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A Review of Studies on the Selective Attention Strategy During Language Comprehension: The Present and the Future

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***Abstract*—Selective attention (SA) is an important strategy for language comprehension both in L1 and L2. Much of the existing research on L2 listening and reading has identified SA as a distinctive ability of effective and skilled L2 listeners and readers. However, extensive and intensive research on this specific strategy is relatively sparse. Therefore, this article provides an in-depth review of previous research involving the SA mechanism in both L1 and L2 language comprehension. As a result, this article identifies that there are two-levels of SA existing in previous academic research: the word level and sentence level SA. They may represent different cognitive processes as well as different SA strategies in real practice. However, this kind of classification on SA has not been fully recognized and specifically pinpointed by previous literature, since previous studies focused on only one type of SA while ignoring the other. Therefore, this article proposes to classify these two kinds of SA and then reviews previous literature according to this novel classification. In addition, this article summarizes the most frequently investigated modulators of SA as well as commonly used research methods for SA-related research. Some possible research gaps are pinpointed accordingly. Finally, this article illustrates several concepts and models that could explain the SA mechanism from psychological and linguistic perspectives, which could serve as a theoretical framework in future study. This article may offer some inspirations for future academic research in this field and listening or reading practices in the real world.**

***Index Terms*—Selective attention strategy, language listening strategy, language reading strategy, language comprehension strategy**

I. Introduction

Selective attention (SA) for language comprehension is defined as the process by which the importance of language element is determined by its importance and additional attention is devoted to more important elements during the comprehension process (Anderson, 1982). SA has been regarded as an important strategy for listening and reading comprehension in both L1 and L2. Some studies involving L2 strategies have found SA to be a distinctive strategy that is exclusively employed by effective and skilled L2 listeners and readers. Moreover, in interpreting-related research (Gile, 2009), SA strategies (such as "focusing on the major information") have been identified as one of the most important strategies that need to be acquired by interpreters. However, despite the importance of SA in real practice, research on SA has been relatively sparse. These studies offering complete and comprehensive reviews on this topic are even more limited.

In addition, in the real practice of listening or reading comprehension, the strategies of "focusing on key words, such as nouns" and "gasping the main idea and major information" are two equally important but different SA strategies. These two strategies involve different cognitive process, and they are applied in different situations during language comprehension. However, in terms of academic research, these different kinds of SA strategies have not been fully recognized up to now. Most of the previous research has been focused on one type of SA while ignoring the other types. Therefore, this article has recognized these different kinds of SA strategies and proposes two new terms for them: the word-level and the sentence level SA, which refer to the SA on a word level (such as key words) and SA above sentence level (or the text level, such as focusing on major information or overall meaning) respectively. This article will then review the previous research by first classifying them into these two categories.

This article attempts to provide a relatively comprehensive review on previous literature involving the SA mechanism for language comprehension. Specifically speaking, this article covers several SA-related aspects also reviewed by previous research: the definition of SA, the empirical research involving SA, and theoretical research that could explain the SA mechanism. Among these aspects, the aspect of the empirical research involving SA covers the dual-level classifications of SA, the major modulators (factors that cause the selective attention, such as the key words) of SA, and the research methods adopted in previous SA-related research.

This review could be significant from several aspects. Firstly, this article proposes an important and novel classification of the SA mechanism: the word-level and sentence-level SA. This classification has not yet been officially recognized by related academic research, but it could be very significant since these two strategies are applied differently in real practice. For example, the word-level SA could represent the strategy of "focusing on key words", while the sentence-level SA could represent the strategy of "focusing on major information during listening or reading". Secondly, this article summarizes and analyzes the most investigated modulators of SA, which could offer some insight into the most consistent or important modulators of SA. Identifying this modulator could help language users by allowing them to focus only on this modulator when they encounter stressful language comprehension situations (e.g., fast delivery or unfamiliar words). Thirdly, this article summarizes several commonly used research methods for SA-related research and analyzes the advantages and or disadvantages of these methods. This analysis could help to identify the most reliable research method for SA-related research in the future. Finally, this article discusses several psycholinguistic and linguistic concepts and models that could explain the reasons for the SA mechanism, and these models or concepts could serve as theoretical support for future research involving SA.

