

# Processing Conceptual Metaphors in On-Going Discourse

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In this study, we investigate whether or not conceptual mappings are accessed and used in on-going discourse when people process conceptual metaphors. In particular, we postulate that the conflicting results of previous studies (Nayak & Gibbs, 1990; Glucksberg et al., 1993) may be due to either one or both of the two diverse methods employed: (1) the different task demands (a judgment task employed by the former versus a reading task employed by the latter) and (2) the distinct visual presentations of stimuli (a paragraph presentation in the former versus the line-by-line presentation in the latter). We carried out one off-line and four on-line tasks in order to examine which factors affect the access of conceptual mappings in on-going discourse. Our study supports the hypothesis that conceptual mappings exist and are accessed in on-going language processing when materials are presented in a paragraph style. We argue that the line-by-line presentation method creates an expectation for new information, and thus, does not facilitate the activation of conceptual mappings, while a paragraph presentation method allows for conceptual representations to be built and accessed, regardless of what type of task is used.

The issues of how non-literal language is processed and whether or not the conceptual mappings are accessed in the processing of metaphors have been intensively studied in recent decades. Researchers' attempts to investigate how metaphors are interpreted have led to two different approaches—the conceptual metaphor view (Ahrens, 2002, 2006; Bowdle & Gentner, 2005; Coulson & Van Petten, 2002; Lakoff, 1993; Lakoff & Johnson, 1980; Gibbs, 1994) and the attributive categorization view (Glucksberg et al., 1997; Keysar et al., 2000; McGlone, 1996). The conceptual metaphor view proposes that metaphors are instantiations of concep-

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tual mappings, which are understood via mapping source/concrete domains to target/abstract domains. The attributive categorization view, however, examines the processing of metaphors of the form "X is a Y" and proposes that there are no pre-existing mappings between source and target domains. Metaphors are postulated to be comprehended via class-inclusion assertions, in which a metaphorical category is assigned to the source domain and the assignment entails a property of that category. However, the questions of which account better explains how metaphors are understood and whether the conceptual mappings between source-target domain pairings are activated in on-going discourse are still controversial.

Prior studies on idioms (Gibbs, 1994; Gibbs, Bogdanovich, Sykes, & Barr, 1997; Gibbs & O'Brien, 1990; Nayak & Gibbs, 1990), metaphor (Allbritton, McKoo, & Gerrig, 1995; Kemper, 1989), and euphemisms (Pfaff, Gibbs, & Johnson, 1997) demonstrated that conceptual mappings were accessed in on-going discourse in off-line rating, on-line priming, and on-line reading experiments. These studies all supported the conceptual metaphor view. Nayak and Gibbs' (1990) idiom study, for example, showed evidence that people used conceptual mappings in reading idiomatic sentences in discourse. Participants were asked to read and rate texts ending with two possible English idioms "bites their heads off" and "blows her top." The conceptual metaphor for the idiom "bites their heads off" is ANGER IS A FEROCIOUS ANIMAL, which was conceptually consistent with the prior context. However, the conceptual metaphor for the idiom "blows her top" is ANGER IS HEAT IN A PRESSURIZED CONTAINER, which was conceptually inconsistent with the prior context. They found that the conceptually congruent condition (i.e., "bites their heads off") was rated significantly more appropriate than the conceptually incongruent (e.g., "blows her top"). Their study indicates when the context is biased, people may unconsciously make reference to conceptual mappings in on-going discourse.

Other work (Glucksberg, Brown, & McGlone, 1993), argued against there being a pre-existing mapping between two domains. Participants were asked to read materials, which were presented line-by-line, in front of a monitor. Reading times for each sentence were measured from the onset of the line to the keypress made by the participants. Based on their findings and comparison with Nayak and Gibbs' (1990) results, they proposed that context played a role during idiom comprehension in a task without time constraints (i.e., an off-line rating task), but that the facilitation effect was diluted in a task with time constraints (i.e., an on-line reading task). Therefore, they argued that context effects found in Nayak and Gibbs' (1990) off-line reading study had to do with the non-automatic access of conceptual mappings, which may have occurred as a result of the analogical analysis participants were performing.

Based on the conflicting findings of previous studies on the activation of conceptual mappings in on-going discourse, we postulate two possibilities to explain why Nayak and Gibbs' (1990) results diverge from Glucksberg et al.'s (1993) re-

sults. First, the demands of the task may influence the use of the conceptual mappings in on-going discourse. In fact, two previous studies adopted different tasks to test this issue. Participants were asked to judge the appropriateness level of idioms to prior contexts in Nayak and Gibbs' (1990) off-line study, but idioms were simply read in Glucksberg et al.'s (1993) study. It is possible that the conceptual mappings in on-going discourse are only activated under the condition of a judgment task, but not during a reading task, since it requires more processing resources to read and make a judgment.

