or antecedents of text actions and events. Predictions and explanations are manifestations of causal reasoning.

Backward inferencing: Backward inferencing occurs when the reader forms expectations about the causal antecedents of the actions described in the text. The reader attempts to connect the current, focal sentence with its immediate predecessor, or distal predecessor (Trabasso & Magliano, 1996)

Predictive inferencing: This occurs when the reader forms expectations about the causal consequences of the actions described in the text.

Isolated meaning units: They are unconnected text ideas extracted from different segments of the text.

Pragmatic function of the meaning: This is one important layer of meaning conducted

during discourse processing. The readers go into surface language or deep structure semantic analysis while making meaning or sometimes they go into pragmatic function that require effortful cognitive processes, for example, the integration of information located across larger distances using pragmatic means across sentences and the paragraphs.

Relational markers: Linguistic marking of coherence relations in a text that the reader uses to construct the mental representation from the text, for example, a causal relation that is made explicit by a connective (e.g. on the other hand) or left implicit.

APPENDIX B: LIST OF COHESIVE DEVICES

Cohesion category	Definition with samples
Argument overlap	There is overlap between a noun in one sentence and the same noun (in singular or plural form) in another sentence; it also occurs when there are matching personal pronouns between two sentences (e.g., he/he)
Anaphor overlap	A pair of sentences has an anaphor overlap if the later sentence contains a pronoun that refers to a pronoun or noun in the earlier sentence.
Connectives	They create cohesive links between ideas and clauses and provide clues about text organization. Causal connectives (*because, so*), logical connectives (*and, or)*, adversative/contrastive connectives (*although, whereas)*, temporal connectives (*first, until)*, and additive connectives (*and, moreover)*.
Causal cohesion	It signifies events and actions with the use of casual verbs and signals how the events and actions are connected in a text with the use of causal particles. For example, cohesion suffers when the text has many causal verbs but few causal particles that signal how the events and actions are connected.
Syntactic complexity	The syntax in text tends to be easier to process when there are shorter sentences, few words before the main verb of the main clause, and few words per noun-phase. For example, some sentences are short and have a simple syntax that follow an actor-action-object syntactic pattern, have few if any embedded clauses, and have an active rather than passive voice. Some sentences have complex, embedded syntax that potentially places heavier demands on working memory.

Adapted from the cohesion categories created by Graesser and his colleagues (2004)

APPENDIX C: IRB APPROVED STUDY INVITATION MATERIALS

IRB approved study invitation letter

FOR IRB USE ONLY
APPROVED BY: IRB-02
IRB ID #: 201305750
APPROVAL DATE: 06/21/13
EXPIRATION DATE: 06/21/14

International graduate students are invited to participate in a second language learning study, which is being conducted specifically to examine meaning construction processes of highly proficient second language (L2) readers during reading. International graduate students who meet the following criteria may be eligible for the study:

- International graduate students who are seeking doctorate or masters degree at the University of Iowa
- Non-native speakers of English
- Having Internet-Based TOEFL (IBT) score over 100 or Paper-Based TOEFL (PBT) score over 600
- Having Internet-Based TOEFL (IBT) score under 100 or Paper-Based TOEFL (PBT) score under 600, but passed English Proficiency Exam given by English as a Second Language Program at the University of Iowa or had conditional passing from English Proficiency exam, but did not take English as a Second Language Reading course.

If you have already completed another doctorate degree or undergraduate degree in another US university, or currently studying in a language learning and acquisition program at the University of Iowa, you will not be eligible for the study.

Taking part in the study is your decision. You may quit being in the study at any time or decide not to answer any questions you are not comfortable answering.

If you have any questions about the study that you would like to discuss or if you would like to participate, please contact the researcher, Zeynep Bilki, at zeynep-bilki@uiowa.edu, or at 319 512 9752.

With kind regards,

Zeynep Bilki
PhD candidate
College of Education
Teaching and Learning
Foreign Language and ESL Education
S117 LC
Phone: 319 512 9752
Email: zeynep-bilki@uiowa.edu

IRB approved participant recruitment poster

FOR IRB USE ONLY
APPROVED BY: IRB-02
IRB ID #: 201305750
APPROVAL DATE: 06/21/13
EXPIRATION DATE: 06/21/14

Are you an international graduate student at the University of Iowa?

***

If so, you are invited to participate in a research study, which examines the reading process of highly proficient second language readers.

If you would like more information, please contact:

Email: zeynep-bilki@uiowa.edu
Phone: 319 512 9752

Thank you for your consideration!

APPENDIX D: INTRODUCTORY SURVEY

Introductory survey

If you agree to participate this study, please complete the short survey below before signing the consent form. The questions below require information about your academic and language background. Please feel free to skip any questions or decline giving information that you feel intrudes upon your privacy. If you decide to skip any questions or decline giving information, please inform the researcher, Zeynep Bilki, about your decision so that she can finalize or continue the survey depending on the question you skip. Your responses are voluntary and confidential. The information you will provide will only be available to the researcher, not an unauthorized person.

Your full name: _____

1. Are you an international graduate student at the University of Iowa?

YES _____ NO _____

2. What is your program/department/major?

(Graduate students studying in any of the language acquisition or linguistics programs at the University of Iowa will not be eligible for the study)

3. Are you at least 18 years of age?

YES _____ NO _____

4. Are you a non-native speaker of English?

YES _____
NO _____ (Stop answering the following questions if you are a native speaker of English)

5. Do you remember your TOEFL score? If yes, do you mind if we ask you to share it with the researcher?

TOEFL score (IBT): _____ TOEFL reading score (IBT): _____
TOEFL score (PBT): _____ TOEFL reading score (PBT): _____

6. Have you attended any other graduate program at another US university or a university in an English speaking country in which instruction language is English?

YES I attended _____ Did you complete the program? YES ___ NO ___

NO I did not attend _____

7. If you are in a doctorate program at the University of Iowa, did you complete your Bachelors or Masters degree in the US or any other university in an English speaking country in which instruction language is English? (You can select more than one option if necessary).

_____ YES I completed my Bachelors degree at a US university/at a university in an English-speaking country

_____ YES I completed my Masters degree at a US university/at a university in an English-speaking country

_____ No I did not complete either my BA or MA at a US university/at a university in an English-speaking country

8. What year/semester are you in your graduate program? ____ year ____ semester

9. Did you take English Proficiency Exam given by English as a Second Language Program at the University of Iowa after you are admitted to the university?

_____ YES I took the exam and passed without being required to take any English as a Second Language Coursework (etc. reading, writing, grammar)

_____ YES I took the exam and conditionally passed it. I am currently taking/took required English as a second language coursework _____ (if you selected this option, could you please provide the name of the coursework to us in the following section)

10. What is/was the name of the English as a second language course/courses you are taking/ took? (e.g. reading, writing, speaking, grammar etc.) _____

_____ NO I did not take the exam

Thank you for taking the time to answer the questions.

Zeynep Bilki
PhD candidate
College of Education
Teaching and Learning
Foreign Language and ESL Education
S117 LC

APPENDIX E: INFORMED CONSENT DOCUMENT

INFORMED CONSENT DOCUMENT

Project Title: **A close observation of second language (L2) readers and texts: meaning construction through cohesion**

Principal Investigator: Zeynep Bilki

Research Team Contact: **Zeynep Bilki (phone number: 319 512 9752)**

This consent form describes the research study to help you decide if you want to participate. This form provides important information about what you will be asked to do during the study, about the risks and benefits of the study, and about your rights as a research subject.

- If you have any questions about or do not understand something in this form, you should ask the research team for more information.
- You should discuss your participation with anyone you choose such as family or friends.
- Do not agree to participate in this study unless the research team has answered your questions and you decide that you want to be part of this study.

WHAT IS THE PURPOSE OF THIS STUDY?

This is a research study. We are inviting you to participate in this research study because you are an international graduate student at the University of Iowa and you are a non-native speaker of English.

The purpose of this research study is to examine meaning construction processes of highly proficient second language readers during reading and describe how they benefit from discourse features contributing to text cohesion while constructing meaning from the texts, written in their second language, English.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 20 people will take part in this study at the University of Iowa.