II. Definition of Selective Attention

Systematic research on SA began in the 1980s when Anderson (1982) proposed a theory asserting that text elements are processed and graded for importance and that additional attention is devoted to more important elements during text comprehension. In other words, more important text elements receive more attention than less important elements. Since Anderson proposed this theory, dozens of studies started to focus on SA mechanism during language comprehension. Some of the studies have proposed different names for SA mechanisms, such as the SAS and depth of processing. These two concepts will be expounded below.

A. Selective Attention Strategy

Reynolds (1992) proposed the term "Selective Attention Strategy" (SAS), claiming that language learners will devote additional attention to text elements in proportion to their importance during the reading process and text element salience (importance) can be manipulated by different variables (e.g., text-related modulators, reader-related modulators, and task-related modulators). Reynolds's research on SA is very influential, as it has provided a basis for SA-related research in L1 comprehension.

Subsequently, Hidi (1995) further expanded the concept of SAS by classifying SA into two phases: perceptual attention and conceptual attention. Perceptual attention processes orthographic characteristics of words, and it can be represented by the attention duration. While conceptual attention determines the semantic characteristics of words, and it can be represented by the attention intensity. Therefore, conceptual attention is different from perceptual attention. For example, a listener would pay more attention on unfamiliar words while listening, which represents increased perceptual attention but decreased conceptual attention since the listener may fail to understand the words' meanings. According to the research of Hidi (1995), SA involves both types of attention but in different ratios. Hidi's classification of SA is significant because it offers a more reliable approach for analyzing and measuring attention during language comprehension.

B. Depth of Processing

Another scholar who has conducted extensive research on the SA mechanism is Sanford. Sanford and Graesser (2006) proposed the term "depth of processing," which indicates that "language input, both spoken and written, is not processed in a precise and complete manner; rather, some language input is processed more deeply than others because the information is incomplete or it is not worthy of too many processing efforts" (Sanford & Graesser, 2006, p. 100). This concept of "depth of processing" is like the concept of SAS although they are under different names.

Except for these two studies mentioned above, some other studies have focused on the empirical research of SA mechanism. The next section describes the empirical research on SA in both L1 and L2 comprehension.

III. Empirical Research Involving SA Mechanism in First Language Comprehension

Since the 1980s, dozens of researchers have conducted empirical research on the SA mechanism in first language reading and listening comprehension processes. These studies have adopted various research methods to examine different kinds of SA. The next section provides a brief review of some relevant research from three perspectives: the different levels of SA (the word level and sentence level), the different modulators of SA, and the different research methods that have been used in SA related research.

A. Selective Attention at the Word and Sentence Levels

Previous research divides SA into two categories: word and sentence level. Word-level SA refers to the process in which language users pay more attention to certain types of words during language comprehension, such as content words, nouns, and accentuated words. In contrast, sentence-level SA refers to the process in which language users pay more attention to specific kinds of sentences or information during language comprehension, such as sentences concerning the main idea or gist of a text. However, it should be noted that the sentence level SA does not mean the

exact sentence as it appears in the original text or speech; rather, it could be the paraphrasing form of the original clause or sentence, since the meaning of clause or sentences may not exit the mind verbatim.

This classification of these two levels of SA is meaningful and significant in real-life reading and listening practices because different levels of SA can involve different kinds of reading or listening strategies. For example, word-level SA can involve strategies of "focusing on keywords", while sentence-level SA could refer to strategies such as "grasping the gist or main idea of a text or speech".

However, this kind of classification has been rarely discussed in previous research since most of previous researchers have focused solely on one level of SA. For example, Conrad (1989) and Brown's (2008) research focused only on word-level SA, while Cirilo and Foss (1980) as well as Reynold (1992) focused exclusively on sentence-level SA.

Due to the differences in these two strategies, future research may be needed to further confirm the existence of two-levels of SA during language comprehension based on the empirical research. This article, hereby, would firstly classify SA into word and sentence level SA, and in the following sections it will review previous literature according to this classification.

