The Topic Comprehension Process in Simile Sentences

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Abstract

Our study investigates the process of topic comprehension in comparative sentences and the relationship between this process and the word order of topic and vehicle. Our experiment used a meaningfulness decision task with three conditions: no-vehicle sentence (e.g. *a word hurts someone*), vehicle-after-topic sentence (e.g. *a word, like a weapon, hurts someone*), and vehicle-before-topic sentence (e.g. *like a weapon, a word hurts someone*.) The results of the meaningfulness decision task show that the vehicle-after-topic sentence and the vehicle-before-topic sentence were judged as meaningful more quickly than the no-vehicle sentence. Especially in comparative sentences with low conventional vehicle, the vehicle-before-topic sentences were judged more quickly than the vehicle-after-topic sentences.

Keywords: figurative language, simile, metaphor, comparative sentence, meaningfulness decision task

Introduction

Figurative language is an interesting problem in the fields of linguistics, psychology, and the other cognitive sciences. Many researchers have particularly noticed metaphoric nominal sentences in this regard (e.g., Bowdle & Gentner, 2005; Chiappe, Kennedy, & Smykowski, 2003; Gernsbacher, Keysar, Robertson & Werner, 2001; Jones & Estes, 2006; Utsumi, 2007). In those recent studies, the category of "metaphoric nominal sentence" includes two types of sentences: metaphors and similes. The metaphor is a declarative sentence that is composed of a topic and a vehicle only, such as *a word is a weapo*n, while the simile is a comparative sentence that is composed of a topic, a vehicle, and a comparative word, e.g., *a word is like a weapon*.

Some recent studies have used the two types of sentences as a method to investigate the process of similarity cognition, or evaluation of the similarity between topic and vehicle (e.g. Bowdle & Gentner, 2005; Jones & Estes, 2006; Utsumi, 2007). However, other studies have examined the process of comprehending metaphoric sentences in themselves, without looking at similes (e.g. Blasko & Connine, 1993; Gernsbacher et al., 2001; Jones & Estes, 2005). In studies of metaphor, the main emphasis often falls on the process of vehicle categorization (Gernsbacher et al., 2001; Glucksberg, 2003; Glucksberg, McGlone, & Manfredi, 1997). Experimental research on the topic comprehension-process, on the other hand, seems to be lacking.

In this paper, we examined the simile and its effect on topic comprehension. In comparison with metaphor, simile has rarely been examined in the research field of metaphoric-sentence comprehension. Moreover, the role of topic in metaphoric-sentence comprehension has seldom been examined experimentally. We used a simple meaningfulness decision task with three conditions relating to word order to investigate the topic of simile as relevant to the metaphoric comprehension.

Metaphor and Simile

Metaphor and simile are similar and seem, in fact, to be two forms of the same expression, whereas they have different pragmatic aspects (Roberts & Kreuz, 1994). One different point is that the metaphor is an expression that considers the topic as sharing an ad hoc category with as the vehicle, while the simile is an expression that emphasizes similarity between the topic and the vehicle without assigning them to the same category. So metaphor expresses categorical and identical relationships, while the simile expresses comparative but differentiated relationships between topic and vehicle. Because of this difference, two sentences were used as a method to investigate strength of similarity in a topic-vehicle pair, as mentioned above.

This difference explains whether the topic-vehicle pair is preferentially expressed as a metaphor or a simile. For example, Bowdle & Gentner (2005) argued that cognitive similarity between the topic and vehicle is enhanced by the conventionality of the vehicle, explaining the preference for metaphor or simile: a topic-vehicle pair with a conventional vehicle is preferred for the metaphor form, while an unconventional vehicle is preferred for the simile form. Also, Jones & Estes (2006) experimentally showed the effect of aptness on the preference for the metaphor form. They revealed that a highly apt pair of topic-vehicle pair is preferred for the metaphor form, while a less apt topic-vehicle pair is preferred for the simile form. They argued that the similarity between topic and vehicle is determined by how aptly the vehicle expresses the important features of the topic.

These studies on metaphor-simile preference, however, discuss only the process of similarity cognition between topic and vehicle, not the comprehension process of metaphoric sentences. They reveal the relationships between similarity cognition and preference for metaphor or simile, but did not reveal what meaning the topic or vehicle are understood as having in a declarative or a comparative sentence.

