The Prior Knowledge Effect on the Processing of Vague Discourse in Mandarin Chinese

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Abstract

This study investigates whether prior knowledge affects the processing of vague discourse in Mandarin Chinese. Vague discourse refers to the texts using vague references and neutral descriptors (e.g. 東西 *d ngx* "thing", 事情 *shìqíng* "item", and 物件 *wùjiàn* "object"), rather than naming the referred to items at the basic level. Three conditions of discourse were tested: one was vague texts preceded by congruent titles, another was texts preceded by incongruent titles and the third was texts preceded without titles. An on-line self-paced reading task was conducted. Participants were instructed to read the vague texts and rate the level of comprehensibility. The rating scores for the level of comprehensibility and the reading time of the whole texts were measured. The experimental results show that people read texts preceded by congruent titles significantly faster than those preceded by incongruent and no titles. However, the reading time of texts preceded by incongruent titles was also significantly shorter than those preceded without titles. We conclude that when people simply read vague idea at a discourse level, the appropriate information is useful for text integration. Inappropriate information, however, can be paid little attention during the text processing and do not increase too much processing load.

Keywords: vague texts, congruency, self-paced reading task, background knowledge

1. Introduction

There are two basic approaches to text understanding: *the top-down approach*, in which the reader starts with a preexistent structure like a schema and tries to fit the text proposition into it, and the *bottom-up approach*, in which the reader starts with the text propositions and tries to create a new structure for them.

According to the top-down approach, when no schema is explicitly given and the reader needs to determine referents and inter-relate propositions, s/he uses whatever information s/he can guess from the text. The reader may try to guess a schema at the same level of detail as that of "washing clothes"; alternatively, he may use some abstract default schema to relate propositions. We will refer to these two instances of the top-down approach as the "guessing" and "default schema" strategies, respectively [1].

With regard to the bottom-up approach to text understanding, when the reader needs to determine referents or inter-relate propositions, presumably s/he does this by using concepts that have been repeated within and between propositions. This "concept repetition" strategy is probably the best-known instance of the bottom-up approach [2].

The top-down approach predicts a schema advantage, that is, texts with schemas are processed faster than those with no schemas. There is evidence to support that people adopt the top-down approach in reading vague texts. Titles function as prior knowledge activators and allow the reader to connect existing knowledge with new information. Evidence for this effect is based on studies that show increased recall for text content when the text is preceded by a title [3, 4, 5]. Bransford and Johnson's [4] research, the classic study, examined how people comprehend and recall an unclear passage describing a series of actions. Their results showed that when the passage was preceded by a title, participants had better recall for the text context than when the passage was read without titles.

In addition, Smith & Swinney's study [6] supported the idea that the presence of schema facilitated discourse processing on-line. Participants were required to read "vague" texts and the reading time for each sentence was each text was recorded. Half the texts were preceded by a title that activated a relevant schema, whereas the other half were presented without relevant schema. Their results showed that reading time of texts without titles was substantially longer than those of texts with titles.

Moreover, research into narrative has shown the importance of narrative theme statements for the integration of narrative content. Previous studies showed that the absence of an explicit theme statement within the narrative structure reduced the reader's ability to comprehend and recall the narrative [7, 8, 9, 10].

In addition, titles can direct the readers' attention to specific information during reading. Rittschof et al. [11] found that when participants were given a written thematic prime before asking them to read a short expository text, they recalled fewer unrelated facts. The thematic prime directed the participants' attention to thematically relevant information and enhanced their ability to discount irrelevant information. Previous research has shown that thematic titles can enhance readers' ability to focus on topic information of importance or shift the focus of attention to a new integrating theme.

Furthermore, in Lee and Cheng's research [12] on Mandarin Chinese, their comprehensibility rating and recall studies provided evidence that texts with congruent titles were more comprehensible than those without titles or with incongruent titles. Participants were instructed to listen to three passages. One of texts was preceded by a congruent title, another was preceded by no titles and the other was preceded by an incongruent title. When they finished listening to the texts, they had to judge whether they could understand the texts on a 1-5 point scale, 1 indicating not comprehensible, 5 indicating very comprehensible. Their results showed that the mean comprehensibility rating scores preceded by congruent titles were higher than those preceded without titles and those preceded by incongruent titles. However, they didn't find any significant difference in rating scores between the texts preceded by incongruent titles and no titles.