B. Different Modulators of Selective Attention

The modulators of SA refer to the variables that cause the change of attention during language comprehension. For example, content words could be a modulator for SA because they could attract more attention during language comprehension. The concept of a modulator is significant because it can be used as an important strategy for L1 and L2 users. For example, if a specific modulator that requires more processing effort is identified, the language users can be trained to pay additional attention to that modulator during the stressful language comprehension period (such as unfamiliar words or rapid delivery of speech).

Sandford and Reynolds provided a comprehensive summary on all the possible modulators of SA. According to Reynolds (1992), the importance of text elements could be modulated by many factors (modulators), including text-related modulators (e.g., information density), reader-related modulators (e.g., the reader's background), and task-related modulators (e.g., questions concerning a text). Sanford and Graesser (2006) also proposed a wide range of potential attention-capturing devices (attention-modulating devices or modulators of SA), including syntactic devices (e.g., cleft structure), semantic devices (e.g., metaphor), prosody, and text structure (e.g., focus).

Except for the studies mentioned above, other research has tended to focus on one modulator of SA in their studies, such as content words for word-level SA or text structure for sentence-level SA particularly. The next section reviews the most investigated modulators in previous research involving the SA in first language comprehension.

(a). Commonly Investigated Modulators of Word-Level SA

Based on the previous literature, the most investigated modulators for word-level SA include content words, nouns, focus, and prosody.

- Content words

Content words or, more specifically, nouns are the most frequently examined modulator for word-level SA. Dozens of studies have examined the relations of content words and the SA during reading or listening comprehension. For example, Mehler (1978) investigated the allocation of attention between different word classes and found that adjectives were selectively omitted from subjects' recall, which could indicate that less attention was paid to adjectives during the reading process. Conrad (1989) showed that native listeners concentrate on key content words in the listening input. In addition, Brown (2008) suggested that nouns, particularly argument nouns, appear to be preferentially selected for attention when subjects were required to listen under stressful conditions.

- Focus

Another commonly examined modulator for SA in L1 listening is focus. Focus is a concept from the theory of information structure, which refers to the part of a sentence that contributes new and prominent information to a sentence (Rochemont & Culicover, 1990). Focus can be realized in various ways (Zimmermann & Onea, 2011). For example, in the cleft sentence "it is you who should take the blame", "you" is the focus of the sentence. This focus is realized by syntactic manipulation. While, in the question-answer sentence "who took this? - I took it", "I" is the focus. This focus is realized by contextual manipulation. Typically, one sentence will have only one focus, and a sentence will not have a focus at all if no information is specifically emphasized in that sentence. A couple of previous researchers have examined the effects of focus on the SA process during language comprehension. For example, Sanford and Graesser (2006) investigated the effects of focus on attention allocation during listening comprehension and found that focus-driven stress leads to an increased depth of processing. Moreover, Yang et al. (2019) obtained evidence that increased attention is allocated to the focus during reading comprehension.

- Accentuation and prosody

Another commonly investigated modulator of SA in listening is accentuation or prosody. Accentuation is one type of prosodic information that reflects the relative prominence of a particular syllable, word, or phrase in an utterance (Shattuck-Hufnagel & Turk, 1996). Li and Ren (2012) investigated how accentuation influences semantic processing during online spoken comprehension, which concluded that accentuation can rapidly modulate SA and influence the depth of semantic processing. Other researchers subsequently used ERP (event-related potential) technology to

investigate the relationship between accentuation and SA, and the similar results were obtained (Li et al., 2014; Li & Yang, 2013).

(b). Commonly Investigated Modulators of Sentence-Level SA

The most frequently investigated modulator of sentence-level SA is very consistent through the past research, and that is the text structure. The term "text structure" originates from Kintsch's (1978) model of text comprehension. According to that model, meaning is typically represented in the form of propositions during comprehension of connected speech or text. These propositions are connected by the text structure, which includes the microstructure and macrostructure. The microstructure is the structure of the individual propositions and their relationships, which represents the details of the text and the relationships between them, while the macrostructure represents the global coherence of individual propositions and the gist of the text or speech.