HOW LONG WILL I BE IN THIS STUDY?

If you agree to take part in this study, your involvement will last for 2 hours for the first visit and 45 minutes for the second visit (as your schedule permits). The second visit will be held two days after the first visit. After the study is completed, you will have a short final meeting (face-to-face conversation) with the researcher for member checking procedure. This final procedure will last (maximum) 30 minutes.

WHAT WILL HAPPEN DURING THIS STUDY?

You will be asked to complete a series of procedures described below:

Pre-reading interview: In the first phase of the study, you will have an interview with the researcher. You will answer the researchers' questions directed to you to gather information about your language background including your second language (English) use, reading experiences and interests in English. Some examples of the type of questions that will be asked include: When did you start learning English? Where did you learn it? Would you prefer reading academic texts in English or in your first language? What kind of difficulties do you have while reading texts in English? Your answers will be recorded.

Think-aloud protocols: In this second phase of the study, you will be asked to read each of two different scientific texts selected from popular science magazines twice. You will be asked to read the texts out loud and think out loud while reading. In your first time reading of the texts, you will be asked to stop every two or three sentences and report the meaning you got from these sentences. In your second time reading of the texts, you will be asked to highlight or underline the parts of the text (e.g. specific words, phrases, sentences or paragraph) that facilitate or hinder your comprehension and make comments on these parts explaining why they helped you to understand the text or not. What you say and mark during the think-aloud protocols will be recorded.

Post-reading task: In this final section of the study, you will sit together with the researcher and watch your think-aloud recordings. While watching, you will be asked to reflect back to your comments and actions recorded during think-aloud. You will be asked to make comments on what you said, provide further explanations to your recorded comments if you want and answer the researcher's questions that might be directed to you for further information or the confirmation of the information you provided during think-aloud recordings.

You are free to stop or skip any of the interview questions or stop the reading task at any time. All of the procedures will take place while you are seated in a comfortable chair in front of a computer monitor located in the Language Media Center at the University of Iowa.

Member checking: After the study is completed, you will have a short final meeting (face-to-face conversation) with the researcher for member checking procedure. During this meeting, the researcher will share findings of the study with you; and you will have the opportunity to provide feedback on the findings, verify your information and correct errors of interpretation, if there is any. The researcher will complete the study and the dissertation, after you confirm the accuracy and completeness of the information you provided.

- **Audio/Video Recording or Photographs** ¶

One aspect of this study involves making audio recordings of you and screen captures of what you mark throughout the texts you will be reading during the study. All sections of the study including pre-reading interview, your read aloud and think aloud sections, and your final comments you make during post-reading task, will be recorded using screen and audio capture

software, Camtasia, so that the researcher can accurately reflect on what is discussed, analyze the entire data appropriately to be able to conduct a close of observation of your reading process as intended in the study.

The audio and screen capture recordings will be stored in a safe and password-protected computer and only be accessible to the researcher. They will not be released to any unauthorized persons.

WHAT ARE THE RISKS OF THIS STUDY?

You may experience one or more of the risks indicated below from being in this study. In addition to these, there may be other unknown risks, or risks that we did not anticipate, associated with being in this study.

The reading task may be mentally tiring and cognitively overwhelming. You will have the opportunity to discontinue participation anytime. Mental fatigue will be monitored closely and you will be provided appropriate rest breaks. Think aloud task will be broken into two units so that you can work on one unit at a time, which will prevent overload of working memory.

WHAT ARE THE BENEFITS OF THIS STUDY?

You will not benefit from being in this study.

However, we hope that, in the future, other people might benefit from this study because it will help us gain a better understanding of reading process of highly proficient second language readers. Deep description of highly proficient readers' reading processes will illuminate new dimensions to the design of meaningful materials and instruction used for advanced level second language readers.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

You will not have any costs for being in this research study.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study.

WHO IS FUNDING THIS STUDY?

The University and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

WHAT ABOUT CONFIDENTIALITY?

We will keep your participation in this research study confidential to the extent permitted by law. However, it is possible that other people such as those indicated below may become aware of your participation in this study and may inspect and copy records pertaining to this research. Some of these records could contain information that personally identifies you.

- federal government regulatory agencies,
- auditing departments of the University of Iowa, and
- the University of Iowa Institutional Review Board (a committee that reviews and approves research studies)

To help protect your confidentiality, we will maintain all records in secure storage areas with access limited to researchers directly involved in this study. You are guaranteed that identifying information collected through consent form and screening questions (e.g. your name) will not be released to any unauthorized persons. You will select a pseudonym and we will use this pseudonym as the code that will be linked to your identity. This linking file including your pseudonym and your identity information will be stored separately from the collected data and stored in a secure location that is accessible only to the researcher. The researcher will not allow the subjects or anyone not directly involved with the study to view the recordings. If the researcher writes a report or an article about this study or shares the study data set with others, she will do so in such a way that they cannot be directly identified. Your real name will not be provided in these written reports.

IS BEING IN THIS STUDY VOLUNTARY?

Taking part in this research study is completely voluntary. You may choose not to take part at all. If you decide to be in this study, you may stop participating at any time. If you decide not to be in this study, or if you stop participating at any time, you won't be penalized or lose any benefits for which you otherwise qualify.

WHAT IF I HAVE QUESTIONS?

We encourage you to ask questions. If you have any questions about the research study itself, please contact: Zeynep Bilki by phone at 319 512 9752 or email at zeynep-bilki@uiowa.edu, or contact the faculty supervisor of this study, Dr. Lia Plakans at 319 335 5565. If you experience a research-related injury, please contact Dr. Lia Plakans at 319 335 5565 or email at lia-plakans@uiowa.edu.

If you have questions, concerns, or complaints about your rights as a research subject or about research related injury, please contact the Human Subjects Office, 105 Hardin Library for the Health Sciences, 600 Newton Rd, The University of Iowa, Iowa City, IA 52242-1098, (319) 335-6564, or e-mail irb@uiowa.edu. General information about being a research subject can be found by clicking "Info for Public" on the Human Subjects Office web site, http://hso.research.uiowa.edu/. To offer input about your experiences as a research subject or to speak to someone other than the research staff, call the Human Subjects Office at the number above.

If you agree to be in this study, please tell me now and we will begin the pre reading interview. If you do not wish to be in the study, please let me know now or at any time. Thank you very much for your consideration of this study. You may keep this document for your records.

APPENDIX F: MODIFIED TEXTS

Low cohesive text

A Natural Obsession

When delegates from 192 nations arrive in Copenhagen in December for the UN COP15 summit, they will confront a 181-page draft negotiation text, 2,000 bracketed passages still in dispute, and just 11 days in which to come to some sort of consensus. To power them through these discussions, Denmark has promised a wide variety of ecologically minded fare: All water will be tap, tea and coffee will be fair trade, and the food menu will be no less than 65 percent organic.

Though undoubtedly well-intentioned, this last provision is troubling, but not because anyone really cares about the provenance of Ban Ki-Moon's turnip greens. Rather, it suggests a willful and dangerous ignorance about global agriculture, and the prospects for feeding 9 billion people while also addressing biodiversity loss, water shortage, and, yes, climate change. Organic foods are enjoying skyrocketing popularity in the US and Europe, as are their ill-defined sidekicks, "natural," "whole," and "real" foods. Yet popular notions that these foods at once better for people and for the planet turn out to be largely devoid of experimental support. Worse still, "organophilia" tends to go hand-in-hand with technophobic skepticism towards the very sorts of scientific approaches most likely to supercharge a struggling food system while leaving our planet unharmed.

No one can argue with the value of paying more heed to where our suppers come from. At its best, the organic movement is about reacquainting ourselves with the origins of food—appreciating that chicken is an animal and not just a shrink-wrapped package in the refrigerator case. It's also a reaction to an industry that has, under the banner of "food science," swung in a silly direction.

But do we really need to get our fiber in our coffee or all four food groups plus a multivitamin in a snack ostensibly made of honey and oats?

Nutritionally, there is no clear evidence that organic foods trump conventional ones. In one recent study, researchers compared kale, peas, potatoes, and apples grown organically with those grown according to conventional guidelines. They also fed both organic and conventional produce to rats for two years. "There was no evident trend towards differences in element content of foodstuffs or diets due to the use of different cultivation systems," they concluded. Neither the veggies, nor the rats nourished on them, turned out to be anything other than ordinary.