Although the previous studies provided evidence that background knowledge can facilitate the discourse comprehension (i.e., the level of comprehensibility), the question of whether the title information facilitates the processing time has not been answered yet. Indeed, Lee and Cheng's [12] study used an off-line rating task, which can only measure how much people comprehend vague texts. It is not necessary that the higher level of

comprehensibility for the texts preceded by congruent titles predicts the faster processing time. This unanswered question needs to be further determined.

Second, it is quite surprising that there was no significant difference in the rating scores between the vague texts preceded by incongruent titles and those without titles in Lee and Cheng's study. It is possible that the auditory presentation of vague texts affects the results. In the auditory processing, participants could easily ignore the inappropriate information since the auditory sentences went quickly. People in this situation can not memorize everything. We postulate that it is why Lee and Cheng found no significant difference between vague texts preceded by no titles and by incongruent titles. In this study, we wonder whether the significant difference in rating scores will occur between the two vague text conditions if the vague texts are presented visually and people will detect the inappropriate background knowledge.

Finally, another reason to re-conduct this experiment is that the experimental materials in Lee & Cheng's study [12] were not well-controlled, which may cause the biased results. Indeed, only three paragraphs were tested in Lee and Cheng's study, each condition involving only one paragraph. The limited numbers of materials tested in their experiment can result in unreliable results. In addition, the congruent and incongruent titles were not balanced for the character length and structure complexity, either. For example, the length of characters for the congruent titles in Lee & Cheng's study is 8.7 characters but the length for the incongruent titles is 3 characters. The longer titles could allow participants to process the vague texts with less effort. This factor could also affect how participants comprehended the vague texts.

Therefore, the goal of this current study is to determine whether the relevant background knowledge facilitate the processing time and whether the irrelevant background knowledge inhibit how much people understand vague texts when materials are presented visually. The reading time of whole texts and rating scores on the level of comprehensibility of vague texts will be recorded. In addition, we will increase the number of the vague texts and balance the length and syntactic complexity of titles in congruent and incongruent conditions. We hope that the replication of this experiment in Mandarin Chinese can bring us to understand the role of background knowledge in the text processing.

2. Experiment: An On-line Self-Paced Reading task

The purpose of this study is to look at the role of background knowledge in the processing of vague texts. We designed three conditions of vague texts: those preceded by congruent titles, those preceded by incongruent titles and those preceded without titles. An on-line self-paced reading task was conducted. Participants were instructed to read the three conditions of the vague texts sentence by sentence and judge how much they comprehend the texts on a 1-5 point scale. The rating scores on the level of comprehensibility of texts were recorded. In addition, the response time for comprehensibility judgment and the reading time for the whole text were recorded, too.

We predict that the appropriate background knowledge can facilitate the processing of vague texts. However, the inappropriate background knowledge will not always result in inhibitory effects in text processing. In particular, it is proposed that the inappropriate background knowledge can increase the processing load only in the situation when participants make semantic/comprehensibility judgment. But the inappropriate background

knowledge will not increase the processing load when participants simply read the texts without making judgment. We think that when people simply read vague texts preceded by incongruent titles, they will not concentrate on inappropriate background information occurring between titles and contents of vague texts. Readers would like to read texts as quickly as possible in order to grasp the main idea of the vague text. So, we postulate that incongruent titles may not elicit the processing difficulty in reading time.

The absence of titles, on the other hand, does not allow one to expect what the vague texts discuss and they have to guess the themes of the vague texts until the end of texts. When people read a text without any title, they have to construct a title first. In the middle of the text, they have to keep revising the title according to the text information. The trial-and-error processing can increase the processing load and the reading time will be longer.