A couple of previous researchers have investigated the SA mechanism (sentence level) modulated by text structure. Johnson (1970) found that sentences that were important in the structure of a text were recalled significantly better than those that were not during text reading, which indicated that text structure was an important modulator of SA. Other research has also examined text structure-modulated SA (sentence level). For example, Cirilo and Foss (1980) found that subjects took a longer time to read and had a better recall of a sentence when the sentence played a high-level role in a text than when it played a low-level role in the text.

Although text structure is the most frequently investigated modulator of sentence-level SA, other research has also focused on other modulators of sentence-level SA during reading comprehension, such as interestingness and cognitive load. For example, Goeze (1983) indicated that the interestingness affects the SA mechanism during language comprehension. Britton (1980) investigated the effects of cognitive load on SA, which revealed that cognitive load also modulated SA during reading.

The research mentioned above has investigated several commonly investigated modulators of word level SA and sentence level SA. The summary of these modulators is showed in Table 1.

TABLE 1
THE DIFFERENT MODULATORS OF SA EXPLORED IN PREVIOUS RESEARCH

Levels of SA	Specific Modulators
Word-level Modulators	Content words or nouns
	Focus
	Accentuation or prosody
	Other modulators: interestingness or load
Sentence-level Modulators	Text structure Other modulators: interestingness or load

Previous research either focuses on one modulator of SA for investigation or summarizes all the possible modulators of SA. There are few studies that have attempted to identify the most significant and consistent modulator of SA during listening or reading comprehension. This research is very crucial, because it is highly likely that the language users can only focus on one or two modulators during language comprehension due to their limited cognitive resources. Therefore, determining the most consistent and significant modulator of SA could help language users focus on that specific language element (e.g., keyword or important information), thus helping language users better manage the stressful language comprehension situations. However, the previous literatures aiming to determine the most consistent and important modulator of SA are very sparse. Therefore, further research may be needed to identify the most significant and consistent modulator of SA during listening or reading comprehension, or, at least, a comparison between different modulators could be conducted in order to find the most important one.

C. Research Methods Involved in SA Related Research

Exploring the SA mechanism in L1 listening and reading is not easy, as it involves people's cognitive processes. Nevertheless, previous research has examined the SA mechanism using various methods. Some of these methods have maintained the natural comprehension process without much interference, while others have interrupted the natural comprehension process for connected speech or text to some extent. In the next section we will discuss some commonly used research methods for SA-related research, which are also divided into the word and sentence-level research.

(a). Research Methods Employed in Research on Word-Level SA

Several research methods have been widely used in research concerning word-level SA previously, which includes the recall method, change-detection method, the secondary-task method, and some novel techniques such as ERP and eye-tracking. These research methods will now be discussed in detail.

➢ Recall method for word-level selective attention

The recall method has been widely used in word-level SA research. Most studies employing this method would first establish a stressful language comprehension situation, and then the participants would be required to listen to or read a text before recalling it. Such studies have used recall as a measurement for the depth of processing or attention during language comprehension. For example, Conrad (1989) constructed a stressful listening scenario in which the delivery rate of the speech used was accelerated by 40–90%, and the native listeners were required to have an aural recall on the

speech to expose the possible use of SA strategies. Brown (2008) created a stressful language comprehension condition in which listeners were provided with an excessive amount of information within a given time limit, and then the participants were required to recall as much information as possible to expose the possible use of SA strategy.

However, this research method has been challenged by other researchers, including Reynolds (1988). Reynolds (1988) claimed that using the recall method to measure the attention process (or depth of process) during language comprehension may not be reliable, as some other variables (such as memory) cannot be successfully controlled, and these variables will interfere with the results. In such contexts, better recall would be contributed to by greater memory capacity, rather than the depth of processing. Furthermore, most of the research mentioned above has manipulated the natural comprehension process by constructing a stressful language comprehension condition to some extent. Therefore, the research method of recall may not be reliable enough to investigate the SA mechanism during language comprehension, and other research methods should be considered.

➢ Change-detection method for word-level selective attention

In the change-detection method, subjects listen to or read similar language input twice and determine the possible changes between the language inputs. This research method was frequently employed by Sanford. Sanford (2005) used an auditory change-detection method to examine the effect of comprehension load on the depth of processing during listening comprehension. Sanford and Graesser (2006) also employed a change-detection method to investigate the effects of focus on attention allocation during listening comprehension. However, this research method may compromise the natural listening comprehension process since subjects must listen to the similar speech twice to determine the possible changes.

