

第二言語の文章理解過程：照応関係処理に関する課題の考察

Text Comprehension Processes in the Second Language: Issues of Anaphoric Resolution

森島 泰則 MORISHIMA, Yasunori

● 国際基督教大学
International Christian University

佐藤 彩華 SATO, Sayaka

● 国際基督教大学教育学研究科
Graduate School of Education, International Christian University



文章理解, 第二言語読解, 照応解析, 言語心理学

text comprehension, second language reading, anaphoric resolution, psycholinguistics

ABSTRACT

Establishing referential coherence during reading comprehension is a necessary process in text comprehension. When readers encounter anaphora, they use information from the text and their world knowledge in order to refer back to potential antecedents. These candidates need to satisfy certain constraints, and therefore, resolution of anaphora requires non-trivial processing. As can be understood, these processes are not simple procedures, and the difficulty in the resolution process is likely to be greater than that in first language (L1) than in second language (L2). The Capacity Hypothesis by Just & Carpenter (1992) suggests that the cognitive resources that we possess are limited, and thus, a tradeoff between low level tasks and high level tasks can occur. Under this theoretical framework, this article discusses some current research issues, and we argue that in the L2 context, resolving a bridging description which is not co-referential, calls for a greater demand of cognitive resources than the resolution of direct anaphora.

読解過程において指示的一貫性を得ることはテキスト理解において必要不可欠な手続きである。読み手は照応形 (anaphora) に行き当たった場合、テキスト上の情報及び読み手自身の既有知識を用い、可能な先行詞 (antecedent) の候補と適合させる。これらの候補は幾つかの制約を満たさなければならず、

そのために必要とされる処理は些末ではない。これから解るように、これらの処理過程は決して容易なものではなく、第二言語 (L2) においてはその難易度は第一言語 (L1) 以上に増すと考えられる。Just & Carpenter が提唱する Capacity Hypothesis (1992) によると我々には限られた認知資源しか備わっていないために、低い水準の処理過程と高水準の処理過程との間にトレードオフが起きる。これを前提として、本論文では L2 における照応解析の研究課題を提案すると同時に、L2 のコンテキストにおいて同一指示的でない橋渡し指示表現 (bridging description) の解析が直接照応形 (direct anaphora) に比べ、より認知資源を要するという主張を議論する。

1. Introduction

The world is becoming highly international, and estimations show that a large number of people in the world are bilingual (Crystal, 1992). As people from different ethnic, national, or cultural backgrounds communicate with each other, the presence of a common language is required. Today, English meets such a need of international communication, and there is a growing demand to better the methodologies and contents of education of a second language (L2). Such aspirations presuppose the advancement in our understanding of the nature of cognitive processes of L2 comprehension. Given the state of affairs, the growing level of interest in research on L2 seems only natural, as we enter a new era of bilingualism or multilingualism. In particular, rapid information exchange is carried out today through the medium of English. For example, most international scientific and scholarly journals are published in English. This example illustrates the need for a vast majority of people in the world to comprehend a substantial amount of information that is crucial to their professional activities and personal lives in English as a second language.

At a first glance, it may seem reasonable to assume that skills and processes of L2 reading comprehension have a number of characteristics and properties shared with or derived from those of first language (L1) comprehension. However, through the research in reading comprehension

in L2, which attempts to reveal the processes that readers undergo in order to take in, process, and comprehend information from a text, it has been shown that it is too naïve to assume that L1 and L2 reading processes would be identical. According to the linguistic threshold hypothesis, a threshold level in the L2 is required as a condition for L1 reading abilities to transfer to L2 (Alderson, 1984). This suggests that not all L2 readers can benefit from their reading capabilities that they exhibit in their L1, and would be highly challenging for a language learner to make sense of a text in their L2 over which they have limited control.

Of the many processes involved in text comprehension, this article focuses primarily on anaphora resolution, which attains referential coherence of a text. Anaphora resolution is the process of matching a referring expression to its antecedent (Mitkov, 1999). As shall be discussed later, this process is a basic, yet crucial stage needed to reach successful comprehension either in L1 or L2, for readers would not establish a coherent representation of the text if anaphora were not disambiguated.