First, when the rating scores on the level of comprehensibility across the three conditions of vague texts are compared, we expect that the rating scores for texts preceded by congruent titles should be *significantly higher* than those preceded by incongruent titles and no titles since the appropriate background information will facilitate the processing of vague texts. Furthermore, the rating scores for texts preceded without titles should be *significantly higher* than those preceded by incongruent titles since the inappropriate background information will produce an inhibitory effect when people make comprehension judgment.

Second, when the rating response times across the three text conditions are compared, we also predict that the response time for the vague texts preceded by congruent titles should be *significantly shorter* than those preceded by incongruent titles and no titles because of the advantage of the appropriate background information. Moreover, the response time for texts preceded without titles should be *significantly shorte*r than those preceded by incongruent titles. It is the same reason that the inhibitory effects occur during the judgment task.

Finally, when the reading time of whole texts across the title condition are compared, we expect that the vague texts preceded by congruent titles will be read *significantly faster* than those preceded by incongruent titles and no titles because the relevant background information elicits facilitation effects. However, the vague texts preceded by incongruent titles will be read *significantly faster* than those preceded without titles. It is because the absence of background knowledge will cause much processing load than the inappropriate information during the reading of vague texts.

2.1 Method

2.1.1. Participants

63 undergraduate students of National Chiayi University (age range from 18 to 23 years old, mean age= 19.87 years old, SD = 1.30, 6 male and 57 female) participated in our task. They were tested individually and paid for their participation. All subjects were controlled for their language background (i.e. native speaker of Mandarin/Taiwanese).

2.1.2. Materials and Design

Our experimental stimuli consist of 51 sets of vague stories in three conditions: vague texts preceded by congruent titles, vague texts preceded by incongruent titles, and vague texts preceded without titles.

For the vague texts, each was created by using vague references and neutral descriptors (e.g. 東西 *d ngx* "thing", 事情 *shìqíng* "item", and 物件 *wùjiàn* "object"), rather than naming the referred to items at the basic level. For instance, the example in Table 1 is a vague text discussing snowman. The content does not explicitly point out lexical items associated with these concepts "snow" or "snowman" or "winter". It uses vague descriptions or references such as 過程 *guòchéng* "procedure" and 成品 *chéngp n* "thing". In addition, the congruent title is 堆雪人 *du xu rén* "a snowman", which provides relevant information what a text is discussed and the incongruent one is 洗杯子 *x b iz* "washing cups", which provides irrelevant information to the text. Both of the congruent and incongruent titles are controlled for the same syntactic structures, e.g., V+N, in this example.

Table 1: An Example of the Vague Texts in this Study

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A Vague Text:

這個**過程**很簡單也很有樂趣。整個**過程**可以在任何地方發生。平均大概要花費一小時或甚至整天都有可能。**過程**中，時間長短取決於你是否要求最後**成品**要非常精緻。整個**過程**只需要一個材料。材料不但要很充足而且越新鮮越好，因為這些原因可以決定**成品**的壽命。另外，**成品**放置的位置也可以決定成品的壽命。如果你等待太久才使用材料，這種材料是會消失的。這個**過程**幾乎每一個人都可以做。

Three Conditions of Titles:

A congruent Title:	堆雪人
An incongruent title:	洗杯子
No title:	Ø

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In our 51 sets of titles, the length of texts in both congruent and incongruent condition was 161 characters (range from 160 to 161 characters) and the length of titles in both congruent and incongruent conditions was 3 characters (range from 2 to 5 characters). In addition, the structures of titles involved in both title conditions were the same. There are 8 titles using the "V" structure pattern (e.g., 慢跑 *mànp o* and 洗澡 *x z o*) and 43 titles using the "V+N" syntactic pattern (e.g., 剪指甲 *ji nzh ji* and 寫報告 *xi bàogào*).