Disturbingly, the booming popularity of organics is coming precisely at a time when science must be leveraged to confront the truly Herculean task ahead: By 2050, the world's population could swell to 9.1 billion from the current 6.8 billion. As incomes rise across parts of the developing world, people are consuming more grain-intensive meat; as a result, food demand is actually outpacing population growth. In short, from an ever-smaller parcel of land, we must somehow produce nearly twice as much food as today.

From the perspective of science, there isn't—and has never been—anything natural about farming. Ever since our Mesopotamian forbears began purposely breeding crops to promote desirable traits, humans have been adding an artificial twist to natural

selection. For a science-skeptical community, the knowledge that scientists are ready to take on the challenge may not be comforting at all. How then, to begin moving away some of these organic myths? Most proponents of organic food believe that their choices are better for human society and for the planet.

Perhaps learning what gains have already come in a genetically engineered form may persuade them. In China, the introduction of insect-resistant Bt cotton curbed pesticide use by 71 million kilograms in just four years, drastically lowering the rate of poison-related illness among farmers. In the US, herbicide-tolerant "Roundup Ready" crops have enabled American farmers to essentially put away their plows, thus conserving soil, and saving water.

"This is a technology that's pretty green," says Paarlberg. "If you're a member of an environmentalist organization that took its ideology from Rachel Carson, you're not going to like it because it is based upon what is seen as an arrogant effort to dominate or engineer nature rather than yield to nature or try to work in harmony with nature."

Next month, when experts from across the globe convene in Rome for the annual World Food Summit, they will be discussing how to shore up the long-term food supply and, crucially, how to diminish the number of hungry people in the world. A vital part of their conversation will be to what extent biotechnology can—or should—play a role in these efforts. For the rest of us "foodies," now is the time for some deep soul-searching, to decide whether we will allow ideology to win out over evidence, particularly when the goals of biotech are increasingly aligned with many of the values the organic community allegedly holds dear.

Original text: http://seedmagazine.com/content/article/a_natural_obsession/

High cohesive text

Will Organic Food Fail to Feed the World?

Food for hungry mouths, feed for animals headed to the slaughterhouse, fiber for clothing and even, in some cases, fuel for vehicles—all derive from global agriculture. As a result, in the world's temperate climes human agriculture has supplanted 70 percent of grasslands, 50 percent of savannas and 45 percent of temperate forests. Farming is also the leading cause of deforestation in the tropics and one of the largest sources of greenhouse gas emissions, a major contributor to the "sixth extinction," ongoing extinction of species like plants and animals, and a perennial source of water pollution.

To restrain the possible environmental impacts of agriculture as well as produce more wholesome foods, some farmers have turned to so-called organic techniques. This type of farming is meant to minimize environmental and human health impacts by avoiding the use of synthetic fertilizers, chemical pesticides and hormones or antibiotic treatments for livestock, among other tactics. But, despite minimum environmental and human health impacts of organic techniques, the fact remains that the use of industrial technologies, particularly synthetic nitrogen fertilizer, has fed the swelling human population during the last century. This seeming contradiction, organic foods for healthy generation versus more foods for increasing human population, raises a new question: Can organic agriculture feed a world of nine billion people?

Organic versus conventional agriculture
In a bid to bring clarity to what has too often been an emotional debate, environmental scientists performed an analysis of 66 studies comparing conventional and organic methods across 34 different crop species. They found that, overall, organic yields are considerably lower than conventional yields. But, this yield difference varies across different conditions. When farmers apply best management practices, organic systems, for example, perform relatively better.

In particular, organic agriculture delivers just 5 percent less yield in rain-watered legume crops, such as alfalfa or beans, and in perennial crops, such as fruit trees. But when it comes to major cereal crops, such as corn or wheat, and vegetables, such as broccoli, conventional methods delivered more than 25 percent more yield.

How to boost organic farming?
The key limit to further yield increases via organic methods appears to be nitrogen — large doses of synthetic fertilizer can keep up with high demand from crops during the growing season better than the slow release from compost, or nitrogen-fixing cover crops. In fact, more knowledge would be key to any effort to boost organic farming or its yields. Conventional farming requires knowledge of how to manage what farmers know as inputs—synthetic fertilizer, chemical pesticides and the like. Organic farmers, on the other hand, must learn to manage an entire ecosystem geared to producing food—controlling pests through biological means, using the waste from animals to fertilize fields and even growing one crop among another. Organic farming is a very knowledge-intensive farming system. For example, an organic farmer needs to create a fertile soil that provides sufficient nutrients at the right time when the crops need them. The same is true for pest management. But the end result is a healthier soil, which may prove vital in efforts to make it more sufficient in the face of climate change as well as conserve it.

Organic or conventional food for growing human population?
At the same time, a still-growing human population requires more food, which has led some to propose further intensifying conventional methods of applying fertilizer and pesticides to specially bred crops genetically modified. Crops genetically modified to endure drought may also play a role as well as efforts to develop perennial versions of annual standard crops, such as wheat, which could help reduce environmental impacts and improve soil. "Increasing salt, drought or heat tolerance of our existing crops can move them a little but not a lot," says biologist Nina Fedoroff. "That won't be enough." And breeding new perennial versions of standard crops would require compressing millennia of crop improvements that resulted in the high-yielding wheat varieties of today into a span of years while changing the fundamental character of wheat from an annual crop to a perennial one. Then there is the profit motive. "The private sector is not likely to embrace an idea like perennial crop seeds, which do not require the continued purchase of seeds and thus do not provide a very good source of profit." McGill's Seufert notes.

Regardless, the world already produces 22 trillion calories annually via agriculture, enough to provide more than 3,000 calories to every person on the planet. The food problem is one of distribution and waste—whether the latter is food spoilage during harvest, in storage or even after purchase.

What is the solution?
A simple solution is unlikely. Instead the best farming practices will vary from crop to crop and place to place. Building healthier soils, however, will be key everywhere. "Current conventional agriculture is one of the major threats to the environment and diminishes the very natural resources it depends on. We thus need to change the way we produce our food," Seufert argues. "Given the current precarious situation of agriculture, we should assess many alternative management systems, including conventional, organic, and possibly hybrid systems to identify the best options to improve the way we produce our food."

Original text: http://www.scientificamerican.com/article.cfm?id=organic-farming-yields-and-feeding-the-world-under-climate-change

APPENDIX G: COH-METRIX COHESION MEASURES FOR THE FIRST PILOT STUDY TEXTS

Cohesion measure	Text 1	Text 2	Text 3
Number of words	1236	1348	1150
Reading ease	41.978	39.821	36.293
Reading level	12.698	11.891	13.392
Casual cohesion	0.522	0.237	0.909
LSA global cohesion	0.106	0.152	0.132
Connectives	90.615	86.053	93.043
Type token ratio	0.527	0.425	0.464

APPENDIX H: PILOT STUDY 1 DATA COLLECTION PROCESS WITH TWO PARTICIPANTS

First pilot study data collection process

Participants	Serap	Nil	
Pre-reading interview	Semi-structured interview for personal background information 20 min	Semi-structured interview for personal background information 15 min	Recorded with Camtasia - Audio and screen capture
Think aloud training	- Explaining what think aloud is - Introducing website and Camtasia - Reading a short text 25 min	- Explaining what think aloud is with shorter instructions and samples - Introducing website and Camtasia - Reading a short text 15 min	
Reading with think-aloud	- Reading aloud and report the meaning after each paragraph 40 min	- Reading loudly and report the meaning after each paragraph or every two or three sentences - Reporting in participant's first language 30 min	
Active reading with think-aloud	- Reading and marking words, phrases or sentences that facilitate or hinder comprehension - Make comments on marked sections 15 min	- Reading and marking words, phrases or sentences that facilitate or hinder comprehension - Make comments on marked sections 15 min	
Post-reading task	Going over the text together with the researcher and reflecting back to reflections 45 min	Watching the readings (think-aloud products) with the researcher and reflecting back to the thoughts and actions/ meaning construction 40 min	
Post reading interview	Additional questions about text difficulty and cohesion level 10 min	Cancelled	