In the present article, we will first review some basic but important concepts and theories pertaining to cognitive processes in reading comprehension in general. Then, we will review several major studies on anaphoric resolution in L1, and present our arguments on anaphoric resolution in L2.

2. Cognitive Processes in Reading Comprehension

2.1. The Role of Memory

Research on reading comprehension has essentially focused on examining readers' memory rather than examining the text itself. This is because when readers read texts, any incoming information is immediately stored in memory. Therefore, a closer examination on reader's memory can lead to a better understanding of how readers comprehend the text with respect to their objectives.

Atkinson and Shiffrin (1971) proposed the dual storage model claiming that for information processing, the functions of memory are divided into three parts: sensory information store, the short-term memory (STM) and long-term memory (LTM). The sensory information store is an immediate and direct image of the input which enters through visual or auditory means. It is assumed to have a large amount of capacity, but is believed to last only for a brief period of time less than 1 second. STM is believed to hold a limited amount of knowledge, about seven plus or minus two 'chunks' of information (Miller, 1956), for about fifteen to thirty seconds, and if information does not undergo maintenance processes such as rehearsal, it is forgotten. All incoming information is temporarily stored in STM, but due to the limited capacity, information that receives the most attention becomes most accessible. On the other hand, the capacity for LTM is considered to be infinite and any information that is passed on is likely to be stored permanently. Baddeley (1986) revised the notion of STM, and referred to it as the working memory (WM) to emphasize the fact that this memory component is not simply storage but also functions as a workbench on which a variety of processing of information takes place.

During reading processes, WM temporarily

stores newly processed information. The information that is temporarily stored in WM is considered as being 'activated,' which refers to high accessibility of the information. It is this activation that allows the reader to retrieve and integrate information. The reader integrates the information in WM with newly incoming information, as well as world knowledge stored in LTM. This so-called world knowledge, or our understanding of the world acquired through direct and indirect experiences are organized into schemata (Bartlett, 1932), and helps readers to predict and build the representation of the information. As the reader progresses in their reading and receives new information, they may encounter failure to any initial predictions of the textual content. They then immediately make new predictions that fit the understanding of the newly processed information (Baddeley, 1986).

These basic operations of memory which perform integration of textual information are pertinent to reading processes in L2 as well. However, unlike processes in L1 where information is effortlessly processed, comprehending information in one's L2 sets a greater impediment for processing, due to the reader's inexperience and incompetence in their L2. According to the Capacity Hypothesis proposed by Just and Carpenter (1992)(further explained later in the text), there is only a limited amount of cognitive resources that can be allocated for cognitive activities. On the basis of these facts, it is possible to assume that memory retrieval and retention of information in L2 would demand a greater cognitive resource for processing.

2.2. Textual Coherence and Inferences

According to Kintsch and van Dijk (1978), readers analyze a text into meaning units called 'propositions' and store them in memory during comprehension. A proposition is the representation

of a single informational unit. For example, “The pretty girl was upset” may be analyzed into the following propositions; PRETTY [GIRL] (denoting “*The girl is pretty*”) and UPSET [GIRL] (denoting “*The girl was upset*”).

During reading processes, a reader assumes that the text is a meaningful set of informational units, whether they are properly organized or not, and seeks to form a representation of the text that is coherent. Coherence is the logical continuity of a sentence or text that strings informational entities together. Specifically, local coherence is the relatedness between sentences, whereas global coherence is the connection that unites the whole theme together. Both are necessary to achieve textual understanding. If the text is found to be coherent, the reader perceives the text to be meaningful. On the other hand, lacking textual coherence implicates that there are textual gaps, which make it more difficult for the reader to understand the content. Consequently, textual coherence is crucial in facilitating messages to be accurately conveyed.

A goal of comprehension, then, is to bridge these textual gaps that occur between sentences. The process of bridging such gaps, known as inferencing, involves the integration of world knowledge and information included in the text. For instance, in order to understand the sentence, “*Splash. The fish jumped.*” the reader must conjure the image of water, say a pond or a lake, in order to depict the situational environment in their mind, despite the fact that the text does not include any direct indication of the word ‘water’ or ‘pond’. In this example, the reader must search for such information from their world knowledge to infer that the terms ‘splash’ and ‘fish’ are related to some body of water.

