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Active Inferential Processing During Comprehension in Poor Readers*

미숙 독자들에 있어 이해 도중의 능동적 추리의 처리

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Abstract Three experiments were conducted using a verification task to examine good and poor readers' generation of causal inferences (with *because* sentences) and contrastive inferences (with *although* sentences). The unfamiliar, critical verification statement was either explicitly mentioned or was implied. In Experiment 1, both good and poor readers responded accurately to the critical statement, suggesting that both groups had the linguistic knowledge necessary to the required inferences. Differences were found, however, in the groups' verification latencies. Poor, but not good, readers responded faster to explicit than to implicit verification statements for both *because* and *although* sentences. In Experiment 2, poor readers were induced to generate causal inferences for the *because* experimental sentences by including fillers that were apparently counterfactual unless a causal inference was made. In Experiment 3, poor readers were induced to generate contrastive inferences for the *although* sentences by including fillers that could only be resolved by making a contrastive inference. Verification latencies for the critical statements showed that poor readers made causal inferences in Experiment 2 and contrastive inferences in Experiment 3 during comprehension. These results were discussed in terms of context effect: Specific encoding operations performed on anomaly backgrounded in another passage would form part of the context that guides the ongoing activity in processing potentially relevant, subsequent text.

Keywords active and passive modes of processing; individual differences; causal and contrastive inferences; context effect.

요 약 본 연구에서는 능숙 독자와 미숙 독자가 수행하는 인과 추리(because 문장 조건)와 대비 추리(although 문장 조건)를 연구하기 위해 문장검증과제를 사용하여 세 실험을 수행하였다. 외현 조건에서는 추리되는 정보가 직접 제시되었으나, 내현 조건에서는 제시되지 않았다. 각각의 조건에서 추리되는 정보를 담고 있는 검증문장이 제시되었다. 실험 1 에서 능숙 독자와 미숙 독자 모두 검증문장에 정확하게 반응하였다. 이 결과는 두 집단 모두 인과 추리와 대비 추리에 필요한 언어 지식이 있음을 시사한다. 하지만 문장검증 시간에서는 두 집단간에 차이가 있었다. 미숙 독자는 because 문장과 although 문장 모두 외현 조건의 문장검증 시간이 내현 조건보다 빨랐지만 능숙 독자는 그렇지 않았다. 실험 2 에서는 인과 추리를 하지 않으면 사실과 반대되는(counterfactual) 것으로 보이는 메꾸기 덩이글(filler)을 포함시켜 미숙 독자로 하여금 because 문장에 대해 인과 추리를 수행하도록 유도했다. 실험 3 에서는 대비 추리를 통해서만 해소될 수 있는 메꾸기 덩이글(filler)을 포함시켜 미숙 독자로 하여금 although 문장에 대해 대비 추리를 수행하도록 유도했다. 실험 2 와 실험 3 의 결과는 미숙 독자가 글을 이해하는 도중에 인과 추리(실험 2)와 대비 추리(실험 3)를 하였음을 보여준다. 이러한 결과는 문맥 효과의 관점에서 논의되었다. 다른 단락(passage)이 담고 있는 모순성(anomaly)에 대한 특정한 부호화 조작이 문맥의 일부를 형성하며, 이 문맥이 잠재적으로 적절한 후속 교본(text) 처리시 진행되는 활동을 인도할 것이다.

주제어 적극적 처리 상태/방식(mode)과 소극적 처리 상태/방식, 개인차, 인과 추리와 대비 추리, 문맥 효과

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There are substantial individual differences in language processes. Researchers generally agree that factors which distinguish a good reader from a poor reader are domain knowledge and language skills including decoding (Kintsch, 1998; Perfetti, 1985). With respect to the knowledge, however, there is evidence that the source of difference may not be in knowledge that good and poor readers possess, but in their use of that knowledge.

Long, Oppy, and Seely (1994) extended an experiment by Till, Mross, and Kintsch (1988) and contrasted good and poor readers' performances. In fact, Till et al.'s (1988) participants had exhibited no difference in lexical decision times between appropriate and inappropriate topic words within 1,000 ms after they read brief passages. This suggests that the topic inference was not generated on-line. Long et al. (1997) replicated the results only with poor readers, whereas good readers responded faster to appropriate topic words than to inappropriate topic words within 500 ms after they read passages. This suggests that good readers did generate topic inferences during comprehension. In their later study (Long et al., 1997, Experiment 2), they examined the thematic priming effect on verification of target sentences to test for a memory connection between two different passages that share the same theme. Good readers responded faster when the priming and the target sentences came from the same-theme than when they came from different-themes, whereas poor readers exhibited no difference between the two conditions.

Furthermore, Long and her colleagues observed that poor readers' failure to generate the topic inferences did not result from their deficient knowledge about the topics of passages. Long et al. (1994) recruited an additional group of participants and asked them to produce a single word for a passage, describing what it was about. Long et al. (1997) asked their participants to rate the similarity of thematically related stories. In both cases, poor readers appeared to possess adequate knowledge to judge the topics of the stories. An analogous finding was also reported by Long and De Lay (2000) in which less skilled readers showed the discrepancy between possession and use of knowledge about implicit causality inherent in certain verbs. Therefore, Long et al. (1997, p. 141) suggested that although poor readers do possess the knowledge and ability to make inferences, "they are simply less likely than skilled readers to do so during comprehension."

These results and interpretations are comparable to those of Pearlmutter and MacDonald (1995). They found that good readers had reliably longer reading times than did poor readers for sentences with potential syntactic ambiguity. These results indicate that good readers used probabilistic lexical and contextual constraints in syntactic ambiguity

resolution during reading. Similar to Long et al. (1994), they recruited an additional group and observed that good and poor readers did not differ in the off-line rating assessment of probabilistic constraints, which may affect the relative plausibility of alternative interpretations of the ambiguity. Therefore, they proposed an experience-based interpretation as the source of individual differences, and concluded that good readers are able to use their linguistic knowledge of constraints during reading because such computation has been done frequently in the past. Long and De Lay (2000) supported this view.

One possible reason why poor readers show discrepancy between their possession and use of knowledge in reading comprehension may lie in their passivity. This possibility was suggested by Kintsch (1998)'s comprehension-integration (CI) model. The CI model's account of good or poor performance in comprehension can be broken down into two sources. One is a mechanism which is concerned with whether knowledge is in readily usable form or not. Concurring with Long et al. (1994) and Pearlmutter and MacDonald (1995), the CI model suggests that skilled readers have available effective retrieval structures that enable them to reliably access to long-term memory and extend their working memory. The other part is concerned with use of knowledge by active processing. The CI model assumes that making long-term memory contents available via retrieval is a necessary condition for generating inferences in general during reading, but that it is not a sufficient condition. Kintsch (1998) often chides poor readers for their "passivity" and "laziness," and argues for "the importance of making learners active, intentional agents rather than passive vessels in which information is poured at will"(p.330). This argument suggests not only that one source of individual difference is poor reader's passivity, but also that they are able to be active.