Second, the way in which materials were presented may also have affected the on-line access of conceptual mappings in on-going discourse. Nayak and Gibbs (1990) gave participants paragraph-long texts with a terminal idiomatic sentence to read while Glucksberg et al. (1993) let participants to read texts sentence-by-sentence. It is possible that the paragraph presentation allowed the metaphorical concepts to build on one another, which allowed the access of the conceptual mappings.

In this study, we aim to investigate whether or not the access of metaphoric mappings occurs in the processing of metaphors in on-going discourse. In particular, we postulate that the divergent results between Nayak and Gibbs' (1990) and Glucksberg et al.'s (1993) studies may be due to either one or both of the two diverse methods employed: (1) the different task demands (a judgment task employed by Nayak & Gibbs versus a reading task employed by Glucksberg et al.) and (2) the distinct visual presentations of stimuli (a paragraph presentation by Nayak & Gibbs versus the line-by-line presentation by Glucksberg et al.). In addition, in our current study we will also control for word frequency of the target idioms and the level of semantic association between target idiomatic phrases and contextual lexical words. We will conduct one off-line and four on-line tasks in order to examine whether task demands or stimuli presentation or a combination of both affect the activation of conceptual mappings in the process of conceptual metaphors in on-going discourse.

In Experiment 1, an off-line *paragraph judgment* task, we test whether people use the knowledge of conceptual mappings in the processing of conceptual metaphors in Mandarin Chinese with an off-line rating paradigm. Participants in this task read a paragraph that contains four to five examples of a particular conceptual metaphor and rate a target sentence (that contains either an instance from the same conceptual mapping or from different conceptual mappings) on a scale of 1 to 7. Word frequency, collocating frequency and the level of acceptability between the two terminal sentence conditions are controlled. In Experiment 2, an on-line *paragraph judgment* task, participants perform a similar experiment on-line by making a yes-no decision to the target metaphorical sentence. In Experiment 3, an on-line *paragraph reading* task, participants *read* the same materials without performing any additional task. In Experiment 4, an on-line *sentence judgment* task, participants are asked to *judge* the same materials with a *line-by-line context presentation*. In Experi-

ment 5, an on-line *sentence reading* task, participants *read* the same materials with a *line-by-line context presentation*.

It is hypothesized that either the presentation method of stimuli or task demands involved influences the access of conceptual mappings in the processing of conceptual metaphors in on-going discourse. In particular, if a *paragraph* presentation method (Dillon, Richardson, & McKnight, 1990; Mandler & Johnson, 1977) allows for conceptual representations to be built up, we predict that the incongruent target pairings will be rated less appropriate and take longer to read and judge than the congruent target pairings in all paragraph presentation tasks regardless of task type, i.e., in Experiments 1–3. However, if a *judgment* methodology (Love et al., 2003) aids participants in computing conceptual mappings when prior contexts are presented, we predict that the incongruent target pairings will be rated less appropriate and take longer to read and judge than the congruent target pairings in all judgment tasks regardless of what presentation style of materials is employed, i.e., in Experiments 1, 2, and 4. If both a *paragraph* presentation method and a *judgment* method in combination affect whether conceptual mappings are accessed, we predict that the incongruent target pairings will be rated less appropriate and take longer to read and judge than the congruent target pairings in a paragraph judgment task, i.e., in Experiments 1 and 2.

## EXPERIMENT 1: AN OFF-LINE PARAGRAPH RATING/JUDGMENT TASK

The goal of Experiment 1 was to replicate Nayak and Gibbs' (1990) study and to ensure that people did employ conceptual knowledge in the processing of metaphors in on-going discourse in an off-line paragraph rating task. Thus, the paradigm of this experiment was similar with Nayak and Gibbs' (1990) study. Even though the materials tested in our study are conceptual metaphors and those tested in Nayak and Gibbs' (1990) study were idioms, these metaphors and idioms are both motivated by certain conceptual mappings.

Participants in this study read texts that contained four or five metaphorical expressions and ended in a metaphorical expression whose conceptual mapping was either congruent or incongruent to the prior context. The texts were presented in a paragraph style. Participants had to rate the terminal metaphorical sentences according to how well they fit in with prior contexts. We expect that, as consistent with Nayak and Gibbs' (1990) results, the incongruent target pairings will be rated less appropriate than the congruent target pairings.

### Method

*Participants.* Forty-four participants (mean age = 19.8 years, *SD* = 1.6 years) took part in the off-line appropriateness rating task. These participants were all un-

dergraduate students of National Taiwan University, lived in Taiwan since birth, and were native speakers of Mandarin Chinese. All participants were paid NT\$100 for their participation, which took approximately one-half hour. None of the participants participated in any of the pretests for the stimuli.