➢ Secondary-task method

For the secondary-task method, participants are required to listen or read a text or speech while simultaneously responding to a probe as quickly as possible. The probe response, as a secondary task, is used to measure the attention or processing depth during language comprehension. This research method assumes that the deeper the processing depth, the less attention is left for the secondary task (the probe response), which would cause more reaction time to the probe. Several studies have employed this research method. For example, Wearing (1971), Britton (1980), and Reynold (1988) used this method to study SA and obtained successful results.

The advantage of this method is that it can successfully measure both conceptual attention and perception attention. However, the secondary-task also interrupts the natural comprehension process since participants might pay more attention to the secondary-task than the primary task (reading or listening) during the language comprehension task.

➢ Event-related potential and eye-tracking for word-level selective attention

As technology develops, new technologies have been adopted in SA (word level) related research, such as eye-tracking and ERP technology. Rayner (1997) employed an eye-tracking system to examine the relationship between SA and focus, which obtained some successful results. However, this new technology has its limitations. For example, eye-tracking technology may measure more perceptual attention (reading time) but less conceptual attention (processing depth), which may compromise research results.

Another research technology is ERP. Yang et al. (2019) employed ERP in a reading experiment. They induced focus using question-answer sentence pairs and found that the focused word elicited a larger P200, showing that increased attention is allocated to the focused item during reading comprehension. Li and Ren (2012) investigated the influence of accentuation on semantic processing during listening comprehension using an ERP technique. Subsequent researchers also used ERP to investigate SA during speech comprehension and obtained successful results (Li et al., 2014; Li & Yang, 2013). However, the ERP technique still has limitations, as it requires subjects to listen to similar sentences (rather than connected speech) dozens of times to expose the target variables. Therefore, the ERP method may compromise the natural listening comprehension process for connected speech or text.

Except for the research methods mentioned above, other research methods have also been previously used. For example, Conrad (1985) employed a cloze test technique to investigate listeners' attention allocation during listening comprehension. In Conrad's research, the participants listened to a speech and then completed a cloze test. This test was then scored to determine whether some language elements were filled up more thoroughly. However, this research method was used by other researchers.

These studies mentioned above all investigated the SA mechanism at the word level. The next section discusses the research methods employed in research involving sentence level SA.

(b). Research Methods Employed in Research on Sentence-Level SA

Several studies have investigated SA at the sentence level. However, these studies mainly involved reading comprehension, and studies on listening comprehension have been sparse. As for reading comprehension, the most commonly used research method is the recall-rating method for sentence-level SA.

➢ Recall-rating method for sentence-level selective attention

In the recall-rating method, the importance of sentences in one text is categorized into different levels according to their role in text structure, and the classification is based on Kintsch's (1978) text model. Then, subjects are asked to recall the text after reading it. Then, the rating of the text and the recall of subjects are compared to investigate how many high-level and low-level sentences are recalled, thus revealing if the high-level sentences are easier to recall than low-level sentences. This research method has been widely used to investigate the SA modulated by text structure. For

example, Johnson (1970) and Goeze (1983) have used this method to examine the SA mechanism during reading comprehension.

This research method investigates SA at the sentence level and does not compromise the natural comprehension process, so it is widely used in previous research involving sentence level SA. However, the method has also been challenged by some researchers, such as Briton (1979) and Reynolds (1988). They argued that the recall process may be influenced by subjects' memory capacity. Thus, another research method based on this one emerged later, the sentence-repetition and recall method, which successfully avoided the interference of memory capacity.

➢ Sentence repetition and recall method for sentence-level selective attention

In the sentence-repetition and recall method, the same sentence repeatedly occurs in two different texts. In one text, the sentence is located in high-level structure. While, in another text, it is located in a low-level structure. Then, the subjects are required to read and recall these two texts. The two recall protocols are then compared to determine whether the sentence in the high-level structure will be more successfully recalled than the same sentence in the low-level structure. Thus, the influence of text structure on attention allocation is exposed, and the variable of memory capacity is successfully controlled, since the subjects need to recall two texts under the same conditions. This research method has been successfully utilized in a few studies. For example, Cirilo and Foss (1980) employed a sentence-repetition method to examine the influence of text structure on attention allocation during reading, which obtained reliable results successfully. Besides, this technique does not interrupt the natural comprehension process for connected text, so it deserves credit in this regard.