APPENDIX I: COH-METRIX ANALYSIS OF THE TEXTS BEFORE THE FINAL MODIFICATION

	A Natural Obsession	Will organic food fail to feed the world?
Text easibility		
Syntactic simplicity	27	53
Word concreteness	51.99	42.47 (%)
Referential cohesion	0.52	5.37 (%)
Referential cohesion		
Noun overlap	0.121	0.197 (mean)
Argument overlap	0.217	0.271 (mean)
Content word overlap	0.019	0.046 (mean)
Anaphor overlap	0.049	0.021 (mean)
LSA (Latent Semantic Analysis)		
Semantic overlap between sentences	0.102	0.238
Semantic overlap between paragraphs	0.104	0.234
Lexical diversity (Type token ratio)	0.532 0.802 (content words lemma)	0.481 0.651 (content words lemma)
Connectives	88.69 incidence score	88.27
Causal cohesion	0.44	0.44
Readability		
Flesch Reading Ease	42.97	35.70
Flesch-Kincaid Grade Level	12.56	12.90
Coh-Metrix L2 Readability'	4.65	5.90

APPENDIX J: THE PROCESS OF GROUNDED THEORY BUILDING IN THE STUDY

Phase	Activity	Rationale
Research Design Phase		
Step 1 Review of technical literature	Definition of research question Definition of a priori constructs	Sharpens external validity
Step 2 Selecting cases	Theoretical sampling	Focuses efforts on theoretically useful cases (e.g. those that test or extend the theory)
Data Collection Phase		
Step 3 Develop rigorous data collection protocol	Employ multiple data collection methods	Strengthen grounding of theory by triangulation of evidence. Enhances internal validity
Step 4 Pilot study	Test and revise the texts, research methods and participants	Increases internal validity
Step 5 Overlap	Overlap data collection and analysis	Speeds analysis and reveals helpful adjustments to data collection Allows to take advantage of emergent themes and unique features
Data analysis phase		
Step 6 Analyzing data relating to first set of data collected	Use open coding Use axial coding Use selective coding	Develop concepts, categories and properties Develop connections between a category and its sub-categories Integrate categories to build theoretical framework All forms of coding enhance internal validity
Step 7 Theoretical sampling	Literal and theoretical replication across data (go to step 2 until theoretical saturation)	Confirms, extends and sharpens theoretical framework
Step 8 Reaching closure	Theoretical saturation when possible	Ends process when marginal improvement become small
Step 9 Compare emergent theory with extant literature	Comparison with conflicting frameworks Comparisons with similar frameworks	Improves construct definitions, and therefore internal validity Also improves external validity by establishing the domain to which the study's findings can be generalized

Adapted from the table created by Pandit (1996) to show the process of Grounded Theory building in a qualitative study

APPENDIX K: PRE-READING INTERVIEW QUESTIONS

1. What are you studying at the University of Iowa?
2. How long have you been in US and at the university?
3. When did you start learning English? Where did you learn it?
4. What is your first language?
5. You are reading academic texts for the courses you are taking at the university and they are all in English. Are you reading some other academic or scientific texts in English in addition to the ones you are assigned for your classes?
6. What about your daily reading *(e.g. novels, newspapers?)* Would you prefer them to read in English or in your first language?
7. Would you prefer reading academic texts in your first language or in English? Why?
8. Do you find the texts you read in English *(academic)* difficult to understand? What kind of difficulties do you have while reading? Could you please describe the main difficulties you experience in your own words just considering your own personal academic reading experiences?
9. As a second language reader, what do you think in a text is helping you most while reading in English? Could you please describe it considering your own academic reading experiences? *(For example, vocabulary, extra sentences explaining the topic or event in the text, a short sentence or phrase explaining a jargon in a text, sentences summarizing the paragraph, well connected sentences that make meaning, organization of the text* - These samples will be provided if the participant needs further explanation about the question!*)*

APPENDIX L: THINK-ALOUD TRAINING WRITTEN INFORMATION

What is think-aloud?

The think-aloud is a type of data collection procedure used in process research. The method is known as “thinking-aloud” or “concurrent verbalization”, which means that participants are asked to perform a task and to verbalize whatever crosses their mind during the task performance. In simple words, the researcher asks participants to say out loud what they are thinking about when reading.

You will read for meaning in this study. You will express the meaning you got from the text loudly in your own words as well as what you have in your mind while making the meaning. You will read the sample text twice in this training following the given instructions.

Reading 1: Read loudly and Think Loudly: In your first reading:

1. You will read the text loudly

2. When reading aloud, stop after every two or three sentences and report what you understood from the text in your own words. You can use the words in the text or paraphrase the sentences. See the examples below:

So far, I've learned ...
This made me think of ...
I think the author will talk about .... next
I reread that part because ...
I was confused by ...
I wonder why ... (These samples were extracted from the previous studies using think aloud strategy)

3. During think aloud, if any, express your opinions, reactions, comments on the text ideas, and sentences, which you think might influence your understanding of the text. Please see the examples below.

I did not understand this sentence. These two words do not make sense to me.
What does the author mean in this sentence? It looks like he develops an opposite idea to what he said before.

Reading 2: Active reading while thinking aloud: In this second time reading of the same text, please follow the instructions below:

Mark the words, phrases, sentences that you think hinder your comprehension or facilitate your comprehension
Make comments on (please say out loud) why you find them difficult or easy to understand

I did not understand these two sentences at all because of ...
I did not understand this paragraph because the author does not express his ideas clearly

These words help me to understand this sentence, but could not make its connection to the next sentence.

APPENDIX M: RESEARCHER'S NOTES: SAMPLE

A Natural Obsession

INTRODUCTION - When delegates from 192 nations arrive in Copenhagen in December for the UN COP15 summit, they will confront a 181-page draft negotiation text, 2,000 bracketed passages still in dispute, and just 11 days in which to come to some sort of consensus. To power them through these discussions, Denmark has promised a wide variety of ecologically minded fare: All water will be tap, tea and coffee will be fair trade, and the food menu will be no less than 65 percent organic. **[How did you get the meaning from the first paragraph? What are the key words, sentences and phrases helping you to get the meaning? In your comments, you mentioned you did not understand very well the first paragraph and decided to move to the next paragraph. Why did you decide to move to the next one? Did you find the introductory paragraph well-written or weak entrance? Would you prefer to read a different introduction? Why***?** *[She focused on specific words when she is making meaning from two sentences, but when she is reporting the gist of the paragraph, she does not make entirely verbatim copying from the text. The meaning she provided was repeating the textual knowledge. Normal that she trying to get some input, but the introductory paragraph did not help her]*

[What does this last provision refer to?] Though undoubtedly well-intentioned, this last provision is troubling, but not because anyone really cares about the provenance of Ban Ki-Moon's turnip greens. Rather, it suggests a willful and dangerous ignorance about global agriculture, and the prospects for feeding 9 billion people while also addressing biodiversity loss, water shortage, and, yes, climate change. Organic foods are enjoying skyrocketing popularity in the US and Europe, as are their ill-defined sidekicks, "natural," "whole," and "real" foods. Yet popular notions that these **[what does these refer in this sentence?]** foods at once better for people and for the planet turn out to be largely devoid of experimental support. Worse still, "organophilia" tends to go hand-in-hand with technophobic skepticism towards the very *sorts of scientific approaches most likely to supercharge a struggling food system while leaving our planet unharmed*. **[Why does the author think that the last provision mentioned in the first paragraph, use of organic products is troubling? What is the main reason for him?] [Could you understand the meaning the last sentence tries to tell? If the author provided the meaning of the word organophilia, would this help you understanding this section better?)**

Although you said you don't know the meaning of many words, you can still get the main idea discussed in this paragraph. What are the key words helping you to get this meaning? What helped you to get this meaning? And how can you be sure that the meaning you got from this section is correct?

[If the words like "though undoubtedly well intentioned", "worse still" were not included in this paragraph, would it be a big problem for you to get the meaning of the text? Did you focus on these words and phrases in the text? Are there any other examples of these words you can provide throughout the text that you think helped you make the meaning easily?