Readers must effectively make inferences based on the information that is provided by the text. Graesser, Singer & Trabasso (1994) identify

thirteen main types of inferences: referential, case structure role assignment, causal antecedent, superordinate goal, thematic, character emotional reaction, causal consequence, instantiation of noun category, instrument, subordinate goal-action, state, and emotion of reader and author’s intent. Of these thirteen types, referential inference has attracted wide attention from researchers in the psycholinguistic field as it is a fundamental procedure in understanding the whole text (e.g. Garnham, 1984; Boland, Tanenhaus, & Garnsey, 1990; Foertsch, & Gernsbacher, 1997). Interpretation of a text demands the identification of certain events or states, more specifically, the matching of such events or states to particular individuals and entities mentioned in the text. Maintaining such continuity among individuals and events is highly important for the completion of the reading task for they connect incoming information with the mental representation that is already constructed. Furthermore, from a methodological view, stimulus texts for an experiment with referential coherence can be easily manipulated and have been practical in testing and experimenting (Graesser, Singer & Trabasso, 1994).

2.4. Referential Coherence and Anaphoric Resolution

Relating entities in a text is dependent on comprehension of syntactic, semantic, and contextual clues. An anaphora is an expression that refers back to an entity that was mentioned previously in the text, and the entity that is being referred to, is the antecedent. For example, in the following examples, “*he*” in sentence 1), refers back to the antecedent “*John*”; Similarly, the anaphora “*her*” of “*her parents*” in Sentence 2), refers back to the antecedent “*Cindy*”:

- 1) John left for work earlier than usual. He reached his office late.

2) Cindy introduced me to her parents. Her parents were nice and sincere.

3) Billy and Joe were late for work. He decided to call in sick.

During reading processes, the reader connects the anaphora to its antecedent. Clark & Haviland (1977) suggest that by bridging the antecedent and anaphora, readers are able to connect the mental representations of the sentence including the anaphora and the sentence including the antecedent. The complexity in resolving referents is that references to certain individuals or objects are likely to be referred to again with different anaphoras. Anaphoric relations can be subtle in that they require particular knowledge and may pose a challenge in interpreting which expressions refer to mentioned items. For example, "Jesus" may be referred to as "the lion of the tribe of Judah." This requires the biblical knowledge.

Studies support the strategic search models that state that when readers come across an anaphoric noun in their L1, they strategically search for its antecedent in the representation of the discourse by exploring the mentally represented proposition (Clark & Sengul 1979; O'Brien, Plewes, & Albrecht, 1990). Such a process of resolving an anaphora is highly complex, for the reader must rely the subtle hints implicated in the text in order to eliminate other possible choices. Incoming input must be connected to information stored in WM or to information introduced earlier in the text that is no longer stored in WM. In other cases, the reader is expected to make inferences from world knowledge in order to fill in missing information gaps. In the above example sentence 3), the reader has no way of knowing whether the "he" refers to Billy or Jack. Though there are no textual hints that determine who "he" is referring to, a preceding text may indicate that Billy is very serious about his work, while Joe is always finding a new job. This may imply that the "he" is Joe.

But before any of this takes place, readers must decide whether a word or an expression actually refers to another entity, because parts of texts may not provide referential information at all (Just & Carpenter, 1987).

Such contextual and/or informational hints which guide readers to make intelligent assumptions are called saliency. Referents need some level of saliency in the text in order to be resolved. However, the difficulty of saliency is that it occurs in many ways such as gender agreement in sentence a) below, where "she" can only refer to *Mandy*, and not *Chris*. Or there may be syntactic constraints as in sentence b), where "herself" refers to *Christina* and not somebody else as seen in sentence c).

a) Mandy and Chris were ready to show the class the picture. She was confident that the other students would love it.

b) Christina forgave herself for the incident.

c) Christina forgave her for the incident.

Another common element which may ease resolution processes is merely recency of the target anaphora to its antecedent. In the paragraphs below, paragraph 1) would be easier (reading times would be shorter; this will be further discussed later) for a reader to resolve the anaphora than that of paragraph 2) because the distance between the first anaphora and its antecedent is shorter than that of paragraph 2).

1) **Dr. Stevens** took **his** scrubs out of his locker and headed for the OR. **He** had intended to take some time off, but **his** hard schedule did not allow **him** such luxury.