The 51 sets of vague materials with their corresponding congruent and incongruent titles were selected from 100 vague texts via running two pretests: one title production task and one title relevance yes/no judgment task. In the production task, we instructed the 100 undergraduates (Mean age = 20.6 years old, age range from 18 to 23 years old) to read the 100 vague texts and to guess the possible titles for these texts. The titles of texts that were easily guessed by participants were filtered in our main experiment. The final 51 vague materials were controlled for the title predictability: 89 percent of participants can not guess

the correct or appropriate titles for the 51 vague texts.

In addition, 100 participants were instructed to judge the level of relevance of tiles in a YES/NO force choice task. Participants saw a paragraph that was preceded by a title and had to determine whether the title was suitable for this paragraph by selecting YES or NO, YES indicating "relevant" and NO indicating "irrelevant". The purpose of this judgment task is to screen out the inappropriate titles. Congruent titles and incongruent titles were controlled for the level of relevance: the average for congruent titles on the level of relevance is 95% and for incongruent titles on the level of irrelevance is 97%.

In our self-paced reading task, the 51 sets of vague texts were counterbalanced into three lists. Each list included 51 trials in total: one third of vague texts preceded by congruent title, one third preceded by incongruent titles, and one third preceded without titles. Participants did not see the same vague text repeatedly and only saw each paragraph in one title condition once. Before the main task, participants were instructed to read 12 practice vague texts for getting familiar with the whole procedure of the self-paced reading task.

2.1.3. Procedure

The experimental stimuli were randomized in the three lists. At the beginning, participants were instructed to sit in front of a computer and gave an instruction and practice items. They were instructed to read the texts presented by titles or "XXXX" (indicating no titles). These texts were presented sentence by sentence and participants had to read them as quickly as possible but they could read them based on their reading speed. After they finished each sentence, they needed to press the button for the next sentence. The reading times from the onset of the first sentence to the button press by participants for reading the last sentence of texts were recorded by the computer. After the text reading, participants saw a 1-5 point scale on the screen and had to judge the level of comprehensibility of texts. If the text would be highly incomprehensible, they would rate 1 for "very incomprehensible". If the texts would be very comprehensible, they would rate 5 for "very comprehensible". If the texts would be partially comprehensible or incomprehensible, they could rate the number from 2 to 4 on a scale based on their intuition. The rating scores for each trial were recorded, too.

The presentation procedure of this self-paced task is as follows (Figure 1). A cross presented on the screen for 350 milliseconds and then it disappears quickly. A 150-millisecond blank followed and disappear quickly. The second cross appeared again on the screen for 350 milliseconds and disappeared immediately. The purpose of the two crosses appearing on the screen was to allow participants to concentrate their eyes on the middle of the screen and wait for the upcoming target stimuli. Then, the title of a vague text presented on the screen for 600 milliseconds and another blank slide followed for 500 milliseconds. Afterwards, the first sentence of this text appeared on the screen. Participants were asked to read and understand them based on their intuition. After reading each sentence, they pressed the button for continuing the next sentence until the last sentence of this text. After reading the whole text, the previous text was presented again with a rating scale from 1-5 point scale. Participants had to rate the level of comprehensibility of texts by pressing a button.
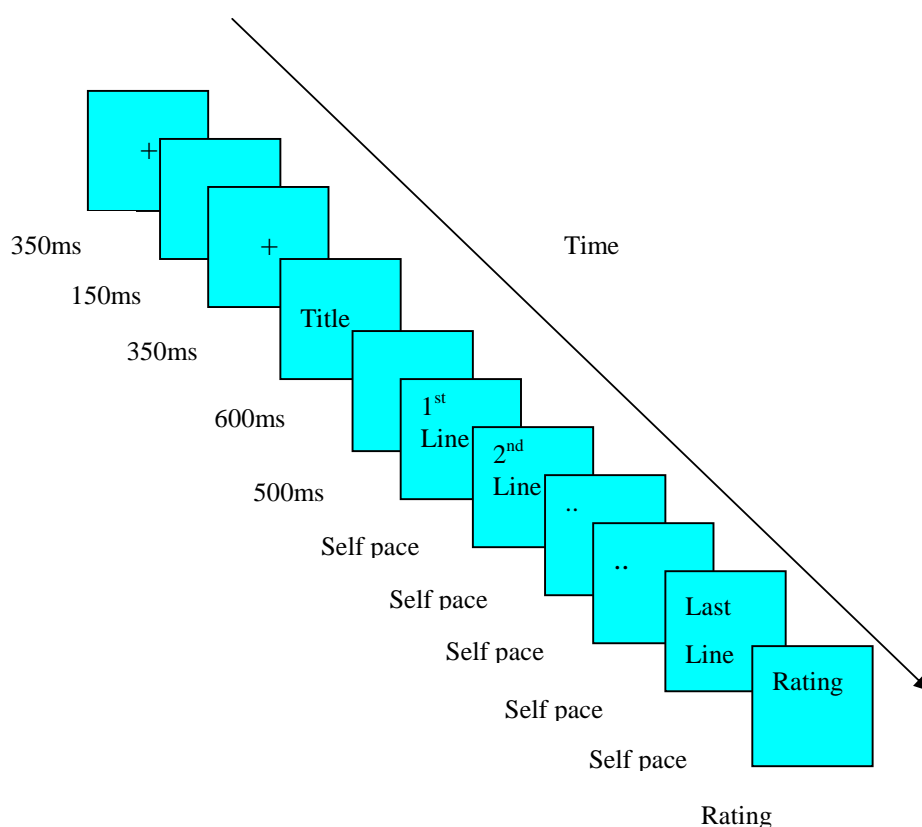
Figure 1. The procedure of the stimuli presentation