Comprehension of Topic and Vehicle

Some previous studies have examined the problem we mentioned above. For example, Gernsbacher et al. (2001) and Glucksberg, Newsome, & Goldvarg (2001)

experimentally examined the understanding of the meaning of the vehicle in metaphor comprehension. Their experiment used a priming paradigm and sentence reading task to investigate how metaphor-relevant (superordinate relevant) and metaphor-irrelevant (basic relevant) meanings are processed in a vehicle during metaphor comprehension. For example, Gernsbacher et al. (2001) showed that the vehicle activates the metaphor-relevant meaning (e.g. *Sharks are tenacious*) but suppresses the metaphor-irrelevant meaning (e.g. *Sharks are good swimmers*) in metaphor comprehension (e.g. *that defense lawyer is a shark*).

In other previous studies, the role of the topic in a metaphor comprehension was examined. Taira & Kusumi (2009a, 2010) investigated how strongly not only the vehicle but also the topic in a metaphor activates metaphor-relevant and metaphor-irrelevant meanings by using a priming paradigm and a meaningfulness decision task. Their research also examined the effect of vehicle conventionality and aptness of metaphor on meaning-activation of topic and vehicle. They showed that the vehicle activates the metaphor-relevant meaning in highly conventional and highly apt metaphors and suppresses the metaphor-irrelevant meaning in all types of metaphor, but that the topic activates not only the metaphor-relevant meaning but also the metaphor-irrelevant meaning in all types of metaphors. The result that the topic of all types of metaphor activates the metaphor-relevant meaning is seemingly strange because of the fact that the topic of low-conventionality and low-aptness metaphors (e.g. *marriage is a refrigerator*) can be understood quickly as a metaphor-relevant meaning (e.g. *in a marriage, we can find various things*). One possible answer to this question is the prediction that the topic in metaphor comprehension can play a role in making acceptable all the meanings for the correct and quick comprehension of the metaphor (cf. McGlone, & Manfredi, 2001). However, Taira and Kusumi's experimental paradigm contains the problem of word order only in their topic experiment.

The vehicle-activation experiments used a simple priming task and a reading task or a meaningfulness decision task (Gernsbacher et al., 2001; Glucksberg et al., 2001; Taira & Kusumi, 2009a). The experimental paradigm employed in these studies presented the priming stimulus of a metaphor (e.g., *a word is a weapon*); then, the pair of vehicle and metaphor-relevant meaning (e.g., *a weapon hurts someone*) was read. The distance between the vehicle in a priming stimulus and the vehicle in a reading task or meaningfulness decision task is very short. As a result of this distance, the meaning of the vehicle can be investigated correctly because the distance disallows unnecessary (and complicating) processes.

On the other hand, the topic-activation experiment used the same tasks as the vehicle-activation experiment (Taira & Kusumi, 2009a; 2010). In Taira and Kusumi's experiment, the distance between the topic in a priming stimulus (e.g., *a word is a weapon*) and the topic in a decision task (e.g., *a word hurts someone*) is long in comparison with the vehicle experiment. Furthermore, by using the metaphor-priming and the topic in a decision task, the topic is presented two times for the participants. Those long distance and double presentation of topic can help the participants comprehend the topic as carrying not only a metaphor-relevant meaning but also metaphor-irrelevant meaning.

A problem remains because a metaphor is expressed in a predetermined word order. This problem, however, can be solved by the use of Japanese comparative expression and a meaning-decision task. In natural Japanese, a comparative expression can be formed by two types of simple sentence. For example, a sentence like "a word is like a weapon (*kotoba wa buki no youda*) because it hurts someone (*nazenara sore wa hito o kizutsukeru karada*)" can be rewritten as "a word, like a weapon, hurts someone (*kotoba wa buki no youni hito o kizutsukeru*)" and "like a weapon, a word hurts someone (*buki no youni kotoba wa hito o kizutsukeru*)." If we use the subject and the predicate in the two sentences for the decision-task, the problems in a priming task can be settled. Furthermore, the word order enables us to change the progress of topic process, especially in the experiment which investigates the online process of sentences: the topic in the comparative sentence which put the vehicle before the topic is understood later than the topic in the sentence which put the vehicle after the topic. This difference and the comparison between the after-topic sentence and the before-topic sentence will reveal the role of topic in metaphor comprehension. Our previous studies indicated that the role of topic is to accept all the meanings for the metaphor comprehension (Taira & Kusumi, 2009a). If the previous studies' indication is correct, the after-topic sentence will be decided as meaningful more quickly than the before-topic sentence because the topic of the after-topic sentence can activate its meanings longer than the before-topic sentence.