Given this possibility, one remaining issue is how to make poor readers active. Regarding this issue, Foertsch and Gernsbacher's (1994) study is relevant. Foertsch and Gernsbacher (1994) assumed that experimental participants do not often engage in any unnecessary comprehension processing beyond what is required in an experimental task. In fact, Foertsch and Gernsbacher tested such "satisficing subject" hypothesis by asking different comprehension tasks, finding different effects of reading time for the same texts. Similar to Kintsch's argument, they suggested that "using 'natural texts' that are inherently interesting and enjoyable to read increases the chance that experimental subjects will be internally motivated to process those texts" (Foertsch and Gernsbacher, 1994, p. 295). To us, the benefit of this discussion is that it suggests the amount of processing can be adjusted as textual content of potential relevance

to readers varies. It further suggests the way in which the discrepancy between possession and use of knowledge may wax and wane.

We propose that some intriguing context can induce readers to engage in using their knowledge actively and that the context reinstatement can in turn afford a particular perspective, from which they spontaneously take an active role in processing subsequent, potentially relevant text. Such a context effect would occur even when an entire episode intervenes between context and its subsequent target line (see Klin, Guzman, and Levine, 1999, Experiment 2) and even when local coherence of a current episode is maintained (see Albrecht & Myers, 1995). Research concerning the perspective taking within the memory-based text processsing framework is relevant here, even though the framework is concerned with a natual consequence of the way in which memory processes work on text representations without being concerned with any active inferential process(Gerrig & McKoon, 1998). Albrecht, O'Brien, Mason, and Myers (1995) have demonstrated that text can be processed differently depending on the perspective that readers have adopted. They found that the probe recognition times for goal categories were affected only by following goal-potential inference statements as a reader-centered perspective was adopted, whereas the probe recognition times were affected only by following goal satsfaction statements as a character-centered perspective was adopted. Gerrig and McKoon (1998) takes one step further toward perspective taking as their terminology readiness implies. Readiness, by which they mean a certain range of accessibity of information, affords reader a particular perspective in such way that information in memory was ready to be used on the one hand and readers were ready to use it on the other hand.

The goal of the current set of experiments is to contrast active and passive processing across good and poor readers and to provide any evidence of shift from passive to active mode of processing of the same text within poor readers by varying some contextual manipulation. We argue that the same individuals may engage in different types of task processing, depending on whether the active or passive mode is adopted as a consequence of a certain level of previous engagement in context on the part of the reader. The primary goal of the present study was to explore intra-individual variation in inferential processing by determining whether poor readers when they are prompted to engage in more active processing, could generate on-line inferences and thus behave like good readers.

We adopted the task used by Noordman, Vonk, and Kempff (1992) and Vonk and Noordman (1990), in which participants were asked to read passages that contained *because* or

but/although sentences. The understanding of conjunctive *because* or *although* requires generating a particular inference that accounts for a causal or contrastive interpretation. The particular inference that was required to understand the conjunctive sentence was either explicitly stated in the explicit version or was missing in the implicit version. After participants read either version of the text, they verified test sentences.

Using the verification task has some obvious advantages for the present purpose. One can quite safely assume that university students have more than adequate linguistic knowledge regarding the semantic relations between the subordinate and main clauses of the *because* and *although* sentences. Moreover, ascertaining the truth value of the test statement can be taken as evidence of whether participants possessed the linguistic knowledge and the ability to make inferences even when this had not occurred during reading.

Noordman and his colleagues reported that verification times for explicit test sentences were reliably faster than those for implicit test sentences in the case of unfamiliar passages, whereas there was no difference between the two types of sentences in the case of familiar passages. Therefore, we constructed only unfamiliar passages whose information is not part of either good or poor readers' existing world knowledge. Each *because* or *although* sentence contained a target information which is assumed to be inferred by generating logically implied text information based on readers' linguistic knowledge of each connective usage. We assumed that readers would draw inferences only when they adopted active mode of processing. This is because drawing inferences is not based on the retrieval that adds readily available, preexisting information from long-term memory, but on generation that produces new information as readers construct representation of individual sentence [see classification system for inferences by Kintsch (1998)].

In Experiment 1, we first aimed to replicate the pervasive finding of individual differences in drawing inferences between good and poor readers. We predicted that poor readers would be faster at the verification task after they read the explicit version of the text than they read the implicit version, indicating that they did not generate a bridging inference on-line. On the other hand, with good readers, there should be no difference in verification latencies between the explicit text version and the implicit text version. We further predicted that there would be no difference in verification accuracy between good and poor readers. The former prediction was based on the finding that inferences were not drawn on-line in general with these kinds of unfamiliar materials (Noordman et al., 1992; Vonk and Noordman, 1990). The latter prediction was based on the

finding that poor readers' failure to draw inferences does not reflect their deficient knowledge (Long et al., 1994, 1997; Pearlmutter and MacDonald, 1995). More important, we aimed to establish a baseline performance of good and poor readers against which the next two experiments were to be compared.

Experiments 2 and 3 used manipulations designed to encourage or even force readers to engage in inferential activity in order to understand apparently anomalous sentences in the text. This was accomplished by constructing filler passages, each of which contained a sentence that was pragmatically anomalous with respect to causation (Experiment 2) or grammatically anomalous with respect to the statement of a contrast between two propositions (Experiment 3). We assumed that the experience of these odd filler sentences and the need to engage in active inference to understand them would enhance the richness of encoding and reactivating level of the filler sentences because elaborated information is easily accessed and reinstated (Albrecht & Myers, 1995; Myers & O'Brien, 1998). In turn, this context effect would encourage the poor, more passive, readers to read the potentially relevant experimental sentences more actively in terms of a particular reader perspective provided by the reinstated information (Gerrig & McKoon, 1998). The predicted increase in active reading would reduce or eliminate any difference in verification times between the explicit and implicit versions of the experimental sentences for the poor readers.

The nature and logic of filler passages and our specific predictions will be described in the introductions of Experiments 2 and 3. Since all three experiments were virtually identical in their basic design, a General Method section is provided first.