3. Results and Discussion

No data of participants were removed. The comprehensibility rating scores, the rating response time and the reading time of the whole texts were analyzed. Table 2 shows that the average rating scores on the level of comprehensibility of texts for the vague texts preceded by congruent, incongruent and no titles are 4.81, 2.27, and 3.36 scores, respectively. So, the vague texts preceded by congruent titles are the most comprehensible, followed by no title and those preceded by incongruent titles are the least comprehensible.

A one-way repeated ANOVA test for testing rating scores was conducted. The by-subject analysis shows there was significant difference in rating scores across the three conditions of vague texts (F_1 (2, 189) = 246.12, $p < .05$). The post-hoc analysis shows that the rating scores of the vague texts preceded by congruent title were *significantly higher* than those of texts preceded by incongruent titles and no titles ($p < .05$). Moreover, the rating scores of the text preceded by incongruent title were *significantly lower* than that those of the texts preceded without titles ($p < .05$). The by-item analysis also yielded consistent results as the by-subject analysis (F_2 (2, 150) = 330.97, $p < .05$). There were s*ignificant differences* in rating scores between the texts preceded by congruent texts and those by incongruent/no titles ($p < .05$). And the vague texts preceded by incongruent titles were *significantly less comprehensible*

than those of the texts preceded without titles ($p < .05$).

Table 2: Means of rating scores across the three conditions of discourse

Conditions of Texts	Mean rating scores
Congruent Titles	4.8 (SD= 0.24)
Incongruent Titles	2.3 (SD= 1.07)
No Titles	3.4 (SD= 0.81)

Additionally, the rating response time was analyzed. Table 3 shows that the average response times for the texts preceded by congruent title, incongruent title, and no titles are 1037.5 ms, 1809.4 ms and 1887.8 ms, respectively. The results show that the texts preceded by congruent titles were rated faster than the other two text conditions. Participants took longer time to rate the texts preceded without title than those preceded by incongruent titles.