[Where did you start understanding the text? After your second time reading, could you understand the sections you find difficult better? What helped you to understand them in your second turn? *[She prefers reading silently] [She says the*

text does not help her to make guesses] [What would you like to see in the text that will help you to make guesses?]

PARAGRAPH RELATION?

No one can argue with the value of paying more heed to where our suppers come from. At its best, the organic movement is about reacquainting ourselves with the origins of food—appreciating that chicken is an animal and not just a shrink-wrapped package in the refrigerator case. It's also a reaction to an industry that has, under the banner of "food science," swung in a silly direction. *Maybe again, not sure. She focuses on words that makes her feel confused and cannot be sure about the meaning she got because of the last sentence that she could not understand very well.*

But do we really need to get our fiber in our coffee or all four food groups plus a multivitamin in a snack ostensibly made of honey and oats? **What ARE the two DIFFERENT arguments does the author discuss in this text?** *She says that she is not familiar with these American dishes… cultural issues…situational model…*

Nutritionally, there is no clear evidence that organic foods trump conventional ones. In one recent study, researchers compared kale, peas, potatoes, and apples grown organically with those grown according to conventional guidelines. They also fed both organic and conventional produce to rats for two years. "There was no evident trend towards differences in element content of foodstuffs or diets due to the use of different cultivation systems," they concluded. Neither the veggies, nor the rats nourished on them, turned out to be anything other than ordinary. EXAMPLES FOR CLARIFICATION?

[She doesn't care about that kind of conjunctions especially the ones the author puts his own ideas. As long as she understands the main meaning, she does not focus on a lot on the specific features like disturbingly, nutritionally. However, if she read the text for a different purpose maybe just to criticize the author's ideas, that would be different.] Disturbingly, the booming popularity of organics is coming precisely at a time when science must be leveraged to confront the truly Herculean task ahead: By 2050, the world's population could swell to 9.1 billion from the current 6.8 billion. As incomes rise across parts of the developing world, people are consuming more grain-intensive meat; as a result, food demand is actually outpacing population growth. In short, from an ever-smaller parcel of land, amidst hotter and drier conditions, we must somehow produce nearly twice as much food as today. **[The author is making a relation between the popularity of organic foods and also the use of science mostly for conventional food. Why does the author think that organic foods, although they are very popular, might stay in shadow of conventional foods? How does he explain the reason?]**

From the perspective of science, there isn't—and has never been—anything natural about farming. Ever since our Mesopotamian forbears began purposely breeding crops to promote desirable traits, humans have been adding an artificial twist to natural selection. For a science-skeptical community, the knowledge that scientists are ready to take on the challenge may not be comforting at all. How then, to begin moving away some of these organic myths? Most proponents of organic food believe that their choices are better for human society and for the planet. *Not sure again on the paragraph – maybe I will move to next one…why you could not understand this paragraph. Can you read it again and tell me the meaning you got? Any change? These two sentences make me stop and try to understand.*

Perhaps learning what gains have already come in a genetically engineered form may persuade them. In China, the introduction of insect-resistant Bt cotton curbed pesticide use by 71 million kilograms in just four years, drastically lowering the rate of poison-related illness among farmers. In the US, herbicide-tolerant "Roundup Ready" crops from the agribusiness giant Monsanto have enabled American farmers to essentially put away their plows, thus conserving soil, and saving water. **(The author thinks that the knowledge and what scientists say about conventional foods are not enough to persuade the supporters of organic foods. What does he suggest to do at this point to convince these people?]**

"This is a technology that's pretty green," says Paarlberg. "If you're a member of an environmentalist organization that took its ideology from Rachel Carson, you're not going to like it because it is based upon what is seen as an arrogant effort to dominate or engineer nature rather than yield to nature or try to work in harmony with nature." **Quote from someone??? Would you like to know who are these guys shortly rather than seeing only their names?**

Next month, when experts from across the globe convene in Rome for the annual World Food Summit, they will be discussing how to shore up the long-term food supply and, crucially, how to diminish the number of hungry people in the world. A vital part of their conversation will be to what extent biotechnology can—or should—play a role in these efforts. For the rest of us "foodies," now is the time for some deep soul-searching, to decide whether we will allow ideology to win out over evidence, particularly when the goals of biotech are increasingly aligned with many of the values the organic community allegedly holds dear. *[The author is looking for a balance in this last sentence]*. **Does the conclusion help you be sure on the argument the author supports personally or do you think the author is neutral on the argument? Biased statement? Making comment on the author's style. Why do you think the author is biased?**

More like New York Time article – whole paragraph to catch the idea. When I read it again, I understand it better…quite clear in general.

APPENDIX N: SAMPLE TRANSCRIPTIONS

Sample pre-reading interview transcription

Pre-reading interview questions (for language background information)

R: What are you studying at the University of Iowa?

Huyen: *Urban and Regional Planning*

R: How long have you been in US and at the university?

Huyen: *My first year and first semester in the program. I have been here more than a month [laughing] very new. I am from Vietnam.*

R: When did you start learning English? Where did you learn it?

Huyen: *In my home country. Actually I started at primary school, but, but, is I did not get the when I was more, actually learning process started in 6th grade.*

R: So your real actual learning started in the middle school, right?

Huyen: *Yes, yes in the middle school.*

R: You got your undergraduate degree in your country as well, right?

Huyen: *Yes, in my country.*

R: Was the instruction language English in the university you attended?

Huyen: *No no it was taught in Vietnamese. But I attended several online courses maybe so I am kind of familiar with.*

R: familiar with academic English?

Huyen: *Yes, academic English. I did several researches and read some English materials during my research in my country.*

R: What is your first language? Can you speak other languages?

Huyen: *Vietnamese is my first language. I cannot speak other languages, only English [laughing]*.

R: You are reading academic texts for the courses you are taking at the university and they are all in English. Are you reading some other academic or scientific texts in English in addition to the ones you are assigned for your classes?

Huyen: *I see I yes maybe most of my English experience was from reading Vikipedia articles from many many topics because hmmm …when I was younger Vikipedia was not very popular in the world [laughing]. I read English magazines but not I do not read everyday. Sometimes. Umm I read nonfiction sometimes fiction English books.*

R: What about your daily reading *(e.g. novels, newspapers?)* Would you prefer them to read in English or in your first language?

Huyen: *Yes, yes in my first language* [laughing]

R: Would you prefer reading academic texts in your first language or in English? Why?

Huyen: *It depends. Umm when the maybe when the content is so hard to obtain or sometimes to save the time when I was rush for maybe I prefer to read in Vietnamese but most of the time I think English material is okay.*

R: How do you find your own reading performance if you compare yourself with native students in your program or around you? Do you see any big differences?

Huyen: *Hmm I say yes I did. They do reading much faster than me maybe because of the characteristics of the reading material sometimes it is the verbal I guess umm it is wordy sometimes I feel boring even my native speaker friends sat that it is boring and it is not easy to obtain that material.*

R: To understand, comprehend the material?

Huyen: Yes, yes, understand the material [laughing].

R: So do you mean that it is related to the author's style?

Huyen: Yes, sometimes they are extremely wordy you have to sometimes some are around 1000 pages for class meeting let's say we have maybe 400 pages to do each week and this in reading related courses. There are other other quantitative related courses we have to do reading it is not that heavy. I still get it very slowly tough.

R: Do you find the texts you read in English *(academic)* difficult to understand? What kind of difficulties do you have while reading? Could you please describe the main difficulties you experience in your own words just considering your own personal academic reading experiences?

Huyen: *I think it is writing style it is not %100 umm scientific text it is not article the article is hard to obtain in terms of the content but writing sty;e is so much easier for me but in my books there are many essays reading for planning theory it they are so*

much verbal the writing style is not so concise and sometimes they use kind of so much big words, so much big words sort of in GRE words almost I forgot. It is kind of like literature not scientific.

R: So do you want to read more scientific texts having specific design, organization?

Huyen: *I want it to be more systematically organized and more scientific and it si like that. I want to know what his her purpose in the text.*

R: As a second language reader, what do you think in a text is helping you most while reading in English? Could you please describe it considering your own academic reading experiences?