*Materials.* Two types of Mandarin Chinese materials were looked at in this off-line task: (1) metaphors whose conceptual mappings were congruent to prior contexts and (2) metaphors whose conceptual mappings were incongruent to prior contexts. Both of the conditions were conventional metaphors. That is, the conceptually congruent condition was material in which the prior context shared consistent conceptual mappings with its terminal target metaphorical expression; the conceptually incongruent condition involved material in which the prior context shared inconsistent conceptual mappings with its correspondent terminal expression.

Thirty sets of materials were created following the steps discussed in Ahrens (2002, 2006) for determining conventional conceptual metaphors in a language. An example for the conceptual metaphor IDEA IS A BUILDING is given in Table 1. The target domain IDEA is conceptually mapped to the domain A BUILDING. The mappings are linguistically realized via four lexical items, such as *gui-hua* “draw up,” *she-ji-tu* “designed map,” *jian-li* “to build up” and *chu-xing* “a model.” Three conditions were designed in the terminal sentences. The lexical word *gou-zhu* “construct” in the metaphorical congruence condition reflects the metaphor IDEA IS A BUILDING that is consistent with the one in the previous context.

TABLE 1  
Sample Experimental Scenario with the Metaphor IDEA IS A BUILDING

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*Context:* Yao zhuan-xie yi-ge hao de yan-jiu ji-hua-shu shou-xian yao gui-hua chu yi-ge wan-zheng de she-ji-tu qie yao neng qing-chu cheng-xiyan-jiu de zong-dian bao-gua xiang-guan yan-jiu wen-xian yi-ti ji dong-ji deng-deng ran-hou jian-li zheng-que yan-jiu de fang-fa yu bu-zou. Zhe yang zheng-ge ji-hua de chu-xing ye jiu da-gai chu-lai le.

“When you write up a good research proposal, you first have to plan a complete design map. In addition, you have to clearly present the research points, including the literature review, the research questions, the motivation, etc. Then, you have to build up the correct research methods and steps. In this way, the model of your proposal will be complete.”

Terminal Targets

Congruent: *Suo-yi yao gou-zhu zi-ji de lun-dian ji fang-an bing bu nan*

“So, it is not difficult to construct your own theory.”

Incongruent: *Suo-yi yao tui-xia zi-ji de lun-dian ji fang-an bing bu nan*

“So, it is not difficult to promote your own theory.”

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Furthermore, the lexical word *tui-xiao* “promote” in the metaphorically incongruent condition reflects the metaphor IDEA IS COMMODITY that is inconsistent with the previous context.

To avoid the semantic priming effect triggered by associated linguistic words, the collocating frequency between the target lexical words and these contextual lexical words was controlled. The collocating frequency is developed from a mathematical model in the computer science (Church & Hanks, 1990) and this function is embedded in the Sinica Balanced Corpus that is available on the Internet (<http://www.sinica.edu.tw/SinicaCorpus/>). The collocating frequency, called the mutual information value, indicates whether or not two lexical words often appear together. If the collocating frequency is higher than 2, it suggests that they are highly associated. If the collocating frequency is below 2, it suggests that the two words may occasionally or accidentally co-occur but they are not syntactically or semantically associated (Huang, 1995; Sproat, Shih, Gale, & Chang, 1996). If the collocating frequency is zero, it suggests that the two lexical words never appear together within this corpus. For example, the collocating frequency between *gou-zhu* “construct” and *diao-bao* “a blockhouse” is 8.65, which suggests that they repeatedly appear together in discourse and have some associations in semantic or syntactic structures. On the other hand, Figure 1 shows that the collocating frequency between *gou-zhu* “construct” and *bu* “not” is 1.48, suggesting that they are not highly associated.

We employed this function to control the collocating frequency between each target and the lexical words within their corresponding prior texts. All of the collocating frequencies were zero for a lexical window plus or minus ten words, which

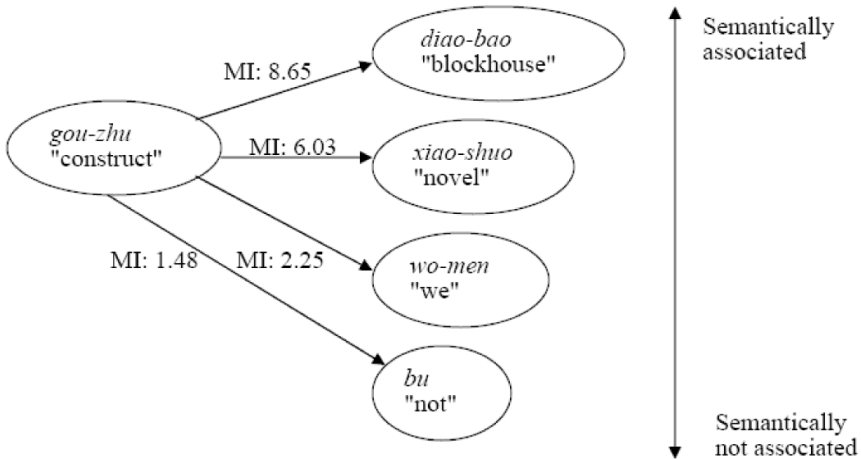


FIGURE 1 An example of the mutual information values between *gou-zhu* and its collocates.

indicate that the target lexical words never co-occurred with their corresponding contextual lexical words and thus should not induce semantic association.