2) The world renown **Dr. Stevens** had no time to spare for more operations. Patients were on waiting lists to be operated. **He** knew that **he** would not be going for a vacation in a long time.

The following are some examples of anaphora in use. There are various types of anaphora, for

instance pronoun anaphora, where the entity is replaced by a pronoun as in sentence (1), noun anaphora, where the entity is replaced by a noun as seen in the second example sentence, or zero anaphora in Japanese where the anaphora is omitted due to the mutual understanding of the communicator and recipient as seen in example sentence (3).

- 1) Rachel drank a can of juice. It was sweet.
- 2) Rachel drank a can of juice. The juice was sweet.
- 3) レイチェルは缶ジュースを飲んだ。甘かった。
Reicheru wa kan juusu o nonda. Amakatta.
(Rachel drank the canned juice. Was sweet.)

As seen in the examples above, the uses of anaphora encompass various styles. According to Tsutsui (1991), textual referents are divided into two main categories, direct anaphora and indirect anaphora. Direct anaphora is considered to be coreferential, meaning that their antecedents are mentioned explicitly in the context. On the other hand, readers need to make inferences to find the antecedents to resolve indirect anaphora for they are not mentioned explicitly in the text. This bridging process requires background knowledge and resolution processes are therefore considered to be relatively difficult.

Of the various types of referring expressions, here, we focus primarily on direct anaphora and bridging description, which is classified as indirect anaphora. Their definitions slightly differ according to researchers, and at times, bridging descriptions are referred as bridging inferences. Here, we adapt the definitions employed by Poesio (2003; Poesio & Vieira, 1998), who have dealt with these two anaphora types in their past research.

Direct anaphora, as indicated above, are cases where the description has the same head noun as its antecedent as in the case of, “*The Hollywood star was now extremely popular. The star was making millions of dollars.*”, where the noun phrase “the

star” refers to “the Hollywood star”. Bridging descriptions, on the other hand, are cases where the head noun of the anaphoric description differs from its antecedent, unlike direct anaphora. Resolving a bridging description requires more than just matching their head nouns, and involves the reader to make logical reasoning from the context to find the corresponding antecedent. Poesio, Vieira, and Teufel (1997) point out that these descriptions may be co-referential with an entity already introduced in the discourse, but characterized by a different head noun as in “*A car stopped in front of the house. However, the vehicle immediately drove off after Emily came out of the house.*” where “*car*” and “*vehicle*” refer to the same entity. Otherwise, they may be simply semantically related to as in “the door” and “*the house*” in the following sentence. “*She saw a white house in front of the school. The door opened abruptly.*”

As mentioned earlier, the goal in anaphor resolution is to match potential antecedents to the anaphora. Finding these potential antecedents rely on implicit hints embedded in the text. Moreover, the potential candidates must satisfy certain constraints and therefore competent reading processes are required. Readers must be efficient and effective in being successful in resolution processes.

Much research on anaphor resolution often employs the self-paced reading technique where readers are presented with a stimulus, usually a word or a sentence. The reader controls the onset of the next stimulus and presses a key to move on. Reading times for each stimulus is measured and later compared for analysis. This method assumes that any additional processing that is needed for certain complex clauses increases the reading time. For example, studies by Garrod & Sanford (1977) showed that reader’s expectation for certain instances changed comprehension processes. In the following example, sentence 1) was processed

quicker than sentence 2) because the word “bus” generates a stronger expectation for the word “vehicle” than “tank”.

- 1) The bus came to a halt. The vehicle was full of people.
- 2) The tank came to a halt. The vehicle was full of people.

As can be seen in the above example, processing is sensitive to even the slightest variables which affect cognitive work load. The work load presumably becomes arduous as these high level tasks are done in the second language.

Studies employing the self-paced reading technique with direct anaphora and bridging descriptions are rare, for most research has centered on the resolution process with the use of algorithms. However, the reading time study carried out by Clark and Haviland (1974) suggests that readers spend a considerably longer time to process sentences with bridging descriptions than those in which readers need to simply match the head noun. If the expression or the information of the anaphora and antecedent match directly, readers simply need to do a matching process. However, when information needs to be inferred to tie the anaphora to its antecedent, as in the case of bridging descriptions, the reading time slows down in order to compensate for the greater burden that is faced, in order to process the text.