General Method

Participants and the Reading Span Test. Two hundred sixteen undergraduate student of Seoul National University in Korea participated in Experiment 1, 2, or 3 in exchange for partial course credit. All participants were classified as good or poor readers according to their performance on the Korean version of the reading span test (Lee, 1995) which (apart from language) was identical with the Daneman and Carpenter's (1980) version, including the scoring system. In this test, participants read aloud a set of sentences which consisted of two to six unrelated sentences. At the end of each set, they were asked to recall the last word of each sentence. A participant's score was defined as the largest set-size successfully completed, with fractional values assigned for partially correct sets. Following the criterion used by Pearlmutter and MacDonald (1995), we assigned participants

to the good reader group if their reading span score was 4.0 or higher and to the poor reader group if their reading span score was 3.5 or lower.

We followed the Pearlmutter and MacDonald's criterion of 1 : 2 split on span size because there is some evidence suggesting that high span readers are active, but that both medium and low span readers in accordance with the Daneman and Carpenter's (1980) criterion are passive in reading processes. Zoh (1997) reported that the average reading times for head noun of relative clause, which was constructed by using the most complex syntactic structure and pragmatically implausible word string, were 1968, 1400, and 1653 ms, respectively, for high, medium, and low span readers. It is not rare to find evidence that high span readers have longer reading times (e.g., MacDonald, Just, & Carpenter, 1992; Pearlmutter & MacDonald, 1995). It seems likely that high span readers make their best possible use of the limited resource to pursue the matter when they encounter a confusing situation of either problematic complexity or considerable subtlety that affects alternative interpretations. On the other hand, it seems likely that medium span readers do not make every effort in that situation for their data pattern of reading times is at best much more close to the low span's rather than to the high span's pattern (see MacDonald et al., 1992, Experiment 1).

As to the reading span test, there seems to be no clear agreement on the arguments that what the test really measures and where its predictive powers come from (Miyake & Shah, 1999). Accordingly, we adopted the neutral terminology of good and poor readers in reference to the span score, instead of high and low span readers or skilled and less skilled readers.

Materials and Design. Sixteen expository passages were used as experimental materials in this study. The material consisted of two sets in which 8 passages contained a target sentence using the connective *because* and 8 passages contained a target sentence using the connective *although*. These connective sentences served as the theme of each passage and state information about the domains with which participants were unfamiliar.

There were two versions of the experimental passage: implicit and explicit. In the explicit version, the critical sentence to be inferred from the *because* or *although* sentence was immediately preceded by the information that has to be inferred. In the implicit (inferential) version, the critical sentence was not provided. Although these critical sentences must be inferred to understand the target sentences, note that it was not necessary to integrate both the causal and contrastive inferences with the rest of the passages to achieve a global coherent representation of the text as a whole. Sample

passages (English renditions of original Korean passages) are presented in Table 1. The target *because* and *although* sentences are italicized and the critical sentences are in parentheses.

Experimental passages were randomly assigned with the constraint that each participant read half of the passages in the implicit condition and half in the control condition. There were 16 filler passages that did not contain *because* or *although* sentences. They were matched for passage length with the experimental passages and interspersed among the experimental passages.

As shown in Table 1, for each experimental

<Table 1> Sample Passages

- *Because* -
Cembalo was the most popular musical instrument during a time when music was mostly played at mansions of aristocrats. In the 19th Century, as the civil class emerged, musical stages were relocated to recital halls. As more and more people wanted to listen to music, the recital halls became bigger and bigger. (The sound of the cembalo was too quiet to fill those grand recital halls.) *Because the grand recital halls required musical instruments which produced sounds with large volume, cembalos gradually disappeared.* Today almost no one but professionals come across cembalos.
- Verification Sentences
The cembalo is an instrument with small volume.
Recital halls were made larger after the 19th century.
The civil class neglected music.
The cembalo is a contemporarily invented instrument.
- *Although* -
One cannot discuss modern linguistics without mentioning Chomsky. His contribution to linguistics was truly revolutionary. When he was a student he wrote his Ph. D thesis under the supervision of Professor Harris. (Professor Harris was a proponent of structural linguistics.) *Although Chomsky was a student of Professor Harris, he opposed structural linguistics.* Chomsky was the person who led linguistics from structuralism toward a new direction.
- Verification sentences
Professor Harris was a structural linguist.
When Chomsky was a student, the mainstream of linguistics was structuralism.
Chomsky was deeply attracted to structural linguistics.
Professor Harris' theory was a revolutionary one.

and filler passage, there were four verification test sentences. Two of them were intended to be answered "true" while two were intended to be answered "false". One of the true verification sentences was related to the inference necessary for understanding the *because* or *although* sentence. The wording of the verification sentences was not exactly the same as that of the texual sentences. Presentation of the four verification sentences for each passage were not arranged in line with the order of the passage.

General Procedure. We tested each participant individually in a session lasting approximately 45 min. Participants were first tested on the reading span task, following which they were informed that they would perform another task about reading comprehension. They were told that their goal was to comprehend the passages and then to answer true/false verification statements for each passage. After the instructions, four practice trials were given to familiarize participants with the experimental procedure before the experimental trials began. The four practice passages consisted of two passages containing the *because* or *although* sentences and two filler passages.

An experimental trial began with a beep sound. At the same time, a plus sign appeared in the center of the screen for 500 ms. Sentences were presented cumulatively, word by word, in the upper portion of the screen. Each word was followed by the next word after a fixed interval. This interval was determined based on the number of characters in the words (45 ms per character) plus a constant (50 ms). Although Korean orthography is an alphabetic script, the alphabetic characters are written such that they are clustered into syllabic blocks. Each character cluster consisted of a block of two to four alphabetic letters so that the function was 15 ms per letter on average.

Each sentence was presented on a separate line. A delay of 1 sec separated the last word of the previous sentence and the first word of the next sentence. After all of the sentences of the passage were presented, verification sentences were individually presented in the lower portion of the screen one by one. The passage remained in the upper portion of the screen during the verification test. Each verification sentence was flanked by an asterisk on each side. Unlike the presentation of the passage, all the words of a verification sentence were presented simultaneously.

Participants were asked to respond by pressing a key of the computer keyboard. If they thought the sentence true, they were to press the right 'shift' key, and if they thought it false, they were to press the left 'shift' key. The participants were instructed to respond as quickly and accurately as possible. The interval between the onset of the verification sentence and pressing the key was registered as the verification time.

The key press removed the verification sentence, and was followed by the next verification sentence. Participants received no feedback message concerning the accuracy of their responses. After the last verification, the warning signal appeared again and the next passage was presented. A delay of 1.5 sec separated the offset of one trial and the onset of the next trial.