In addition, word frequency of target metaphors (i.e., the underlined words *gou-zhu* “construct” and *tui-xia* “promote”) in terminal sentences between the two target metaphor sentences was also controlled (CKIP, 1995; the Sinica Balanced Corpus, Version 4, <http://www.sinica.edu.tw/SinicaCorpus/>). The means of the word frequency were 42.9 for the congruent metaphors and 43.6 characters for the incongruent metaphors. There was no significant difference in word frequency between the two metaphor sentences ( $t(34) = -.03, P > .05$ ). Finally, the target lexical words in the target sentences were placed in the middle of the sentence instead of at the end in order to avoid sentential wrap-up effects.

The average length for the target sentences in two conditions was 20.1 characters ( $SD = 3.8$ ), ranging between 16 and 28 characters. Furthermore, the average length of the contexts was 62.3 character ( $SD = 14.9$ ), ranging between 32 and 90 characters.

In order to control the terminal sentences for their conventionality and acceptability, the target metaphor sentences were pre-tested in an off-line acceptability rating task. The two target conditions were rotated among two counter-balanced lists. Twenty-one undergraduate students of National Taiwan University (mean age = 20 years,  $SD = 1.5$  years) were instructed to rate the two types of metaphor sentences. They rated the materials on a scale of 1-7, 7 being “highly acceptable” and 1 “highly unacceptable”. The results showed that the target sentences had an average rating of 5.3 ( $SD = 1.5$ ) for the congruent metaphor sentences, and 5.0 ( $SD = 1.7$ ) for the incongruent metaphor sentences. The metaphorically congruent metaphors were not rated significantly higher than the incongruent ones ( $t(40) = .80, P > .05$ ).

In this off-line appropriateness rating task, sixty materials were rotated among four lists. Each list contained fifteen contexts with target sentences randomly ordered. In each list, half the stimuli were congruent metaphors and half the stimuli were incongruent ones. Participants only saw each set of stimuli once.

**Procedure.** Participants were randomly assigned to test one of the four lists. Participants were instructed to read each sentence carefully and judge whether the terminal metaphorical sentence was appropriate or not to the prior context on a seven-point scale, with 1 indicating *bu-shi-dang* “highly inappropriate” and 7 indicating *hen-shi-dang* “highly appropriate.” After reading each text carefully, subjects circled their rating directly in the questionnaire list. The task took approximately 15 minutes.

## Results & Discussion

Forty-four participants had reliable data, 11 participants for each list. The mean rating scores for metaphors conceptually congruent and incongruent to prior con-

texts were 5.0 ( $SD = 0.6$ ) and 4.5 ( $SD = 0.7$ ), respectively. The rating scores for the congruent condition were 0.5 higher than the incongruent condition. A 4 x 2 mixed-design ANOVA was run on individual participants data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. An overall significant main effect of Sentence Type was found for the participant analysis ( $F_1(1,40) = 26.66, P < .05$ ) and a main effect for the item analysis ( $F_2(1,52) = 4.44, P < .05$ ). There was no main effect of List for the participant analysis ( $F(3,40) = .56, P = .64$ ).

The results of this off-line paragraph rating/judgment task demonstrate that the congruent target pairings produced significantly higher rating scores than the incongruent target pairings. In the next experiment, we replicate this judgment task in a real time task and examine whether conceptual mappings are accessed in the processing of metaphors in on-going discourse.

## EXPERIMENT 2: AN ON-LINE PARAGRAPH JUDGMENT TASK

Experiment 2 was conducted to replicate Experiment 1 but involved a real time paradigm in order to examine whether or not conceptual mappings are accessed on-line in on-going discourse. The same materials used in Experiment 1 were tested in this task. Participants read texts that were presented in a paragraph style. The texts then disappeared from the screen and a terminal metaphorical expression immediately appeared. Participants had to judge whether the terminal sentence was appropriate to the prior context by pressing a button.

If conceptual mappings do occur in the processing of metaphors in on-going discourse under timed conditions, we expect that the incongruent target pairings will take longer to comprehend than the congruent pairings in this task. In addition, the correct rate for yes/no appropriateness judgment for the incongruent target pairings will be significantly lower than for the congruent pairings.