3. Anaphoric Resolution in Second Language

Obvious as it may seem, not all readers are successful in achieving referential coherence to create consistent mental representations. When readers face situations where a text is difficult to process, they may fail to build constructive mental representations. According to the Capacity Hypothesis (Just Carpenter, 1992) mentioned earlier, there is only a limited amount of cognitive

resources that can be allocated for cognitive activities. This means that when the demand for information storing and information processing surpasses the supply, they will contend for the limited supply, causing a tradeoff to occur. If readers are successful in processing textual information within their cognitive capacity, they may succeed to construct a coherent mental representation of the text.

Research suggests that readers will immediately and automatically activate the intended referent when they come across an anaphora (Gernsbacher 1989). Nevertheless, these quick searches are based on studies in the L1. The same processes when done in the L2 would be much more demanding on the part of the reader.

The tradeoff between information processing and information storing differs between L1 and L2 readers. The Capacity Hypothesis proposes that low level processes will precede high level ones, when the demand to attend to, is greater than the reader’s cognitive limit. Hence, L2 readers must first overcome low level processing such as making lexical and semantic connections, before they can integrate and pertain to other higher level processing, such as making inferences and bridging anaphoras to corresponding antecedents. Because such low level processes already consume much of their cognitive resources, language learners’ allocation of resources to much higher level processing, such as making inferences and reference resolution is much less than would be in processes done in their L1 (Morishima, 2006).

In contrast, such processes would be much quicker for an L1 reader. When an act is practiced intensively, the process is automatized; a phenomenon called automatic processing. Research on automatic processing has been done from different directions, but all of them agree that it is fast and accurate (de Jong, 2005). The efficiency of automatic processing is seen notably

in L1 comprehension processes, evidently due to the familiarization to the native language. L1 readers can easily make surface level connections and therefore can resort much of their cognitive resources for higher level processes such as comprehending the implied message, making elaborations and understanding the author's objectives. This is also demonstrated in research, where simpler processes such as lexical access (Potter, So, von Eckhardt, & Feldman, 1984) and syntactic processing (Zwaan & Brown, 1996) in L2 are indicated as a more resource consuming task than in L1.

Given such premises, the stakes to resolve bridging description in L2 can be expected to be relatively higher than in the case of direct anaphora, for they are not coreferential. An explicit indication of its antecedent would only require a matching process of the referring expression to its antecedent, as well as information storing for the reader. However in the case of indirect anaphoras such as bridging descriptions, where the anaphora and its corresponding antecedent are less salient and do not bear resemblance, the reader must allot a greater cognitive load for resolution measures than in the case of direct anaphora. With such ongoing processes in a language that requires a greater effort to comprehend, the reader is surely to face a greater difficulty for comprehension. In fact, Pretorius (2005) found that despite the seemingly trivial procedure, L2 learners may face difficulty in anaphora resolution.

4. Conclusion

Revealing L2 reading processes is more than a conversion of L1 reading processes into the L2 context, and more research is yet to be conducted. Given anaphora alone, such processes as antecedent retrieval, mental representation construction and textual integration all come

into play, let alone the reader's proficiency in the language, reading strategies and memory span.

Future studies should render attention to comparison of reading processes by language learners and native speakers, for they will specifically indicate difficulty issues as well as differences that learners may exhibit that researchers may have never considered. These studies will clarify unique aspects attributed only for language learners whose language competence is underdeveloped.

Exploring the processes that are taken on by language learners to process a text is crucial for establishing theoretical foundations and premises that underlie practical pedagogy which relies heavily on hands-on pursuits to better their nature. It is important that such studies further develop and advance in the future, for researchers can find specific hints and implications for education that may improve learning or teaching strategies in the future.