EXPERIMENT 1

Experiment 1 examined individual differences in inferential processing during reading and assessed readers' ability to make required inferences. In doing so, we focused on the causal inferences underlying *because* sentences and the contrastive inferences underlying *although* sentences. Noordman and Vonk (1992) have stated that the presence of the connective signals readers to infer a relation between a concept in the subordinate clause and a concept in the main clause. As a result, a backward, bridging inference (e.g., the parenthesized critical sentences in Table 1) can be drawn. However, Noordman and Vonk (1992) and Vonk and Noordman (1990) demonstrated that both the causal and contrastive inferences were drawn on-line only with familiar texts, not with unfamiliar texts.

To examine individual differences in making use of their linguistic knowledge, we constructed the target sentences in the experimental passages so that they were not part of our participants' world knowledge. Although the content of the sentences was not there in the participants' long-term memory, we could reasonably assume that all participants in our study, both good and poor readers, possess enough linguistic knowledge of parsing syntactic structre of the *because* and *although* sentences. However, we also reasonably assume that a strategic, controlled process is required to construct the representations of the implied causal and contrastive relations between the subordinate and main clauses of the sentences. For this reason, we predicted that only good readers would generate the required inference during comprehension. There is evidence that good readers are more likely than other readers to use their linguistic knowledge during comprehension (Long & De Ley, 2000; Pearlmutter & MacDonald, 1995). As described earlier, we predicted in this experiment that good readers would be equally fast at verifying a test sentence regardless of whether they received the explicit or implicit passage version, indicating that the inference was generated during comprehension. On the other hand, we expected that poor readers would be slower at verifying the test sentence when they received the implicit passage, indicating that they do not generate the inferences on-line.

Method

The method in general was the same as described in the General Method section. The participants were 72 undergraduate students from Seoul National University. The mean reading span score was 3.29 (SD = 0.97), with a range from 2 to 5. Using the criterion of Pearlmutter and MacDonald (1995), 48 participants whose scores were 3.5 or lower were assigned to the group of poor readers. Twenty-four participants whose scores were 4.0 or higher were assigned to the group of good readers.

Results

The dependent measures of the study were the time and accuracy required to verify the test sentence. Only correct responses were included in analyses of verification latency. Mean verification latencies and accuracy percentages appear in Table 2 and 3, respectively. We performed separate 2(reader) X 2(connective) X 2(version) mixed analyses of variance (ANOVA) on verification latencies and accuracies. For all of the Experiments reported, F_1 refers to tests against an error term based on subject variability and F_2 refers to tests against an error term based on item variability. The scores in the ANOVA were the means per subject. Experimental versions (explicit vs. implicit) and connectives (*because* vs. *although*) were within-subject factors and reader (good vs. poor) was a between-subject factor.

Verification latencies. Our analysis of the verification latencies revealed that a main effect of reader was not significant in an analysis based on subject variability, F_1 (1, 70) = 2.27, but it reached significance in an analysis based on item variability, F_2 (1, 14) = 27.74, $p < .001$. There was a significant main effect of version (implicit vs. explicit) in an analysis based on subject variability, F_1 (1, 70) = 6. 61, $p < .025$, but it failed to reach significance in an analysis based on item variability, F_2(1, 14) = 1.50. This was modified by a significant 2-way skill X version interaction, F_1(1, 70) = 5.47, $p < .025$; F_2(1, 14) = 8.42, $p < .025$, showing that a different data pattern exists between good and poor readers, as shown in Table 2. Poor readers had longer verification times for the implicit version than did good readers, F_1 (1, 70) = 4.39, $p < .05$; F_2 (1, 14) = 27.27, $p < .001$, whereas there were no effect of reader for the explicit version, F_1 (1, 70) < 1; F_2 (1, 14) = 2.86. Specifically, poor readers had longer verification times for *because* implicit sentences than for *because* explicit sentences, F_1(1, 47) = 10.26, $p < .01$; F_2(1, 7) = 8.27, $p < .025$, and longer verification times for *although* implicit sentences than for *although* explicit sentences only in an analysis based on subject variability,

<Table 2> Mean Verification Latencies (in Milliseconds) as a Function of Reading Skill, Connective and Version.

	Skill	Because		Diff	Although		Diff
		Implicit	Explicit		Implicit	Explicit	
Ex. 1	Skilled (N=24)	1479	1431	+48	1886	1955	-69
		(86)	(83)		(60)	(76)	
	Less skilled	1690	1513	+177	2210	1976	+234
	(N=48)	(73)	(50)		(110)	(84)	
Ex. 2	Skilled	1542	1490	+52	1842	1770	+72
	(N=24)	(65)	(66)		(78)	(88)	
	Less skilled	1666	1627	+39	2193	2018	+175
	(N=48)	(75)	(70)		(88)	(98)	
Ex. 3	Skilled	1637	1599	+38	2119	2101	+18
	(N=24)	(63)	(102)		(107)	(94)	
	Less skilled	1790	1538	+252	2083	2038	+45
	(N=48)	(94)	(60)		(92)	(99)	

**Note: Differences = Implicit - Explicit

Mean Standard Errors are in Parentheses.

<Table 3> Mean Accuracies as a Function of Reading Skill, Connective and Version.

	Skill	Because		Although	
		Implicit	Explicit	Implicit	Explicit
Ex. 1	Skilled (N=24)	95%	98%	89%	94%
	Less skilled (N=48)	96%	96%	86%	92%
Ex. 2	Skilled (N=24)	94%	95%	90%	93%
	Less skilled (N=48)	92%	95%	83%	87%
Ex. 3	Skilled (N=24)	93%	91%	88%	93%
	Less skilled (N=48)	96%	94%	89%	91%

F_1 (1, 47) = 7.62, p < .01; F_2(1,7) = 2.95. On the other hand, good readers showed no differences either between the *because* sentences, F_1 (1, 23) = 1.96; F_2 (1,7) < 1 or between the *although* sentences, F_1 (1, 23) = 1.55; F_2(1, 7) < 1.

There was a significant main effect of connective, showing that readers had longer verification times for *although* sentences than for *because* sentences, F_1 (1, 70) = 109.84, p < .001; F_2 (1, 14) = 18.55, p < .001. There was no interaction between connective and the other variables.

Accuracies. Analysis of the accuracy data revealed that there was no difference between good and poor readers, F_1 (1, 70) = 1.34; F_2(1, 14) = 1.31. The main effect of version was significant, F_1 (1, 70) = 4.61, p < .05; F_2(1. 14) =6.72, p < .025, indicating that accuracy was higher for explicit than for implicit sentences. However, there was no reader X version interaction, F_1 (1, 70) < 1; F_2 (1, 14) < 1, indicating that there was no difference in the accuracy pattern between groups. There was a significant main effect of connective in an analsysis based on subject variability, F_1 (1, 70) = 15.66, p < .001, indicating that accuracy was higher for *because* sentences than for *although* sentences. But it failed to reach significance in an analysis based on item variability, F_2 (1, 14) = 3.06. The other two-way interactions and a three-way interaction were not significant.