### Method

*Participants.* Forty undergraduates (mean age = 20.2 years,  $SD = 1.5$  years) from National Taiwan University served as paid volunteers. All were native Mandarin speakers, and none served as participants in Experiment 1.

*Materials.* We selected 18 sets of materials out of 30 sets of stimuli used in Experiment 1. In addition, a priori pretest for reading time of target sentences without preceding contexts was conducted in order to control the equal reading times for each condition without preceding contexts. Thirty undergraduate students of

National Taiwan University (mean age = 20.1 years,  $SD = 1.2$  years) participated in this task. None of them participated in any previous experiments. The results showed that the mean reading times were 3011 ms ( $SD = 1426$ ) for congruent metaphor sentences and 3062 ms ( $SD = 1426$ ) for incongruent metaphor sentences. The t-test showed no significant difference in reading times between two metaphor sentences ( $t(58) = -.17, P > .05$ ).

Each list contained 36 materials, 18 experimental items and 18 filler items. The order of stimuli in each list was random.

**Procedure.** Participants were randomly assigned to one of the four lists. The subjects were seated in front of an Acer computer at a comfortable reading distance. They were instructed to rest their index finger on the left button and middle finger on the right button. They had to read a paragraph with a terminal metaphorical sentence carefully and judge whether the terminal metaphorical sentence was appropriate or not to the whole given context by pressing a designated button.

At the beginning, the word *yu-bei* "Ready" appeared on the screen. When participants were ready, they pressed the button and a paragraph-long text appeared at the center of the screen. After they finished reading, participants had to press the designated button again and the whole context disappeared and the terminal sentence appeared on the screen. They had to read the terminal sentence carefully and to judge whether this sentence was appropriate to the preceding context by pressing the button for *shi-dang* "highly appropriate" or the button for *bu-shi-dang* "highly inappropriate." After their judgment, *duan-wen jie-shu* "The end of the story" appeared at the center of the screen. They were told to read each paragraph at a pace that they determined but as quickly as they could while still understanding the meanings. They were also instructed that once they pressed the button, they would not be able to backtrack to the preceding text. Reaction time for terminal target sentence was measured from the onset of the sentence to the button pressed by participants.

Participants were told to expect short comprehension questions in the middle of the task. After 6 of the 18 filler stories were read, participants answered a true/false question concerning the context of the preceding story. These questions were included to ensure that the participants read for comprehension. After answering a question, they pressed the button to read the next story. On the average, participants took approximately 30 minutes to complete the task.

## Results and Discussion

Forty participants had reliable data, 10 participants for each list. Data of 40 participants were computed and analyzed. We included all reaction times no matter the participant's response. Table 2 shows that the mean reading times for terminal metaphorical sentences that are conceptually congruent and incongruent with prior

contexts were 3861 ms ( $SD = 1312$ ) and 4241 ms ( $SD = 1236$ ), respectively. The congruent condition is 380 ms faster than the incongruent condition. In addition, the mean correct proportion for appropriateness YES judgment was 91% ( $SD = 11\%$ ) for the congruent condition and 78% ( $SD = 15\%$ ) for the incongruent condition.

A 4 x 2 mixed-design ANOVA for reaction times was run on individual participants data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. An overall significant main effect of Sentence Type was found for the participant analysis ( $F_1(1,36) = 8.99, P < .05$ ) but no main effect for the item analysis ( $F_2(1,64) = 2.03, P = .16$ ). There was no main effect of List for the participant analysis ( $F(3,36) = .34, P = .80$ ). Furthermore, a 4 x 2 mixed-design ANOVA for appropriateness proportion was run on individual participants data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. An overall significant main effect of Sentence Type was found for the participant analysis ( $F_1(1,36) = 31.22, P < .05$ ) and for the item analysis ( $F_2(1,64) = 7.79, P < .05$ ). There was no main effect of List for the participant analysis ( $F(3,36) = .25, P = .86$ ).

The results of this on-line paragraph judgment task show that the incongruent target pairings did take longer to comprehend than the congruent target pairings. However, the results in this task can't yet determine whether either the presentation method or the task demands affects the activation of conceptual mappings in the processing of metaphor in on-going discourse because the two factors were both involved in the on-line paragraph judgment task. In the following experiments, we will split up the two factors into different tasks and to see whether either the factor of the stimuli presentation or the factor of the demands of tasks involved influences the on-line access of conceptual mappings in on-going discourse.

TABLE 2

Mean reaction times (in msec) and mean correctness proportions (in percentage) for congruent and incongruent target pairings for the on-line paragraph judgment task and the on-line paragraph reading task.

	<i>Target Type</i>	
	<i>Congruent</i>	<i>Incongruent</i>
Paragraph Judgment Task	3861ms (91%)	4241ms* (78%*)
Paragraph Reading Task	2116ms	2368ms*

\*Congruent vs. Incongruent differences significant at  $p < .05$ .