References

- Alderson, J. (1984). Reading in a foreign language: a reading problem or a language problem? In J. Alderson & A. Urquhart (Eds.), *Reading in a Foreign Language* (pp.1-24). London: Longman.
- Atkinson, R.C. & Shiffrin, R.M. (1971). The control of short term memory. *Scientific American*, 225, 82-90.
- Baddeley, A., (1986). *Working memory*. Oxford: Clarendon Press.
- Bartlett, F.C. (1932). *Remembering: a study in experimental and social psychology*. London: Cambridge University Press.
- Boland, J.E., Tanenhaus, M.K., & Garnsey, S.M. (1990). Evidence for the immediate use of verb control information in sentence processing. *Journal of Memory and Language*, 29, 413-432.
- Clark, E. V., & Sengul, C. J. (1978). Strategies in the acquisition of deixis. *Journal of Child Language*, 5, 457-475.
- Clark, H. & Haviland, S. E. (1974). Psychological process as linguistic explanation. In

- D. Cohen (Ed.), *Explaining linguistic phenomena*. Washington: V. H. Winston.
- Clark, H. & Haviland, S. E. (1977). Comprehension and the Given-New Contract. In R. Freedle, (Ed.), *Discourse Processes: Advances in Research and Theory*, Vol.1. *Discourse Production and Comprehension*. N. J.: Ablex Publishing Corporation.
- Crystal, D. (1992). *Introducing Linguistics*. London: Penguin Group.
- de Jong, N. (2006). Learning Second Language Grammar by Listening. *Dissertations LOT: Netherlands Graduate School of Linguistics*.
- Foertsch, J., & Gernsbacher, M.A. (1997). In search of gender neutrality: Is singular *They* a cognitively efficient substitute for generic *He*? *Psychological Science*, *8*, 106-111.
- Garnham, A. (1984). Effects of specificity on the interpretation of anaphoric noun phrases. *Quarterly Journal of Experimental Psychology*, *36A*, 1-12.
- Garrod, S. & Sanford, A.J.(1977). Interpreting anaphoric relations: the interpretation of semantic information while reading. *Journal of Verbal Learning and Verbal Behaviour*, *16*, 77-90.
- Gernsbacher, M.A. (1989). Mechanisms that improve referential access. *Cognition*, *32*, 99-156
- Graesser, A.C.; Singer, M. & Trabasso, T. (1994). Constructing Inferences During Narrative Text Comprehension. *Psychological Review*, *101*, 371-395.
- Just, M. A. & Carpenter, P.A. (1987). *The Psychology of Reading and Language Comprehension*. Massachusetts: Allyn and Bacon.
- Just, M. A. & Carpenter, P. A. (1992). A Capacity Theory of Comprehension: Individual Differences in Working Memory, *Psychological Review*, *99*, 122-49.
- Kintsch, W. & Van Dijk, T.A. (1978). Toward a model of text comprehension and production. *Psychological Review*, *85*, 363-394.
- Miller, G. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, *63*, 81-97.
- Mitkov, R. (1999). *Anaphora Resolution: The State of the Art*. Paper based on the COLING' 98/ACL' 98 tutorial on anaphora resolution; University of Wolverhampton .
- Morishima, Y. (2006). A Theoretical Sketch of Discourse Comprehension in Second Language. *The Journal of Social Science*, *57*, COE Special Edition.
- O'Brien, E. J.; Plewes, S. & Albrecht, J. E. (1990). Antecedent retrieval processes. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *16*, 241-249.
- Pretorius, E.J. (2005). English as a second language learner differences in anaphoric resolution: Reading to learn in the academic context. *Applied Psycholinguistics*, *26*, 521-539.
- Poesio, M. (2003). Associative descriptions and salience. In *Proceedings of the EACL Workshop on Computational Treatments of Anaphora*.
- Poesio, M., & Vieira, R. (1998). A Corpus-based investigation of definite description use. In *Computational Linguistics*, Vol. 24(2), 183-216.
- Poesio, M.; Vieira, R. & Teufel, S. (1997). Resolving bridging references in unrestricted text. In *Proc. Workshop on Operational Factors in Practical, Robust Anaphora Resolution for Unrestricted Texts* (pp.1-6). Association for Computational Linguistics.
- Potter, M. C.; So, K.; Eckardt, V. & Feldman, L. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, *23*, 23-38.
- Tsutsui, M. (1991). Establishing Anaphoric Reference: A Contrastive Study of The and Wa. *Intercultural Communication Studies*, *1(1)*, 197-217.
- Zwaan, R.A., & Brown, C. M. (1996). The Influence of Language Proficiency and comprehension Skill on Situation Model Construction. *Discourse Processes*, *21*, 289-327.