Discussion

As expected, verification latencies were longer after the implicit version than after the explicit version for poor readers, but not for good readers. The main difference that distinguished good and poor readers in this task was the absence of on-line inference generation in poor readers. Such a difference, however, does not seem to be due to the lack of adequate linguistic knowledge. There was no difference in the accuracy between the two groups. In fact, the accuracy was very high even in the implicit versions. College students, even poor readers, do possess enough linguistic knowledge to make the necessary inference involving the connective sentences. Finally, in the explicit version there was no difference in either latency and accuracy between the two groups.

Taken together, our results are consistent with the findings and claims of Long, Oppy, and Seely (1994, 1997) and Pearlmutter and MacDonald (1995). Poor readers have adequate linguistic knowledge, but they are simply less likely than good readers to use it during comprehension.

An unexpected characteristic of our data is the finding that verification latencies were slower when the passage contained the connective *although* than when it contained the connective *because*. Close scrutiny of the materials revealed that the verification sentences for the *although*

sentences always referred to subsidiary character or event of the text whereas those for the *because* sentences referred to the primary character or event (see Table 1). Given that information concerning primary character is more elaborated and maintained in focus of discourse representation, it seems likely that the difference in verification times between *because* and *although* sentences may mainly reflect the different accessibility of the first and second character. There is evidence that more elaborated and important antecedents are reinstated more quickly than less elaborated antecedents (O'Brien, 1987; O'Brien, Plewes, & Albrecht, 1990).

EXPERIMENT 2

The results of Experiment 1 suggested that less skilled readers may not make use of their knowledge to draw inferences. Experiment 2 addressed the possibility of encouraging or forcing poor readers use their knowledge during comprehension. Kintsch (1998, p. 232) proposed that "such readers have to be jolted out of their passivity and induced to assume a more active comprehension strategy." Activity is not easily observed and manipulated in a laboratory setting, but several studies have shown that manipulations such as the instructions to "rewrite the sentence in your own words" (Foertsch & Gernsbacher, 1994), missing letters in words (McDaniel, Blischak, & Einsten, 1995), coherence gaps in the text (McNamara et al., 1996), and prompting students for self-explanations of texts (Chi, Leeuw, Chiu, & LaVancher, 1994) encouraged participants to assume an active role in comprehension. In this study, we adopted a more subtle strategy for inducing active involvement during comprehension.

Our intervention is based on an accidental finding of a context effect reported in Cantor and Engle (1993, Experiment 2) in a study of the "fan effect" (increasing interference in memory retrieval as a function of increasing number of learned associations to a cue item). They found that reducing interference by encouraging thematic integration in one condition (the "Fan Size 6 condition") reduced interference in another condition ("Fan Size 3") for both good and poor readers even though the nature of the latter condition was unchanged.

This context effect appears to imply that the level of processing induced in recognizing the Fan Size 3 sentences was modulated in line with the degrees of relatedness among the Fan Size 6 sentences. If so, then processing of experimental passages in the present experiments could be affected by the nature of filler passages. In this experiment, we manipulated the nature of the filler passages to explore whether it affected the levels of processing of the experimental passages.

The goal of Experiment 2 was to induce poor readers to make inferences on-line by using filler passages that contained apparently counterfactual statements. Each filler passage contained an apparently anomalous sentence that could be made comprehensible by adding an inference. For example, filler passages contained sentences such as *Long ago a large comet fell down into the ocean, so the big hole still remains in the Sahara Desert.* These sentences superficially contradict one's world knowledge. We expect that such anomalous sentences would trigger a more active processing of the connective sentences in poor readers.

We constructed materials in accordance with the contrastive criterion of causal attribution suggested by Hilton and Slugoski (1986). According to their suggestion, causal remarks (i.e., remarks about the cause of events) are uninformative if they are about any one of several plausible necessary conditions. However, causal remarks could be informative if they are about a necessary condition that cannot be presupposed from one's general world knowledge. Likewise, our counterfactual statement in a filler passage is informative. We assumed that such pragmatically anomalous sentences in the filler passages would enhance the participants' encoding sensitivity due to the characteristics of informativeness and unusualness.

The nonredundant information regarding the intended relation between *ocean* and *desert*, which is not easily available, could be made coherent by actively inferring a proposition such as *The Sahara Desert once had been an ocean.* Once an active mode emerges as a consequence of processing an individual filler sentence, it could be maintained throughout the entire experimental session, and applied at least to other sentences that express a causal relation. Thus we predicted that the difference in verification times between good and poor readers would be reduced.

Method

Participants. The participants were 72 undergraduate students from Seoul National University. The mean reading span score was 3.14 (SD = 1.03), with a range from 1.5 to 5. Forty-eight participants whose scores were 3.5 or lower were assigned to the group of poor readers. Twenty-four participants whose scores were 4.0 or higher were assigned to the group of good readers.

Materials, Procedures and Design. The method, in general, was the same as in the General Method section except for one change. For each of the 16 filler passages used in Experiments 1, one sentence was changed so as to contain a counterfactual statement that apparently contradicts world knowledge. If that change disrupted the coherence of the content of a

<Table 4> Sample Filler Passages

- *Sample Filler Passage for Experiment 2* -
There are a number of hypotheses to explain why dinosaurs which ruled the world at one time became extinct. The leading hypothesis is that they became extinct due to a comet colliding with the earth. *Long ago a big comet fell down into the ocean, so the big hole still remains in the Sahara Desert.* It is assumed that when the comet exploded, the earth experienced a major climate change resulting in the extinction of dinosaurs. This hypothesis is supported not only by most astronomers but also by some geologists. However, even this hypothesis does not explain why only the dinosaurs became extinct.
- Verification Sentence
Most astronomers see the comet's collision as the reason for the extinction of dinosaurs.
The comet's collision caused climate change.
Contemporary creatures if the dinosaurs all became extinct.
All geologists support the comet-collision hypothesis.
- *Sample Filler Passage for Experiment 3* -
Some ten thousand moas, which were largest birds that have ever existed in the world, used to live in New Zealand. This bird had a beak and claws as sharp as those of eagles. *If the moa bird were enormously large and fierce, it would not assault people.* In fact, the moa was too big and slow to catch people. One can assume from their skeletal remains that some of them were as much as four meters tall.
- Verification Sentences
The biggest birds that have ever existed used to live in New Zealand.
There used to be birds that were even taller than human beings.
Moa are now close to extinction.
Moas used to be very fast, and as swift as an eagle.

passage, the related part was adjusted. We kept the theme and other parts of individual sentences the same as much as possible. A sample of the filler passages used in Experiment 2 is presented in Table 4. These anomalous sentences were not used as verification sentences.