Table 3: Means of rating response time across three conditions of discourse

Conditions of Titles	Mean reaction time
Congruent Titles	1037.5 (SD= 570.1)
Incongruent Titles	1809.4 (SD= 602.4)
No Titles	1887.8 (SD= 889.3)

A one-way repeated ANOVA analysis for testing the rating response time was conducted. The by-subject analysis shows that the rating response time was significantly different across the three text conditions (F_1 (2, 189) = 61.24, $p < .05$). A post-hoc analysis shows that the response time of the texts preceded by congruent title was *significantly shorter* than those of the texts preceded by incongruent titles and no titles ($p < .05$). However, the reaction time of the texts preceded by incongruent titles was *NOT significantly longer* than those of the texts preceded without titles ($p > .05$). The by-item analysis also yielded the significant difference across the three conditions of texts as the by-subject analysis (F_2 (2, 150) = 41.90, $p < .05$). The response time for the texts preceded by congruent titles was *significantly shorter* than that those preceded by incongruent/no titles ($p < .05$). Additionally, there was *NO significant difference* in reaction time between the texts preceded by incongruent titles and no titles ($p > .05$).

Moreover, Table 4 shows that the reading time for the texts preceded by congruent titles, incongruent titles and no title are 13976.8 ms, 15302.5 ms, and 17123 ms, respectively, which demonstrates that the vague texts preceded by congruent titles were read faster than the other two text conditions. In addition, the vague texts preceded without titles seem not to be easily read because people took the longest time to read the no-title condition.

A one-way repeated ANOVA analysis for testing reading time was conducted. The by-subject analysis shows that there are significant difference across the three text conditions (F_1 (2, 189) = 40.95, $p < .05$). A post-hoc test demonstrates that the reading time of the texts preceded by congruent titles was *significantly shorter* than those preceded by incongruent titles or no titles ($p < .05$). In addition, the reading time of the texts preceded by incongruent titles was *significantly shorter* than the one of the texts preceded without titles ($p < .05$). The by-item analysis also yielded the same results as the by-subject analysis (F_2 (2, 150) = 28.60, $p < .05$). The congruent condition was read *significantly faster* than the other two title conditions ($p < .05$). And, the vague texts preceded by the incongruent condition were read *significantly faster* than those preceded without titles ($p < .05$).

Table 4: Means of text reading time across three conditions of discourse

Type of Titles	Mean
Congruent Title	13976.8 (SD= 5052.1)
Incongruent Title	15302.5 (SD= 6486.8)
No Title	17123.0 (SD= 5401.7)

To summarize, the results of the rating scores show that the vague texts preceded by congruent titles were processed with less effort than the other title conditions. Incongruent titles, however, provide inappropriate information and make the vague texts not easily to be understood. So, the texts preceded by incongruent titles were rated as the least comprehensible. The vague texts preceded without titles served as the baseline condition and rated as the neutral one (i.e., neither comprehensible nor incomprehensible). The results of rating scores are consistent with our prediction that the relevant background knowledge facilitates the comprehensibility level and irrelevant information results in the inhibitory effects in comprehension.

On the other hand, the results of the response time show a little different from our expectation. In our experiment, the vague texts preceded by congruent titles were responded faster than the other two title conditions. This also suggests the facilitation effects of appropriate background knowledge in text processing. However, we also found that the vague texts preceded by incongruent titles were responded as fast as those preceded without titles, which is different from our prediction that there would be no difference in response time between the no-title and incongruent conditions. The possible reason may be that each vague paragraph was read twice, which allowed one not to read the texts again when the text presented at the second time and directly made responses based on the memory of their previous reading. Thus, the repeated presentation of the vague texts results in the similar response times between the incongruent titles and no-title conditions.

Furthermore, the results of reading time of whole texts show that the vague texts preceded by congruent titles were read faster than the other two conditions. In addition, the reading time of the texts preceded by incongruent titles were read faster than those preceded without titles. The results of reading time also follow our prediction that appropriate information can facilitate the reading but inappropriate information is not necessary for leading to an inhibitory effect in text reading. Even though participants thought that the

no-title vague texts were much more comprehensible than the incongruent condition, participants took longer time to read the former than the latter. The reason is that participants used the different processing strategies in the reading and judgment tasks. During the reading of a vague text, participants did not suspect what we saw and tried to integrate information together to grasp the main idea for this vague text. Participants may guess the title to be problematic, they still kept reading without paying too much attention on the conflict ideas evoked between the content of the texts and the titles. Thus, the inappropriate information did not cause too much processing load.