Huyen: *Ah umm I am rarely looking at words in the dictionary my difficulty was not because unknown words. I don't have difficulty with words almost but not all the time because the words I mean the big words are not so necessary to look at. It does not change the content, what I understand from the text.*

R: So what are you doing to get the meaning from what you read? What helps you most in the text to get the meaning?

Huyen: *Oh okay. Umm I skim and scan and read the introduction and conclusion and I read the first sentence in each paragraph and try to understand what the author says. Sometimes it works but sometimes not.*

R: So you use some strategies to interpret what the author says.

Huyen: Yes, yes I have some strategies.

Sample cognitive interviewing transcription

(R) Okay. This time I will ask you to compare these two texts. [Okay] So do you see, um….a big difference between these two texts…for your understanding, um, in terms of…the the textual features, uh, the organization, uh, the style of authors? I don't know. What kind of differences do you see between these two texts?

(Akash) F- *first of all was organization. Like it had proper, uh, sections that had been defined and there was, um, a heading, and a a heading helps a lot because if you read the the heading it should basically explain what the next paragraph is all about* [Hmm, okay]. *So heading was very helpful. Also, um* (…..), *one could argue that in in in the first text, there were paragraphs,* [Mhmm] *but, um (…), it did the these are more logically organized. For example, a single point is covered, uh, in a single section.* [Okay] *Whereas in the, uh, in the other text, there was a lot of going back and forth* [I see] *while one point to the other so the organization was much better in the second* [In the second one] *paragraph. Also, uh* (…), *like there was small things like you mentioned like "McGill's Seufer" so I know,* [Okay] *okay, there is McGill's tea so there is export from that from that* [Uh huh] *place. Biologist Nina Fedoroff* [Uh huh] *so it it was, uh, helpful to, uh, understand the context in which [I see] they are being talked about* [You're right] *at that* [Okay]. *Um* [Um]…*hmm…and otherwise the e- even the sentence formation like there were a lot of long sentences that I do, uh, "Disturbingly this this this this"* [I see] *so the sentence structure I don't know it was short or long but, uh, it it was more easy to comprehend for me* [Okay] *so I I can more logically follow what is being going on* [Okay] *and then there was there were like these words that could I could pick out and I could sum entirely like "knowledge intensive"* [Um, okay] *and then there are "intensifying conventional method" as I could figure out "management." It wa- it was getting hard for me to label any paragraph as single one word so i- i- if I want to remember the last thing I won't read anything, uh, entirely again* [Oh okay]. *If I want to make a link I would say management plus disturbingly* [Oh, I see] *so the the the link, uh, part that needs to be followed that one after the other,* [Oh okay] *but it was easier to form a link* [Uh huh] *more, uh, due to these headings* [Uh huh] *and the word that I could* [Mhmm] *be putting on these*, [Uh huh] *um, uh, vertical sections [Uh huh] that that helped me understand it in a more fluid way* [Mhmm] *now than this.*

(R) Okay. So if you go and compare these two texts with the the ones you read for your own major, [Okay, yes], uh, wh- which one is similar, I mean, uh, it doesn't have to be similar, which one is similar to the the ones you read and which one you prefer to read more for your academic, uh, study?

(Akash) *I usually use textbooks* [Yea] *and in in textbooks more l-* [Yea] *it is like this* [Like giving it you] *but sometimes I have read some, uh, not research paper but there have been some articles on the Internet related to my stuff* [Mhmm, mhmm] *and they have been lot of back and forth* [Okay, okay] *but if y-* [S-] I*, uh, I obviously prefer the textbook format. The the the more friendlier version that I can understand.*
(R) Uh, do you have anything you want to add on on the texts about the comparison of the two texts.

(Akash) *Yea, again, uh,* [Okay] *what are the one was more objective compared to this* [Okay] *and what I figured out is probably it was little bit more biased* [Uh huh] *compared to this and one more thing that first thing that hit me was the title.* [Oh, okay] *The the title is "A Natural Obsession" so I would it it it didn't* [You cannot guess where it all, what he will be talking about] *s- yes, so at least I I knew what to expect from this*

compared to this "A Natural Obsession" [Okay] *this was again a thing a help so yea*

(R) Okay uh, so related to your answer to the previous question [Yes] If you, uh, have read the the fir- this text [Yes] before this one [Yes] this, I mean just the the think of the opposite order [Yes] uh of reading, does this make any change in your understanding?

(Akash) *Yes, it would because I, frankly, I don't like reading long texts.* [Okay] *I like to break them into small sections* [Oh, okay] *so like we're having very, first of all I would have taken a step back said, "Oh, so much of text,"* [Okay] *so it it would have been like given my mind.*

(R) Okay, so if you read this text first [Yes] and then the the other one [Yes] in as the second one that would be different. [Yes] That might be different [Yes]. You said that this is kind of objective and giving much more information [Yes] informative text and here the the author is not being bias.

(Akash) *No, the information is here as well, but it don't go in order like it the the last line the the placement of last line actually makes me wonder whether the author is, uh, biased or not.* [Biased or not, okay] *Had it had this been some place in middle* [Okay] *I might not have been able to* [I see] *figure that okay,* [I see, I see] *but I ag- same can be the said of him as well, like he he he says that "given the precarious conditions," so he he he he goes through both pros and cons of the,* [Hmm] *uh, the thing* [Mhmm, mhmm] *he's talking about so it gives.* [What's the object] *Okay, and again, it's not even his words; it's someone else's words* [Okay] *so here he he gives* [Citations] *his own wording. He gives his own wording* [Okay, yea] *so that is*, [Okay] *again, a small nuance* [Okay, I see] *that I observed.* [Okay] *Yes, yep.*

Sample think-aloud transcription
Think-Aloud Protocol – Text 1, Reading 1 – Natasha

"So I'm starting, right?"

A Natural Obsession

When delegates from 192 nations arrive in Copenhagen in December for the UN COP15 summit, they will confront a 181-page draft negotiation text, 2,000 bracketed passages still in dispute, and just 11 days in which to come to some sort of consensus. To power them through these discussions, Denmark has promised a wide variety of ecologically minded fare: All water will be tap, tea and coffee will be fair trade, and the food menu will be no less than 65 percent organic.

"Um,… ok, it's just an introductory sentence. I think the main thing, it's just, you know, hints that organic food is important but it's not about, I mean, all those, um … projects and documents they're going to discuss. Ah…"

Though undoubtedly well-intentioned, this last provision is troubling, but not because anyone really cares about the provenance of Ban Ki-Moon's turnip greens. Rather, it suggests a willful and dangerous ignorance about global agriculture, and the prospects for feeding 9 billion people while also addressing biodiversity loss, water shortage, and, yes, climate change. *["So here they, um, again, they list all those popular ecological topics but I'm not quite getting where they are heading."]* Organic foods are enjoying skyrocketing popularity in the US and Europe, as are their ill-defined sidekicks, "natural," "whole," and "real" foods. Yet popular notions that these foods at once better for people and for the planet turn out to be largely devoid of experimental support. Worse still, "organophilia" tends to go hand-in-hand with technophobic skepticism towards the very sorts of scientific approaches most likely to supercharge a struggling food system while leaving our planet unharmed.

"So here it it becomes obvious that they are going to criticize this obsession with organic ah food and something like this and, um, address, you know, I, I expect them to address um…that all those innovations – agricultural innovations – actually ah try to solve problems that um, more real than, you know, potential harm of, ummm… potential harm of genetical modified food or something like this."

No one can argue with the value of paying more heed to where our suppers come from. At its best, the organic movement is about reacquainting ourselves with the origins of food—appreciating that chicken is an animal and not just a shrink-wrapped package in the refrigerator case. It's also a reaction to an industry that has, under the banner of "food science," swung in a silly direction.

"So…again, just, you know, common phrases. We are trying to explain the source of this obsession."

But do we really need to get our roughage (!) in our coffee or all four food groups plus a multivitamin in a snack ostensibly made of honey and oats?

"So, they question the business practice, I guess, of food producers."

Nutritionally, there is no clear evidence that organic foods trump conventional ones. In one recent study, researchers compared kale, peas, potatoes, and apples grown

organically with those grown according to conventional guidelines. They also fed both organic and conventional produce to rats for two years. "There was no evident trend towards differences in element content of foodstuffs or diets due to the use of different cultivation systems," they concluded. Neither the veggies, nor the rats nourished on them, turned out to be anything other than ordinary.