Results

As in Experiment 1, we performed separate 2(reader) X 2(connective) X 2(version) repeated measures ANOVAs on verification latencies and accuracies to the verification test sentences. Mean verification latencies in each condition

appear in Table 2 and accuracy percentages appear in Table 3.

Verification latencies. Our analysis of the verification latencies revealed a main effect of reader, F_1 (1, 70) = 3.99, p < .05; F_2 (1, 14) = 47.47, p < .001. There was a significant main effect of version (implicit vs. explicit), F_1 (1, 70) = 4.16, p < .05; F_2 (1, 14) = 4.73, p < .05. Although the interactions between version and reader (F_1 (1,70) < 1; F_2 < 1), between version and connective (F_1 (1,70) =1.06; F_2 (1, 14) = 1.47, and between version, connective, and skill were not significant (F_1 (1, 70) <1; F_2 (1, 14)< 1), simple effect comparisons showed that the effect of version difference was mainly due to the differences in poor readers' performances in the *although* connective sentences. Poor readers showed no difference in *because* sentences between the implicit and explicit versions, F_1 (1, 47) < 1; F_2 (1, 7) < 1, whereas they had longer verification times for *although* implicit sentences than for *although* explicit sentences, F_1 (1, 47) = 4.11, p < .05; F_2 (1, 7) =7.95, p < .05. On the other hand, good readers showed no differences between the implicit and explicit versions of either *because* sentences, F_1 (1, 23) = 1.52; F_2(1, 17) < 1, or *although* sentences, F_1 (1, 23) < 1; F_2 (1, 7) < 1. There was a significant main effect of connective, showing that readers generally had longer verification times for *although* sentences than for *because* sentences, F_1 (1, 70) = 61.44, p < .001; F_2 (1, 14) 12.69, p < .01.

Accuracies. Analysis of the accuracy data revealed that there was a marginally significant difference between good and poor readers, F_1 (1, 70) = 3.67, p = .059; F_2 (1, 14) = 4.34, p = .056. The main effect of version was significant in an analysis based on subject variability, F_1 (1, 70) = 4.31, p < .05, but not in an analysis of item variability, F_2(1, 14) = 2.82. There was no reader X version interaction, F_1 (1, 70) < 1; F_2 (1, 14) < 1, showing that no different accuracy pattern existed between good and poor readers. There was a significant main effect of connective, F_1 (1, 70) = 12.18, p < .001; F_2 (1, 14) = 4.49, p = .052, as was in Experiment 1. The other two-way interactions and a three-way interaction were again not significant.

Discussion

Our prediction was partially confirmed by the finding that even poor readers showed no difference in latency between the implicit and explicit versions of *because* sentences. The anomalous sentences in the filler passages appeared to prompt poor readers to generate causal inferences during comprehension. However, there was still a significant difference

between the implicit and explicit versions of the *although* sentences.

This interpretation would be strengthened if the interactions among version, connective, and reader had been significant. The fact that it was not may simply indicate that manipulating the filler sentences had some effect on good readers, not a large enough effect to result in statistical significance but still large enough to reduce the power of the interaction test.

There are two possible reasons why poor readers were not generating inferences on-line when the passage contained an *although* sentence, in spite of the fact that they were doing so for the *because* passage. One reason is the difficulty of contrastive inferences discussed earlier. As Clark and Clark (1977) suggested, the contrastive relation is more complex, thereby requiring more processing steps than the causal relation. As a result, poor readers were not able to draw the contrastive inferences because they may still lack the complex skill. Another reason is the particular characteristic of the anomalous statement used in the filler passages. To make sense of the particular anomalous statements used in Experiment 2, participants needed to generate causal inferences. Thus, the filler passages might have biased participants to engage in an activity specific to the causal inference. We addressed this question in Experiment 3 by creating filler passages that would encourage making inferences about contrastive sentences.

EXPERIMENT 3

The goal of Experiment 3 was to ensure whether the poor readers' failure to make contrastive inferences on-line in Experiment 2 was due to a biased focus on drawing causal inferences. We suggested that context has useful effect when there is unique meaning overlap between what is currently in focus and the previous context. One can find various sources of study in support of this suggestion. Albrecht and Myers (1995, 1998) demonstrated that readers accessed a backgrounded goal information in response to the contextual cue which provided unique overlap associated with the goal. They argued for specificity of the reinstated cue. Gerrig and Bortfield (1999) demonstrated that readers' understanding of noun-noun combinations was not affected by their out of discourse meanings of highly and less accessible compounds (e.g., *doll smile* and *baseball smile*), but their understanding was dependent upon a particular content of innovative context (e.g., smiles on the face of children receiving the gifts of doll and baseball). With regard to active processing, Kintsch put forth an intriguing argument that inserting an impediment---in our case, the anomalous context---may have positive effects, but

"positive effects can be expected only if the extra processing they engage in is appropriate to the task" (1998, p. 319).

Accodingly, we suggest that some intriguing context can afford readers a particular perspective to draw specific kind of inferences in processing subsequent, potentially relevant text. We expect that when people read sentences anomalous with respect to the contrastive relation, encoding the anomaly would arouse the active process specific to the *although* sentences. Thus, in Experiment 3 we constructed anomalous sentences for filler passages so as to force readers to generate contrastive inferences. A sample filler passage can be found in Table 4. For example, we used a sentence like *If the moa bird were enormously large and fierce, it would not assault people.* Halliday (1985) characterizes the *although* sentence as one where a denial of expectation is involved. Hence its meaning can be read as "if P (subordinate clause) then contrary to expectation Q (main clause)." According to this suggestion, we constructed filler sentences so as to replace the normal usage of the conjunctive *although* with *if.* It is reasonable to assume that reading the conditional expression of the *if* clause would encourage readers to anticipate its consequence, which would cause difficulty as they encounter the main clause.

The logic of the construction of anomalous sentences is just the same as in Experiment 2, but the resolution of the anomaly can be accomplished in terms of a grammatical revision That is, these sentences have two characteristics. First, its implausibility can be noticeable at a glance, which would increase the participants' encoding sensitivity. Second, the awkwardness of the sentence meaning can be interpretively resolved only if readers actively make an effort to revise the inappropriate usage of the connective. We assumed that this would encourage participants to enter into an active mode and help them to draw a contrastive inference. Unlike Experiment 2, to provide further evidence that prompting a perspective evokes a specific intention to draw specific kinds of inference, we predicted that less skilled readers should draw inferences during comprehension with the *although* sentences, but not with the *because* sentences.