In addition, the research on simile comprehension is less extensive than the research on metaphor comprehension. The research on the comprehension process in comparative sentences is important not only for understanding topic processes in similes but also for metaphor comprehension research. As we mentioned already, the metaphor and simile are similar but different from each other, so it is little known whether the comprehension process of metaphors and similes is the same or different. Based on the above problems, our study uses two types of comparative sentence to investigate and discuss the topic-comprehension in similes.

Pilot Study

To investigate two types of comparative sentence (e.g., a vehicle presented after a topic: *a word, like a weapon, hurts someone*, and a vehicle presented before a topic: *like a weapon, word hurts someone*), it should be confirmed that the topics of two types of sentences, composed with different word orders, are understood in the same level of comprehension. The aim of this pilot study was to investigate the comprehension equivalence between the

topic in sentences with after-topic vehicles and topic in the sentences with before-topic vehicles. Our predication was that the word order will not affect the extent of saliency which the topic is understood as the metaphor-relevant meaning.

Method

Participants 120 undergraduates participated in the pilot study. All were native Japanese speakers.

Materials Seventy-two Japanese comparative sentences (e.g., "a word is like a weapon") were used in the pilot study. To each comparative sentence, an interpretative feature (e.g. "a word hurts someone") was applied. The comparative sentence and interpretative feature were selected from previous studies (Blasko & Connine, 1993; Gernsbacher et al., 2001; Jones & Estes, 2006; Utsumi, 2007; Taira, Nakamoto, & Kusumi, 2007).

Regarding simile, our past studies have investigated the conventionality of the vehicle and aptness of the simile (Taira & Kusumi, 2009b). In these past studies, 99 Japanese undergraduates participated. The participants were required to rate the conventionality (strength of the association between a simile vehicle and its interpretative feature) and the aptness (extent to which the vehicle's figurative meaning express the topic aptly and correctly) of a simile in terms of the sense of its interpretative feature. We used a 5-point conventionality scale (1 = "not at all conventional" to 5 = "highly conventional") and aptness scale (1 = "not at all apt" to 5 = "highly apt") in the past studies. The summarized results of our past studies are shown in Table 1.

Table 1: Summarized results of conventionality and aptness ratings in Taira & Kusumi (2009b)

Data	Conventionality	Aptness
Mean (*SD*)	3.38 (0.74)	3.14 (0.82)
Max	4.60	4.58
Min	1.89	1.52

Notes: 5-point scale, $N = 72$

Procedure The pilot study was a simple rating task. The participants were presented with the material sentences (e.g., "a word hurts someone"), and required to rate how important a feature the predicate of the sentence (e.g., "hurt someone") was for the subject of the sentence (e.g. "a word"). We used a 5-point scale for importance rating (1 = "not at all important" to 5 = "very important").

We used a booklet in the pilot study. The participants were presented with 96 sentences which included 24 practice sentences and 72 trial sentences. The practice sentences were printed on the first page of the booklet, and the trial sentences were printed in the next pages. The order of printed trial sentences was counterbalanced between participants.

All the material sentences were presented in one of three different conditions (see Table2): the first one presented the topic and features with no vehicle; the second one put the vehicle in natural Japanese order, after the topic; and the third was in reverse order from the second, with the vehicle written before the topic. In the no-vehicle condition, only the topic-interpretative feature pair was presented (as a simple sentence). In the after-topic condition, the vehicle was positioned after the topic; in the before-topic condition, the vehicle was positioned before the topic. The participants were presented with 24 material sentences in each condition.

Table 2: Example of sentence in each condition

Condition	Example of Sentence
no-vehicle	A word hurts someone.
after-topic	A word, like a weapon, hurts someone.
before-topic	Like a weapon, a word hurts someone.

Notes: the sentence in all the conditions could be written and read as natural and simple Japanese sentence.