### EXPERIMENT 3: AN ON-LINE PARAGRAPH READING TASK

This experiment was conducted to investigate whether conceptual mappings are accessed when the materials are presented in a paragraph style regardless of task type. Participants read materials that were presented in a paragraph style and the reading time of each terminal target sentence was measured.

We expect that the paragraph presentation method influences the access of conceptual mappings in on-going discourse regardless of the types of tasks and facilitates the reading times. We predict that the incongruent target pairings will take longer to read than the congruent target pairings in this task.

#### Method

*Participants.* Forty undergraduates (mean age = 20.3 years,  $SD = 1.2$  years) from National Taiwan University served as paid volunteers. All were native Mandarin speakers, and none served as participants in Experiments 1 and 2.

*Materials.* Experiment 3 used the same stimuli as Experiments 2.

*Procedure.* The procedure was similar to Experiment 2 except participants were instructed to read the paragraph rather than to judge the appropriateness level of texts. They rested their index finger on the button. After they pressed the button, a paragraph-long text appeared at the center of the screen. After they finished reading, participants had to press the button again and the whole context disappeared. Immediately, the terminal target sentence appeared on the screen. When they finished reading, they had to press the button again. Reading time for each terminal target sentence was measured from the onset of the sentence to the button pressed by participants. As in Experiment 2, participants had to answer six true/false comprehension questions in the middle of the experiment.

#### Results and Discussion

Data of 40 participants were computed and analyzed. Table 2 shows that the mean reading times for terminal metaphorical sentences which are conceptually congruent and incongruent with prior contexts were 2116 ms ( $SD = 642$ ) and 2368 ms ( $SD = 779$ ), respectively. The congruent condition is 252 ms faster than the incongruent condition.

A 4 x 2 mixed-design ANOVA for reaction times was run on individual participants data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. An overall significant main effect of Sentence Type was found

for the participant analysis ( $F_1(1,36) = 18.91, p < .05$ ) and for the item analysis ( $F_2(1,64) = 5.17, p < .05$ ). There was no main effect of List for the participant analysis ( $F(3,36) = 1.24, p = .31$ ).

The results of this on-line paragraph reading task demonstrates that the incongruent target pairings took significantly longer to read than the congruent target pairings, which suggests that people use the conceptual knowledge during metaphor processing in on-going discourse when the preceding context is presented in a paragraph style. This confirms the hypothesis that the paragraph presentation, regardless of what tasks are used, influences whether or not conceptual mappings are accessed on-line in the processing of metaphors in on-going discourse. In the following two experiments, we will examine whether that conceptual mappings are accessed in on-going discourse when a judgment task is used irrespective of the method of material presentation.

#### EXPERIMENT 4: AN ON-LINE SENTENCE JUDGMENT TASK

The purpose of this task is to investigate whether conceptual mappings are accessed in a judgment task regardless of what types of material presentation are used. In this task, participants were instructed to read the materials that were presented sentence by sentence. The reading time of each terminal target sentence was measured.

If the judgment method influences the access of conceptual mappings in on-going discourse, regardless of the types of material presentation, we predict that the incongruent target pairings will take longer to judge than the congruent target pairings in this task. In addition, the correct rate for yes/no appropriateness judgment for the incongruent target pairings will be significantly lower than for the congruent target pairings.

#### Method

*Participants.* Forty undergraduates (mean age = 20.4 years,  $SD = 1.6$  years) from National Taiwan University served as paid volunteers. All were native Mandarin speakers, and none served as participants in Experiments 1–3.

*Materials.* Experiment 4 used the same stimuli as Experiments 2 and 3.

*Procedure.* As in Experiment 2, participants had to judge the appropriateness level between the prior contexts and the terminal sentences, except in this experiment the materials were presented line by line. The text was presented line by line when participants pressed the button. Before each terminal target sentence, a

cross “+” appeared in the middle of the screen. The purpose of this cross was to indicate the following sentence was the final sentence of the whole text. The cross disappeared immediately when participants’ pressed the button and the terminal sentence appeared on the screen. Participants had to read the terminal sentence and judge whether the terminal metaphorical sentence was appropriate to the preceding context by pressing the designated button either for *shi-dang* “highly appropriate” or for *bu-shi-dang* “highly inappropriate”. Reaction time for each terminal target sentence was measured from the onset of the sentence to the button pressed by participants. Like previous experiments, participants had to answer six true/false comprehension questions in the middle of the task.