"So here they reported their results of research study that, um, suggests that umm organic food is no different from our usual food that is cheaper, actually."

Disturbingly, the booming popularity of organics is coming precisely at a time when science must be leveraged to confront the truly Herculean task ahead: By 2050, the world's population could swell to 9.1 billion from the current 6.8 billion. As incomes rise across parts of the developing world, people are consuming more grain-intensive meat; as a result, food demand is actually outpacing population growth. In short, from an ever-smaller parcel of land, amidst hotter and drier conditions, we must somehow produce nearly twice as much food as today.

"So *here they explain why they, hmm, expect the demand for food, ahhh, to grow in the future."*

From the perspective of science, there isn't—and has never been—anything natural about farming. Ever since our Mesopotamian forbears began purposely breeding crops to promote desirable traits, humans have been adding an artificial twist to natural selection. For a science-skeptical community, the knowledge that scientists are ready to take on the challenge may not be comforting at all. How then, to begin moving away some of these organic myths? Most proponents of organic food believe that their choices are better for human society and for the planet.

"So um, here they, they tell that, you know, our food is artificial in any way whichever way we grow it. Just for the fact that we grow themselves and not just pick what nature gives us. From the perspective…ah sorry."

Perhaps learning what gains have already come in a genetically engineered form may persuade them. In China, the introduction of insect-resistant Bt cotton curbed pesticide use by 71 million kilograms in just four years, drastically lowering the rate of poison-related illness among farmers. In the US, herbicide-tolerant "Roundup Ready" crops from the agribusiness giant Monsanto have enabled American farmers to essentially put away their plows, thus conserving soil, and saving water.
"So, here they list advantages that we have ah thanks for um, modification ah of you know, agricultural science has already ah brought to…you know, to farming business and all of us basically."

"This is a technology that's pretty green," says Paarlberg. "If you're a member of an environmentalist organization that took its ideology from Rachel Carson, you're not going to like it because it is based upon what is seen as an arrogant effort to dominate or engineer nature rather than yield to nature or try to work in harmony with nature."

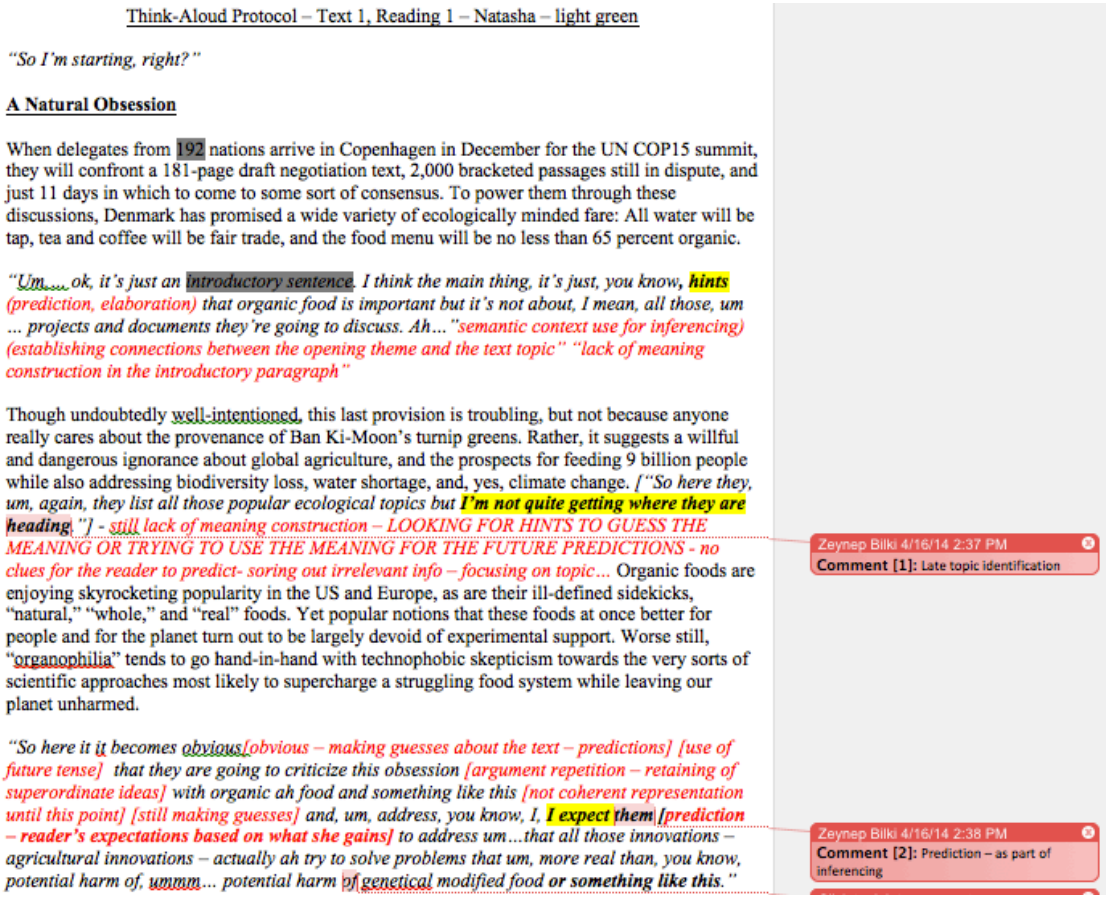
"So, here they try to address the argument of, you know, green activists. So the argument of that opponents."

Next month, when experts from across the globe convene in Rome for the annual World Food Summit, they will be discussing how to shore up the long-term food supply and, crucially, how to diminish the number of hungry people in the world. A vital part of

their conversation will be to what extent biotechnology can—or should—play a role in these efforts. For the rest of us "foodies," now is the time for some deep soul-searching, to decide whether we will allow ideology to win out over evidence, particularly when the goals of biotech are increasingly aligned with many of the values the organic community allegedly holds dear.

"So, ah, in the ver…in the last ah paragraph they kind of umm conclude, you know, summarize ah their argument between ah green activists, proponents of organic food, and ah those scientifically scientific, you know, community who needs to solve practical problems. And now the overall, you know, meaning of the text is about this this argument and obviously the author thinks that umm obsession with the this natural obsession ah that gave the name to the text ah is just a myth and is based on myths and should be, you know, should be ignored while solving an actual problems of feeding people."

APPENDIX O: SAMPLE LINE-BY-LINE ANALYSIS OF THE THINK ALOUD DATA



Think-Aloud Protocol – Text 1, Reading 1 – Natasha – light green

"So I'm starting, right?"

A Natural Obsession

When delegates from 192 nations arrive in Copenhagen in December for the UN COP15 summit, they will confront a 181-page draft negotiation text, 2,000 bracketed passages still in dispute, and just 11 days in which to come to some sort of consensus. To power them through these discussions, Denmark has promised a wide variety of ecologically minded fare: All water will be tap, tea and coffee will be fair trade, and the food menu will be no less than 65 percent organic.

"Um.... ok, it's just an introductory sentence. I think the main thing, it's just, you know, ***hints*** *(prediction, elaboration) that organic food is important but it's not about, I mean, all those, um ... projects and documents they're going to discuss. Ah..."semantic context use for inferencing) (establishing connections between the opening theme and the text topic" "lack of meaning construction in the introductory paragraph"*

Though undoubtedly well-intentioned, this last provision is troubling, but not because anyone really cares about the provenance of Ban Ki-Moon's turnip greens. Rather, it suggests a willful and dangerous ignorance about global agriculture, and the prospects for feeding 9 billion people while also addressing biodiversity loss, water shortage, and, yes, climate change. *["So here they, um, again, they list all those popular ecological topics but* ***I'm not quite getting where they are heading****."] - still lack of meaning construction – LOOKING FOR HINTS TO GUESS THE MEANING OR TRYING TO USE THE MEANING FOR THE FUTURE PREDICTIONS - no clues for the reader to predict- soring out irrelevant info – focusing on topic...* Organic foods are enjoying skyrocketing popularity in the US and Europe, as are their ill-defined sidekicks, "natural," "whole," and "real" foods. Yet popular notions that these foods at once better for people and for the planet turn out to be largely devoid of experimental support. Worse still, "organophilia" tends to go hand-in-hand with technophobic skepticism towards the very sorts of scientific approaches most likely to supercharge a struggling food system while leaving our planet unharmed.