This section illustrated some commonly used methods in SA-related research, and a summary on these research methods is listed in Table 2. Based on previous literature on the same topic, it could be noted that most of the research methods for word-level SA either interrupt the natural comprehension process for connected speech (or text) or fail to control the variable of memory capacity. So, more reliable research methods for word level SA should be constructed in the future. However, for sentence-level SA, the research method of sentence-repetition and recall does not interrupt the natural comprehension process and successfully controls the variable of memory. Therefore, this research method may be more reliable than others for SA related research (sentence-level SA).

TABLE 2
THE COMMONLY USED RESEARCH METHODS FOR SA-RELATED RESEARCH (FIRST LANGUAGE)

Research of different kinds	Research methods used	Features of the research method
Research involving word-level SA	Recall method	Failing to control the variable of memory capacity
	Change-detection method	Interrupting the natural comprehension process for connected speech (or text)
	Secondary-task method	Interrupting the natural comprehension process for connected speech (or text)
	Event-related potential and eye-tracking	Interrupting the natural comprehension process for connected speech (or text)
	Other methods: cloze test	Failing to control the variable of memory capacity
Research involving sentence-level SA	Recall-rating method for sentence-level selective attention	Failing to control the variable of memory capacity
	Sentence repetition and recall method	Might be reliable

D. Inconsistent Research Results

Despite the studies mentioned above, other research concerning SA has produced inconsistent results. For example, Briton (1979) used the rating-recall method to investigate the effects of text structure on the SA during reading comprehension, and the result showed that paragraphs high in the content structure did not require more attention. Hyona (2002) used eye-tracking technology and recall methods to investigate readers' sentence-level SA, which measured the frequency and duration of reader's forwarding fixation and reading back behavior. The results found that 80% of readers did not use an SA processing strategy. These findings did not support the existence of SA mechanism at the sentence level. In addition, Shirey and Reynold (1988) employed a secondary-task method to investigate the effects of interest on the allocation of attention during reading. The results showed that the participants devoted less attention to these interesting words, but they recalled them better. Thus, the findings of this research do not support the existence of SA at the word level either. Therefore, the existence of SA during language comprehension is still unclear, and more research may be needed to confirm the existence of SA at both levels in the future.

IV. EMPIRICAL RESEARCH INVOLVING SA MECHANISM IN SECOND LANGUAGE COMPREHENSION

Compared with SA in first language comprehension, the number of research involving SA in second language comprehension is relatively expansive. In second language comprehension, the term "selective attention" is defined as "the commitment of limited capacity to one stream of information or one set of linguistic features, such as paying attention to keywords or grasping the main idea during comprehension" (Rost, 2011).

Numerous studies on L2 comprehension strategies (Vandergrift, 2006; Graham & Vanderplank, 2008; Goh, 2002; Hasan, 2010; Chen, 2013; Nix, 2016; Wallace, 2020) have employed the interview or the self-report method to tap into

the strategies employed by L2 listeners and readers. These studies found that effective L2 listeners and readers typically do not listen or read word by word. Rather, they tend to grasp main ideas or keywords during language comprehension. Some researchers also concluded that SA is one of the most distinctive strategies for effective (skilled) language users, and the SA strategy discriminates the effective and ineffective L2 listeners and readers (Vandergrift, 1998, 2003).

However, most of the research involving SA in second language comprehension focuses only on the strategy research by listing SA as one of the strategies in a general strategy framework, and an in-depth and intensive research on the SA mechanism from the cognitive perspective is lacking. Only a few studies have specifically focused on SA mechanism during second langue comprehension. For example, Field (2008) employed a pause-transcription method to investigate L2 listeners' SA on content words. Field's findings demonstrated that content words afford more processing efforts during the listening process. Graham and Santos (2013) employed a recall- interview method to examine selective listening in L2. The results showed that effective listeners would selectively listen to words and sentences, and they tend to focus more on nouns than verbs.