## Results and Discussion

Data of 40 participants were computed and analyzed. We included all reaction times no matter whether participants responded to it as appropriate or not appropriate. Table 3 shows that the mean reading times for terminal metaphorical sentences which are conceptually congruent and incongruent with prior contexts were 4108 ms ( $SD = 1731$ ) and 4414 ms ( $SD = 1803$ ), respectively. The congruent condition is 306 ms faster than the incongruent condition. In addition, the mean correct proportion for appropriateness YES judgment were 52% ( $SD = 36\%$ ) for the congruent target sentences and 49% ( $SD = 26\%$ ) for the incongruent target sentences.

A 4 x 2 mixed-design ANOVA for reaction times was run on individual participants data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. No significant main effect of Sentence Type was found for the participant analysis ( $F_1(1,36) = 1.83, p = .19$ ) and for the item analysis ( $F_2(1,64) = .97, p = .33$ ). There was a main effect of List for the participant analysis ( $F(3,36) = 2.99, p < .05$ ). Furthermore, a 4 x 2 mixed-design ANOVA for appropriateness proportion was run on individual participants data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. No significant main effect of Sentence Type was found for the participant analysis ( $F_1(1,36) = .43, P = .52$ ) and for the item analysis ( $F_2(1,64) = .56, P = .46$ ). There was no main effect of List for the participant analysis ( $F(3,36) = .43, P = .74$ ).

The results show that the incongruent target pairings did not take longer to comprehend than the congruent target pairings. In addition, the congruent target pairings were not judged significantly more appropriate than the incongruent pairings. This result does not support the hypothesis that task demands influences the access of conceptual mappings in the processing of metaphors in on-going discourse. As compared with the results of Experiment 2, where the congruent pairings were read faster than the incongruent pairings when the text was presented in a paragraph format, no facilitation effect in reaction times between two metaphorical

TABLE 3  
 Mean Reaction Times (in Msecs) and Mean Correctness Proportions (in Percentage) for Congruent and Incongruent Target Pairings for the On-Line Sentence Judgment Task and the On-Line Sentence Reading Task

	<i>Target Type</i>	
	<i>Congruent</i>	<i>Incongruent</i>
Sentence Judgment Task	4108 ms (52%)	4414 ms (49%)
Sentence Reading Task	2410 ms	2485 ms

parings were found in the line-by-line presentation method. In the final experiment, we present materials line-by-line in a reading task to examine whether or not conceptual mappings are accessed.

### EXPERIMENT 5: AN ON-LINE SENTENCE READING TASK

Experiment 5 was conducted in order to replicate Glucksberg et al.'s (1993) study and to examine whether or not conceptual mappings are activated in the processing of conceptual metaphors in a reading task when materials are presented sentence by sentence. We will compare our data in this task with Glucksberg et al. (1993) and check whether there is a significant difference in readings time between congruent and incongruent target pairings.

Participants read the same materials that were presented sentence by sentence. The reading time of each terminal target sentence was measured. If conceptual mappings do occur in the processing of metaphors in on-going discourse in this task, the incongruent target pairings will take longer to read than the congruent target pairings.

#### Method

*Participants.* Forty undergraduates (mean age = 19.6 years,  $SD = 1.4$  years) from National Taiwan University served as paid volunteers. All were native Mandarin speakers, and none served as participants in Experiments 1–4.

*Materials.* Experiment 5 used the same stimuli as Experiments 2, 3, and 4.

*Procedure.* As in Experiment 4, materials are presented line by line. However, participants only had to read the materials in this task. When participants were ready, they pressed the button and a line appeared. After they finished reading, they had to press the button again, the previous line disappeared on the screen

and the next line appeared immediately. Reaction time for each terminal target sentence was measured from the onset of the sentence to the button pressed by participants. Like previous experiments, they also had to answer six true/false comprehension questions during the task.

## Results and Discussion

Forty-four participants had reliable data. Table 3 shows that the mean reading times for terminal metaphorical sentences that are conceptually congruent and incongruent with prior contexts were 2410 ms ( $SD = 736$ ) and 2485 ms ( $SD = 862$ ), respectively. The congruent condition is 75 ms faster than the incongruent condition.

A 4 x 2 mixed-design ANOVA for reaction times was run on individual participant data employing List (4) as a between-participants factor (materials counterbalancing factors) and Sentence Type (congruent and incongruent) as within-participants factors. No significant main effect of Sentence Type was found for the participant analysis ( $F_1(1,41) = 2.50, P = .13$ ) and for the item analysis ( $F_2(1,30) = .30, P = .59$ ). There was no main effect of List for the participant analysis ( $F(2,41) = .07, P = .94$ ).

Our results demonstrate that the incongruent target pairings didn't take longer to read than the congruent target pairings, which converges with Glucksberg et al.'s (1993) results that conceptual mappings don't affect the comprehension of idioms in on-going discourse. As compared with the results of Experiment 3, where the congruent pairings were read faster than the incongruent pairings when the text was presented in a paragraph format, no RT facilitation effect was found in the sentence-by-sentence presentation method. Thus, our results show that sentence-by-sentence presentation is unable to elicit conceptual mappings during processing metaphors in on-going discourse.