Finally, the absence of titles can cause much effort for readers to process vague texts because the absence of titles can not allow one to construct a theme in mind. So, participants have to always postulate the possible topic from the beginning of the text to the end. If they think the postulated title is not proper, they have to revise it again and propose another possible title. This trial-and-error process costs longer time for readers to read the texts preceded without titles than those preceded by incongruent titles.

4. Conclusion

This study investigates whether the background knowledge can facilitate the processing of vague texts in Mandarin Chinese. We conducted a self-paced reading task and reading time, comprehensibility rating scores and response time were recoded. Our experimental results show that the relevant or proper background knowledge does aid the integration of vague idea together during the discourse process. However, the improper background knowledge can increase the comprehension difficulty but does not necessarily lead to an inhibition in processing. The evidence is that the reading time of the vague texts preceded without titles was longer than those preceded by incongruent titles in our experiment. The inappropriate information does not seriously interrupt how people read the vague texts even though they are considered the least comprehensible. The absence of titles can lead to a trial-and-error processing so that people take the longest time in processing this kind of texts.

Our results on rating scores are little different from Lee and Cheng's findings [12]. Lee and Cheng found that the vague texts preceded by congruent titles were more comprehensible than the other two title conditions, which is also consistent with our results of rating scores. But, Lee and Cheng did not find the significant difference in rating scores between the vague texts preceded by incongruent titles and those preceded without titles. Indeed, we found that the texts preceded by incongruent titles received significantly lower rating scores than those preceded without titles. The diverging results in rating scores between their and our studies can be attributed to the method of how to present the vague texts.

The vague texts in Lee and Cheng's study were auditory displayed but our texts were presented visually. When participants listened to the vague texts preceded by incongruent titles, each sentence went by quickly and it is not easy for listeners to detect the inappropriate information between titles and contents of texts. Therefore, they did not think the vague texts preceded by incongruent titles to be less comprehensible than those without titles. However, in our study, the texts were presented visually. The vague texts appeared on the screen until participants pressed the button to read the next sentence. The visual method can allow readers to have longer time to integrate vague idea together and can discover what information is not appropriate.

To conclude, this psycholinguistic study is to determine whether the background knowledge influences the processing of vague texts. Our results show that relevant background knowledge can aid the processing of vague texts. The irrelevant background knowledge, however, does not necessarily inhibit the processing of vague texts. The inhibitory effect only occurs in the judgment task rather than in the reading task. Finally, the absence of background knowledge leads to much processing difficulty at a discourse level.

Acknowledgments

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模糊語境理解歷程的先前知識效應

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摘要

本研究探討先前知識是否會影響人處理模糊不清的脈絡文章和語境。模糊的脈絡文章是指語境使用含糊、非指涉特定物件、事件，使用中性的描述和詞彙 (例如："東西、"事情"、和"物件")，而不使用特定的名稱。本研究中，測試了三種模糊語境文章。第一是模糊語境使用了合諧 (congruent) 的標題 (titles)；第二是模糊語境使用了不合諧 (incongruent) 的標題；第三種是模糊語境但沒有標題 (no titles)。我們執行了一個「線上自主的閱讀作業」(on-line self-paced reading task) 的心理語言實驗，並測量了受試者的這三種實驗材料的閱讀時間。實驗結果顯示，受試者在處理合諧標題的模糊語境時，閱讀時間比不合諧或沒有標題的文章時，閱讀時間顯著性較短。另外，受試者在處理不合諧標題的模糊語境時，也比沒有標題的實驗材料的閱讀時間顯著性較短，這顯示由不合諧標題所引起的不相干背景知識並不會讓模糊語境處理時間較久,反而是沒有標題的文章處理時間是最長的。本研究結論為：標題的作用為背景知識的激發，可以促進理解模糊語境文章。但是，不合諧標題未必在模糊語境處理上會造成抑制效果。

關鍵字：模糊語境、合諧、自主的閱讀作業、背景知識