Method

Participants. The participants were 72 undergraduate students from Seoul National University. The mean reading span score was 3.21 (SD = 0.89), with a range from 2 to 5. Forty-eight participants whose scores were 3.5 or lower were assigned to the group of poor readers. Twenty-four participants whose scores were 4.0 or higher were assigned to the group of good readers.

Materials, Procedures and Design. The method, in general, was the same as in the General Method section except for one change. A new set of 16 filler passages, each containing an anomalous sentence, was used in place of the original filler materials. A sample filler passage (English rendition of Korean passage) is presented in Table 4. The anomaly was created by using the connective *if* instead of *although* in a contrastive statement. The verification test was not carried out on these anomalous sentences. The average length of filler passages was matched with the length of experimental passages. The same set of experimental passages from Experiment 1 was used.

Results

We performed separate 2(reader) X 2 (connective) X 2(version) repeated measures ANOVAs on verification latencies and accuracies to the verification test sentences. These analyses were the same as in Experiments 1 and 2. Mean verification latencies in each condition appear in Table 2 and mean accuracies appear in Table 3.

Verification latencies. Our analysis of the verification latencies revealed no main effect of reader, $F_1(1, 70) < 1$; $F_2(1, 14) < 1$. There was a significant main effect of implicit vs. explicit version, $F_1(1, 70) = 5.22$, $p < .05$; $F_2(1. 14) = 4.78$, $p < .05$. While the interactions between version and connective ($F_1(1,70) = 1.64$; $F_2(1, 14) = 3.65, p < 1$), between version and skill ($F_1(1, 70) = 2.45$; $F_2(1, 14) = 2.09$, and between connective, version, and reader ($F_1(1,70) = 1.12$; $F_2(1, 14) < 1$) were nonsignificant, simple main effect comparisons showed that the effect of version was mainly due to the difference of poor readers' performances in the *because* sentences. Poor readers showed no differences between implicit and explicit versions of *although* sentences, $F_1(1, 47) < 1$; $F_2(1, 7) < 1$, whereas they had longer verification times for *because* implicit sentences than for *because* explicit sentences, $F_1(1, 47) = 16.77, p < .001$; $F_2(1, 7) = 34.75$, $p < .001$. On the other hand, good readers showed no differences between implicit and explicit versions of both *because* sentences $F_1(1, 23) < 1.52$; $F_2(1, 7) < 1$, and *although* sentences, $F_1(1, 23) < 1$; $F_2(1, 7) < 1$. There was a significant main effect of connectives, showing that both readers had longer verification times for *although* sentences than for *because* sentences, $F_1(1, 70) = 110.95, p < .001$; $F_2(1, 14) = 20.98$, $p < .001$.

Accuracies. Aanalysis of the accuracy data revealed that there was no difference between good and poor readers, $F_1(1, 70) < 1$; $F_2(1, 14) < 1$. The main effect of version was not significant, $F_1(1, 70) < 1$; $F_2(1, 14) < 1$. There

was no reader X version interaction, $F_1(1,70) < 1$; $F_2(1, 14) < 1$, showing that no different accuracy pattern existed between good and poor readers. There was a significant main effect of connectives in an analysis based on subject variability, $F_1(1, 70) = 4.30$, $p < .05$, but no effect in an analysis of item variability, $F_2(1, 14) = 1.30$. The other two-way interactions and a three-way interaction were not significant.

Discussion

The results confirmed our prediction that even poor readers make inferences during comprehension with the *although* sentences, but not with the *because* sentences. This is in striking contrast to the results of Experiment 2, in which poor readers made inferences only with the *because* sentences, but not with the *although* sentences. These findings concerning the context effect, which was specific to the semantic features of anomolous filler sentences, are further discussed in a later section.

The clear weakness in the results of Experiments 2 and 3 lies in the nonsignificance of the interactions involving version, connective, and reader. By pooling the results of these two experiments, we may be able to increase the statistical power of the tests of interaction. We therefore performed separate 2(experiment) X 2(connective) X 2(version) repeated measures ANOVAs on the good and poor readers. We report here statistically significant results only.

For poor readers, the analysis showed significant main effects of connective, $F_1(1, 94) = 127.29$, $p < .001$; $F_2(1, 28) = 32.49$, $p < .001$, and version, $F_1(1, 94) = 13.76$, $p < .001$; $F_2(1, 28) = 9.51$, $p < .01$. There was also a significant experiment X connective X version interaction, $F_1(1, 94) = 5.43$, $p < .025$; $F_2(1, 28) = 4.86$, $p < .05$. The interaction is consistent with our predictions that poor readers draw inferences during reading with the *although* sentences but not with the *because* sentences in Experiment 3, but show the opposite pattern of results in Experiment 2.

On the other hand, good readers had shorter verification times for the *because* connective than for the *although* connective in both experiments, $F_1(1, 46) = 64.65$, $p<.001$; $F_2(1, 28) = 33.27$, $p < .001$. This appears to be a robust finding throughout all three experiments. In contrast to our expectation, however, there was also a significant experiment X connective interaction in an analysis based on subject variability, $F_1(1, 46) = 4.32$, $p < .05$, although it failed to reach significance in an analysis based on item variability, $F_2(1, 28) = 2.05$. We examined this interaction by performing separate analyses of *because* and *although* connectives. Good readers showed no differences between experiments for the *because* connective, whereas they had longer verification times for *although* connective in

Experiment 3 than in Experiment 2, $F_1(1, 46) = 6.68, p < .025$; $F_2(1, 14) = 5.28, p < .05$.

This difference may be explained by considering more closely the nature of anomaly manipulated in each experiment. First of all, the filler sentences of Experiments 2 and 3 were constructed similarly with respect to the informativeness and unusualness of the anomaly. However, there is one important difference between the two kinds of anomalies in resolving their resultant incoherence. In order to achieve coherence for the grammatically anomalous sentences in Experiment 3, participants need to maintain a more analytic mode in order to revise the connectives misused in the sentences. In contrast, the pragmatically anomalous sentences used in Experiment 2 need not be subjected to grammatical revision, but only to knowledge elaboration. Although it is impossible to ever know exactly how participants coped with this problem, it makes sense that good readers expended more time for the *although* sentences in Experiment 3 than in Experiment 2. The findings, which showed that good readers are more likely than poor readers to consume extra time for reading demanding sentences (Lorch, Lorch, & Morgan, 1987; McNamara & Kintsch, 1996; Pearlmutter & MacDonald, 1995), provide a rationale for this interpretation.