## GENERAL DISCUSSION

This present study investigates whether or not conceptual mappings are accessed in on-going discourse and postulates that two factors, the task demands (i.e., a reading task or a judgment task) and the methods of stimuli presentations (materials presented sentence-by-sentence or in a paragraph style), may affect such activation. We examined metaphors that shared either congruent or incongruent conceptual mappings to prior contexts and conducted five experiments to resolve this controversial issue.

The results of the five experiments presented herein demonstrate the evidence supporting that conceptual mappings are accessed in the processing of metaphors in on-going discourse when metaphoric statements are presented in a paragraph style, whereas the line-by-line presentation doesn't elicit this kind of activation.

We found that the mean reaction/reading times and rating scores/correctness percentages for the terminal metaphor sentences in congruent pairings were significantly faster and higher, respectively, than those in conceptually incongruent pairings when materials were presented in a paragraph style in the off-line paragraph rating/judgment task (i.e., Experiment 1), the on-line paragraph judgment task (i.e., Experiment 2), and the on-line paragraph reading task (i.e., Experiment 3). Furthermore, the incongruent target pairings didn't take significantly longer to read and judge than the congruent target pairings when materials were presented line-by-line in the on-line sentence judgment task (i.e., Experiment 4) and the on-line sentence reading task (i.e., Experiment 5). Moreover, the correctness percentage for congruent pairings was not significantly higher than for incongruent pairings in Experiments 4 and 5.

Our findings show that conceptual mappings exist and are accessed in on-going discourse. When a conceptual metaphor is encountered in on-going discourse, and when the target domain remains constant and the metaphors all are taken from the same source domain, then there is continuity in conceptual processing. However, if the metaphor is taken from a different source domain, then an adjustment needs to be made in order to understand the text. This occurs even though the two congruent and incongruent target sentences, which were controlled to be equally acceptable in an off-line acceptability rating test, are conventional expressions and make sense in the on-going discourse.

Furthermore, our research can explain the conflicting results between Nayak & Gibbs (1990) and Glucksberg et al. (1993). Nayak and Gibbs (1990) employed the method of a paragraph presentation, which allowed one to easily activate all conceptual mappings with the same source-target domain pairings. On the other hand, Glucksberg et al. (1993) employed a line-by-line presentation, which allowed individual conceptual mappings to be accessed, but prevented the necessary level of build-up of global activation for semantic access of the conceptual mappings to occur.

In addition, our finding can account for why on-line experiments in Gibbs et al.'s (1997) idiom and Pfaff et al.'s (1997) euphemism studies demonstrated that conceptual mappings were not accessed in the processing of non-literal language. Gibbs et al. (1997) employed a priming method to test whether people accessed conceptual mappings in the processing of idiomatic expressions that were presented line-by-line. Their data demonstrated that the idioms that shared inconsistent metaphoric mappings to prior contexts did not take longer to read than the idioms that shared consistent metaphoric mappings to prior contexts. They concluded that people didn't use the knowledge of metaphoric mappings when reading idioms. The fact that no access of conceptual mappings occurred during the idiom comprehension in on-going discourse might be because Gibbs et al.'s (1997) employed the line-by-line presentation, which resulted in that the conceptual mappings not being elicited. Furthermore, Pfaff et al.'s (1997) tested euphemism expressions that were presented line-by-line in an on-line reading task and also showed that the euphemism expres-

sions that had inconsistent conceptual mappings to prior contexts did not take longer to read than those that had consistent conceptual mappings to prior contexts. Again, this might be because that the line-by-line presentation did not allow one for the access of conceptual mappings.

In sum, our study has methodological implications for researchers in investigating the issue of the access of conceptual mappings in the processing of metaphors in on-going discourse. First, our research supports the idea that the presentation method of metaphorical expressions influences the access of conceptual mappings in on-going discourse. In particular, a paragraph presentation method may encourage people to access conceptual mappings in the processing of metaphors while a line-by-line presentation method does not. Second, task demands do not seem to affect the understanding of metaphors in discourse. Third, this research resolves the conflicting results of previous studies (Nayak & Gibbs, 1990; Glucksberg et al., 1993) and points out under what circumstances (i.e., when materials are presented in a paragraph style) the on-line access of conceptual mappings happens in on-going discourse. Future work will focus on investigating if there is a minimal number of conventional metaphors in a paragraph necessary to be contained in a paragraph in order to activate conceptual mappings, and if conceptual mappings are activated when the paragraph and terminal sentence are novel metaphors in order to better understand how different types of metaphors are processed and integrated in on-going discourse.

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