"So here it it becomes obvious[obvious – making guesses about the text – predictions] [use of future tense] that they are going to criticize this obsession [argument repetition – retaining of superordinate ideas] with organic ah food and something like this [not coherent representation until this point] [still making guesses] and, um, address, you know, I, ***I expect them*** *[****prediction – reader's expectations based on what she gains****] to address um...that all those innovations – agricultural innovations – actually ah try to solve problems that um, more real than, you know, potential harm of, ummm... potential harm of genetical modified food* ***or something like this****."*

Zeynep Bilki 4/16/14 2:37 PM
Comment [1]: Late topic identification

Zeynep Bilki 4/16/14 2:38 PM
Comment [2]: Prediction – as part of inferencing

APPENDIX P: SAMPLE OPEN CODING EXCEL FILE

processing activities	Sample quotes	processing activities	Surface structure	Sample quotes	Shallow processing
paraphrased		first time of reading	Text-base		surface level processing
explain		increasing input	text knowledge		semantic processing
predict		retaining potential blocks of meaning	syntax		semantic decisions
associate	Jayant: LCT: and Denmark, the country that is hosting them (bridging inferencing), is offering	integrating	vocabulary		amount of effort
maintenance	Olga: HCT: "Ah, so here they discuss, like, flipsides	discarding	use of semantic context	Wenwen: HCT: They have	factual questions
retrieve	Huyen: HCT: Ah, this is still, um...the comparison	limited ability on deciding what is	use of grammatical information		factuals provided by the text
meaning construction		processing pure surface langauge	referential meaning located in the text	Jayant: HCT: I could not	L2 readers better because
explanation-based		challenge of decoding aspects of meanings	Representing the local meaning of a text	Olga: here they reported their results of research study,	focusing on isolated element of the text
expectation-based	Jayant: HCT: Again, this seeming contradiction, he himself says that this seeming contradiction organic food for healthy generation versus more food for increasing population raises a new question: Can organic agriculture feed a world of nine billion people? So so far I have guessed that at least this should be the point that this that he has mentioned: Can organic agriculture feed the world of nine people? It is the, um, agricul- it is the question that is going to be discussed so far >>>>> Ali: HCT: to to better understand the idea of the author. [Okay] What the author will say in the next paragraph [Okay] Like i- if the author say organic or conventional food for growing human population that's mean h- I ha- I will have an idea before I will read the whole...whole paragraph. Will I , yea, s-sometimes he he maybe doesn't give good explanation or good answer or clear answer because the author maybe doesn't have the answer		word recognition/ lexical decoding		verbatim copying from the original text

APPENDIX Q: SAMPLE AXIAL CODING EXCEL FILE

Cohesion	Sample quotes	Coherence relations	Sample quotes	Relational markers/discourse markers	Sample quotes	Presence and absence of relational markers
Referential and causal cohesion	Wenwen: HCT: [Highlighting the first sentence of the second paragraph]	cause-consequence	Shichao: LCT: Ja so pretty much the first paragraph	discussion question more use of markers		referential coherence (anaphoric expressions)
temporal and causal relations	Huyen: HCT: And, ah, result is (casual	contrast	Shichao: HCT: The author	some relational markers		relational coherence
Building a causal path between the initial and final states of the text	Huyen: LCT: "Um…this "organophilia" sentence [←unclear], the sentence	problem solution relations	Huyen: HCT: And, ah, um, there are more ways to,	causal connections/ causal relations	Shichao: HCT: they come to the conclusion that organic	improving online processing of the text
Focusing on actions and events that decsribe the succesive transitions between	Shichao: HCT: The author is trying to say the author thinks that the hmmm	connectives	Ali: HCT: This paragraph is talking about the two,	oppositional markers	Olga: "Ah, so, ah there is a-a contradiction between	leading to a poor mental representation
Minimal predication - successive adding of	Olga: HCT: "Ah, so they … ah	signaling phrases	Wenwen: HCT:	extra help/ scaffolding	Shichao: LCT: researcher's	reader's acceptance the
coreferential cohesion		linguistic marking of		getting help to elleviate their lower	Huyen: LCT: "I think, um…..is	intended coherence
propositions that share arguments (do not	Shichao: HCT: The author is trying to	markers they focused		developing a strategy using markers		without making
relations between events, actions	Jayant: LCT: But the rest of the text, although it is good, there are some	markers they used in their meaning	Jayant: HCT: (contrast construction importance)	used to make inferences on the part they did not understand		shallow processing
omission of redundant and less significant text items	Huyen: LCT and HCT: both: In a bid to bring clarity to what has too often >>>> Olga: In a bid to bring clarity >>>>> Shichao: HCT: In a bid to bring clarity >>>>> Jayant: LCT: I completely ignored these words, just skipped them. It does not make sense. I started reading from "this last provision" so completely skipped this conjunction undoubtedly well intentioned. >>>>> Jayant: LCT: No but nutritionally there was a point because they are discussing what are actually the benefits of organic foods (words having related meaning important). So nutritionally did got my attention, but disturbingly it was	markers they did not use		Procesing logical relationships in the text necessary, but not sufficient	Olga: text-based info but also adding extratextual info >>>>> Huyen: LCT: Um…this "organophilia" sentence [←unclear], the sentence will be, ah, much more, um…is have the same idea to the previous one but with, ah, ah, stronger…" >>>>> Jessie: LCT: Hmm I guess so I mean so I think the author wants to emphasize what she is going to say in the next paragraph sentence he puts some personal opinion. (inferencing, prediction)	no deeper active process

APPENDIX R: SAMPLE SELECTIVE CODING EXCEL FILE

	Textual features		Components of cohesion in the protocols			Level of processing						
Processing activities	**Low**	**High**	**Benefitted**	**Discarded**	**Neutral/ fast processing**	**Surface level**	**Global level**	**Shallow**	**Deep level**	**Integration**	**Inferencing**	**Characteristics**
Representing the local meaning of the text (literal meani	relation between cognitively demanding task and prediction activities	*				*						
Getting lost on the local leve/ in sentence level	*					*						
Applying the relations of local coherence	*					*						
Figuring out referential meaning in the text using epxlicit te	*	*				*				*	*	
Focusing on relations left implicit in the text	*					*	*			*	*	
Filling up the gaps (local and global)	*	* local								*	*	
Using categorized words to guess the word meanings or re	*	*	*								*	*
Picking up different meaning blocks (mostly the main idea	*		*				*					*
Keeping info during reading to explain or predict successive	* Local level - conf	*								*		
Creating catalogue of facts		*										
Global meaning: Selecting the meaningful units that accour	*	*								*		
Global meaning: Relating larger units of text into a topical s	*	*					*	*		*		
Global coherent meaning: Recongition of main ideas and th	* weak and lead to	*								*		*
Cross text elaboration: Establishing connections between t	*weak - introducto	*	* signaled text titles, organization				*					
Building a causal path between the initial and final states of the text		*	*				*			*		
Activation of schema with some keypoints in the texts	* local level	*								*		
Creating representation based on repeated arguments	*		*				*			*	*	
Integration: Retrieving information from prior sentences or	*	*	*							*	*	
*Integrating information to build an overall meaning(the relation between text coherence and coherence created by the reader – related to text cohesion and textual features, and text organization)							*			*		
Selecting inportant pieces of information and integrating important pieces into semantic wholes (key words, key phrases, sentences, helpful discourse markers)	*(accuracy) challe	*	*	*	*	*	*			*	*	
Discourse features: Using some discourse markers (e.g. cau	*	*	*			*				*	*	
Discourse features: Ignoring some discourse features, omit	*	*		*								
Creating associations: Establishing source/content, source	*	*								*		
Explicit disocurse features: Using discourse features (surface cues, titles, repet	*	*										
Cross-text elaboration: Explaining the actions using causal el	*	*	*							*	*	

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