The SA mechanism in second language comprehension is very important, and it could be one of the most crucial strategies for L2 language users. Because the SA strategy could help L2 users to address some listening difficulties that is most seen during second language listening or reading comprehension, such as the unfamiliar words or fast delivery of the listening input. Therefore, more research in the future may be needed to conduct an in-depth investigation on the SA mechanism of L2 comprehension, which would not only expand the academic research but also help L2 users in their daily practice.

V. Theories Supporting the SA Mechanism in Language Comprehension

The previous section describes empirical research on the SA mechanism in both L1 and L2 comprehension. With a review on previous literature, it is noted that most of the extensive research conducted only empirical research on SA and lacked theoretical explanation in their studies on why and how SA mechanism works during language comprehension. Therefore, the next section would discuss several relevant models and concepts that may theoretically explain the SA mechanism from the cognitive perspective. Six models and concepts will be illustrated which could serve as the theoretical framework for future research in this field.

A. Kintsch's Model

One of the most important models in SA-related research is Kintsch's (1978) text model of comprehension, which applies to both reading and listening comprehension. According to this model, meaning of text or speech is represented in the form of propositions during text comprehension (or speech listening), and these propositions are connected based on coherence. There are two kinds of coherence: local and global. The local and global coherence are related to the concepts of the microstructure and macrostructure of a text respectively. The microstructure is the structure of individual propositions and their relationships; while the macrostructure refers to the text as a whole and represents the gist of the text. According to Kintsch's model, the propositions at the top level of the text structure are preferentially selected for comprehension compared to the less important propositions. Kintsch's text comprehension model has provided robust explanation for the SA mechanism (sentence level SA) in both reading and listening processes. However, this model has been rarely used to theoretically explain the SA mechanism in previous research.

B. Good-Enough Model

Another important model that could explain the SA mechanism is Ferreira's (2003) "good-enough" (GE) model. In contrast to the traditional model of language comprehension, Ferreira and colleagues argued that language comprehension is not always detailed, complete, and accurate but is sometimes merely good enough depending on the task that a language user needs to perform. The GE model argues that language comprehension is quick and frugal, so the listeners only make GE efforts to understand language items if they can complete communication tasks. An empirical study by Goodman (1967) confirmed that effective readers attended to syntactic cues only as much as necessary and relied more on semantic information during comprehension. Therefore, the GE model may explain why listeners and readers engage in SA during language comprehension to some extent, which may be because the language user only needs to pick up some relevant information for comprehension as long as they can finish the comprehension task during listening or reading.

C. IP Model

Another model that attempts to explain the SA mechanism is the IP (information processing) model proposed by VanPatten (2014). According to the IP model, learners are driven to obtain meaning while comprehending, and they may follow some IP principles during comprehension. One of the principles is "the primacy of content words", which means learners process content words before anything else. This phenomenon may occur because "if the learner processes non-content words first, it is likely that the processors responsible for data storage may not be able to make good use of them and will dump them, preventing further processing" (VanPatten, 2014, p. 115). This model could explain the SA mechanism at the word level, particularly the SA modulated by content words, since the listeners or readers may primarily process the content words in order to grasp the meaning of a text as effectively as possible.

D. Top-Down and Bottom-Up

It is widely recognized that language comprehension includes both bottom-up and top-down processes. In top-down processes (TDP), language users use information from contextual sources, such as world knowledge and the global meaning, to understand meaning of the speech or text. In a bottom-up (BUP) process, however, "the listener focuses on individual words and phrases to achieve understanding by connecting the language elements together to build up a whole" (Harmer, 2001, p. 201). Some studies have found that skilled listeners will adopt a TDP approach for comprehension by focusing more on global meaning rather than word recognition. In contrast, less skilled listeners adopt a BUP approach during language comprehension by which they devote more attention to words and local details (Hildyar & Olson, 1982).

The concepts of TDP and BUP may explain why the first language user will engage in SA strategy during comprehension, and that may be because first language users would process words that weigh more for top-down comprehension with greater efforts.