General Discussion

We conducted three experiments using the same set of materials and the same verification task. Experiment 1 provided a baseline of performance by good readers versus poor readers: Although the poor ones possessed adequate knowledge, only good ones made both causal and contrastive inferences during reading. Experiment 2, in which filler passages contained sentences anomalous with respect to causal relation, showed that even poor readers made causal inferences with experimental passages during comprehension. Experiment 3, in which filler passages contained sentences anomalous with respect to the contrastive relation, showed that even poor readers made contrastive inferences with experimental passages. In summary, across three experiments, there exists a substantial variation in poor readers' ability to draw inferences.

The filler sentences in the present study were manipulated to examine a context effect of active processing in support of Cantor and Engle's (1993) finding. Their participants, both high- and low-span readers, who studied high-integration Fan Size 6 sentences showed faster recognition times for Fan Size 3 sentences than did participants who studied low-integration Fan Size 6 sentences. The memory-based approach to text processing would provide an adequate support for the reinstatement of early context

backgrounded in a different passage. Gerrig and McKoon (1998) and Myers and O'Brien (1998) claim that all the information associated with cues in the text increases in accessibility even when there is no need for a conscious search for information related to the current input. In addition, the filler sentences used in the present study can be assumed to be richly encoded and elaborated, and they shared unique overlap of features with information in the critical experimental sentences (Albrecht & Myers, 1995; 1998), so that the information backgrounded in different passages could be easily---presumably automatically----reactivated.

In contrast to what is known about passive access process of backgounded information, however, less is known about the active role of memory-based processes in drawing inference. Nevertheless, there are many precedents from memory-based research, in which a slowdown in reading is observed when readers encounter sentence containing contradictions of earlier statements (Albrecht & Myers, 1995; Albrecht &O'Brien, 1993; Klin, Guzman, & Levine, 1999). Because a slowdown should occur when readers attempt to continually evaluate the current contents of working memory and to integrate them into their text representation, the reading slowdown suggests that inference is encoded into readers' text representation (Klin et al., 1999). It is true that memory-based research has focused almost exclusively on passive memory process. However, as Meyers and O'Brien (1998, p. 133) put it, "a complete theory of comprehension would describe the inferential machinery" involved in some memory-based process. We assume that inference should occur when reactivated information affords readers a particular perspective on what is currently active in memory.

We originally developed our prediction on the basis of the CI model's claim that, when individuals with adequate knowledge read a challenging text, they process the text actively and deeply. Kintsch and his colleagues (McNamara, Kintsch, Songer, & Kintsch, 1996; McNamara & Kintsch, 1966) measured how a good situation model was constructed by manipulating coherence gaps in experimental passages. They subsequently showed that the knowledge elaboration stimulated by reading a poorly written text could result in a better situation model. In such an experimental paradigm, it would seem to be necessary to have the skill to deal with knowledge elaboration, which can be achieved to the extent that the activity participants are engaging in is task relevant (Kintsch, 1998). Our results make more sense in the framework of the CI model, but there are some aspects of our results that the CI model has not clearly specified.

First, our manipulation of the impediment was not related to task difficulty. Rather, our manipulated variable was the informativeness

and unusualness of the anomalous filler sentences that were assumed to evoke an active process. Hence, we need to specify more clearly what triggered the active process and what effects it had. Task difficulty such as coherence gaps would require one to create a coherent representation as readers endeavour to make every effort to deal with the difficulty. On the other hand, the nonredundant information contained in our filler sentences can be assumed to require self-generated activity to create a coherent representation, especially because the verification test was not carried out on any of these filler sentences. It seems likely that such self-generated activity is responsible for the emergence of the active mode of processing.

Second, the propagation of active processing was specific to the semantic features of sentences. That is, when the anomalous sentences expressed causal relations, their effect was limited to causal inferences. When they expressed contrastive relations, they affected only contrastive inferences. One possible explanation for this result may be the Kintsch's (1998) argument of task relevance in relation to the phenomenon of material appropriate processing (Einstein, McDaniel, Owen, & Coté, 1990; McDaniel, Blischak, & Einstein, 1995). The phenomenon indicates that completing words with deleted letters aided recall for fairy tales but not for descriptive passages, whereas reordering sentences aided recall for descriptive passages but nor for fairy tales. We see in this phenomenon that the experience of extra activity seems likely to provide potentially relevant perspective on text understanding. If so, then the material appropriate processing is comparable with what we have called context effect.

There has been considerable memory research investigating whether memory for episodic information is stored together with memory for the processing of the information when it is acquired. A good example of this sort is the generation effect (Slamecka & Graf, 1978), which refers to the retention advantage found in the generation condition over in the read condition. According to the McNamara and Healy's (1995, 2000) procedural account, the generation effect occurs because generating (e.g., hot - c___) is more likely than reading (e.g., hot - cold) promote procedures during encoding that can be reinstated at the time of retention test. This suggests that transfer between tasks depends on the degree of correspondence of underlying cognitive procedures that share the context of the same mental operations. Extending this transfer-appropriate processing account to the present argument, it seems that specific encoding operations performed on the anomaly would form part of the context that guides the ongoing activity of comprehension.

Third, it should be noted that we are not arguing that the mode of processing (active vs.

passive) is the main, primary source of individual differences. As mentioned earlier, the difference in domain knowledge and language skills among individuals may result in individual differences in reading comprehension. These are stable source of individual differences. However, our study suggests that there is a secondary source of individual differences which shows intra-individual variation in the use of knowledge. This is the individual differences that might be varied in the manner of waxing and waning depending on the active or passive mode that the readers adopt.

Finally, it is interesting to notice that no advantage of reading anomalous sentences was observed for our good readers. This is comparable to McNamara and Kintsch's (1996) notion of the optimal level of the effectiveness of active processing. They argued that truly high-knowledge readers, who already know the text content, should take no advantage for text with coherence gaps. Although their argument is related to level of knowledge, it also seems pertinent to the issue addressed here regarding the use of knowledge. In this respect, this is pure speculation, but it seems likely that our good readers might be perfectionists in the sense of Siegler's (1990) classification of individual differences. On the other hand, being lazy readers as Foertsch and Gernsbacher (1994) and Kintsch (1998) call them, poor readers are perhaps the individuals who have been well adapted to satisfy the minimal requirement to achieve a given goal. However, if an appropriate occasion does arise, they are able to do beyond the requirement spontaneously.

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