E. Competition Model

Another model that is relevant to this study is the competition model proposed by Kos (2010). According to Kos, sentence processing involves a two-stream process: the syntax stream and the semantic stream. These streams interact and compete during sentence comprehension, with the more powerful stream dominating the weak one and guiding the comprehension. Besides, which cues are stronger depends on the availability of these cues. If semantic cues are more easily processed, then the language user will follow the semantic cues to form the meaning. If, however, the semantic cues are difficult to understand, then the language user will instead follow the syntax cues for comprehension. For first language users, the availability of semantic cues could be much greater than the availability of syntax cues. Therefore, L1 users tend to form meaning primarily by focusing on semantic cues. Thus, semantic cues "win" over the syntax cues, leading to SA during L1 comprehension. This model not only explains why L1 listeners or readers engage in SA mechanisms during the comprehension process but also provides some insight into what linguistic items would require more attention. Besides, it also explains why some ineffective L2 do not engage in SA during language comprehension.

F. Language Redundancy

The abovementioned models explain the SA mechanism from a psychological perspective, while the concept of language redundancy would explain SA from a linguistic perspective. Descriptive linguistics has fully acknowledged that natural languages are highly redundant, and redundancy is also necessary in natural language, as it serves the purposes of enhancing comprehensibility, resolving ambiguity, emphasizing, and intensifying. Wit and Gillette (1999) proposed two types of redundancy in natural language: grammatical and contextual. Grammatical redundancy refers to the internal systematicity of language. It is generated from grammatical rules and is independent of situational, contextual, and nonlinguistic considerations. Contextual redundancy, in contrast, refers to the repetition of information that consists of the reproduction of identical elements of language. This concept may explain why listeners and readers engage in the SA mechanism, and it may be because that language is redundant, and the language users can form the meaning of speech or text without the need to individually process every single linguistic element.

These models discussed above explain why and how the SA mechanism functions from both the linguistic and psycholinguistic perspectives. However, these concepts and theories have been rarely used as theoretical supports in SA-related previous research. Most of the previous studies only concern the empirical research of SA and lack the theoretical or cognitive explanation for the SA mechanism. Therefore, these concepts and models illustrated in this article would serve their purpose in future studies.

VI. Conclusion

This article reviews previous research involving SA mechanism for language comprehension, and several research gaps are identified in this regard.

First, this article identifies two kinds of SA that are commonly investigated by previous research: word and sentence-level SA. Then this article reviews the previous research according to this classification. This classification could be very crucial and hold significance, as these two categories of SA represent different SA strategies in real practice. Nevertheless, this classification has not yet been fully recognized by previous research, and this article could be the first one to propose the existent of two-level of SA. However, these two levels of SA should be further tested and examined empirically in future academic research in order to bridge the gap.

Secondly, this article also reviews the major modulators examined in previous literature, such as content words, focus, text structure and so on. After review, this article points out the need to investigate the most significant and consistent modulator of SA since the language users, especially L2 users, can only focus on one or two modulators during stressful language comprehension situation. Therefore, identifying the most significant modulator will help language users focus on that language element, thus helping them address comprehension difficulties or improving the comprehension result. Based on the review, the possible candidates for the most significant modulator of SA could be content words (specifically nouns) for word-level SA and the text structure for sentence-level SA. However, further research may be needed to confirm this result.

Thirdly, this article illustrates several commonly used research methods for SA related research and analyzes the advantages and disadvantages of each of these methods. This analysis reveals that previous research methods involving words level SA may not be reliable enough and more reliable research methods may be needed in the future. While, as for the research methods for sentence level SA, the research method of sentence repetition-recall method is more reliable than others.

Finally, this article illustrates several concepts and models that could explain the SA mechanism from both the psychological and linguistic perspectives. Most of these models and concepts have been rarely used as theoretical framework in previous studies. Therefore, these concepts and models mentioned in present article could serve as theoretical foundations for future research involving SA.

In summary, this article has offered a general review of previous research involving the SA mechanism and pinpointed certain research gaps in this regard. This article may offer some inspirations for SA related academic research as well as the language comprehension practice in the future.

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