Results and Discussion

Mean importance rating data were analyzed (see Table 3). The data were analyzed via one-way ANOVA (sentence conditions: no-vehicle, after-topic, before-topic) with participants (F_p) and items (F_i). The main effect of the sentence conditions was significant ($F_p(2, 238) = 3.50$, $F_i(2, 142) = 4.75$, $ps < .05$). Ryan's multiple-comparison procedure revealed that the interpretative feature in no-vehicle sentences were rated more important than in after-topic and before-topic sentences ($t_p(238) = 2.55, 1.89$, $ps < .05, 10$; $t_i(142) = 2.97, 2.19$, $ps < .005, .05$). Otherwise, the difference between after-topic and before-topic sentences was not significant ($t_p(238) = 0.67$, $t_i(142) = 0.78$, $ps > .10$).

Table 3: Mean importance ratings (with participants)

	no-vehicle	after-topic	before-topic
Mean	3.63	3.33	3.25
(*SD*)	(0.47)	(0.50)	(0.53)

Notes: 5-point scale, $N = 120$

From the results, the sentences with no vehicle tended to be rated the most important. Sentences with any vehicle in any word order, on the other hand, were rated less important. In the pilot study, the participants were required to rate the importance of subject-predicate pairs with no context. The previous studies showed that a metaphorical expression is difficult to understand without sufficient contexts (Keysar, 1989; Ortony, Shallert, Reynolds & Antos, 1978). The sentences in the after-topic and before-topic conditions were more difficult to understand because of the lack of contextual support, than the sentences in the no-vehicle condition.

The important point from the results is that there was no difference between importance ratings in the after-topic and before-topic conditions. This suggests that a topic and an after-topic vehicle are almost equal to a topic and before-topic vehicle. In that light, vehicle word order has little

effect on the saliency strength of topic in a comparative sentence.

Experiment

Meaningfulness decision task (MDT: Taira & Kusumi, 2009a; 2010): a task in which participants are required to decide whether the subject-predicate pair is meaningful or not. The MDT is adequate for investigating the comprehensive strength of relationships between the subject and the predicate in a sentence. Our experiment used the MDT to investigate the topic in sentences with after-topic vehicles and in sentences with before-topic vehicles.

Method

Participants and Materials Eighty-six undergraduates and graduate students participated in the experiment. All were native Japanese speakers and different individuals from the participants in the pilot study. The materials in the experiment were the same as in the pilot study.

Procedure All the experimental trials were conducted in Japanese. Firstly, the participants were instructed that the experiment was composed of two different phases: a MDT and a sentence-recognition task.

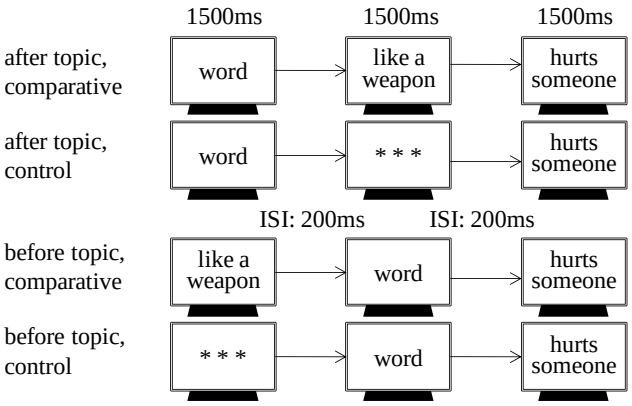

Figure 1: Design of the MDT

In the MDT trial, the fixation mark (+) was presented at the center of a PC screen for 1500 ms. The participants were instructed to watch the fixation mark carefully. After that, the fixation mark was removed, and a material sentence was presented at the center of the screen. At this time, the sentence was separated into three parts, and the parts were presented in sequence. The three parts were the topic (e.g., a word), a comparative vehicle (e.g., like a weapon), and interpretative feature (e.g., hurts someone). The interpretative feature was always presented last, although the comparative vehicle was presented either after or before the topic. The three parts were presented for 1500 ms each, and the ISI for 200 ms. In the comparative vehicles, the vehicle of the material sentences was presented as a comparative stimulus, whereas the character list (* * *) was presented as a matched control stimulus (see Figure 1).

The participants were required to judge whether the pair of topic and interpretative feature was meaningful or not as quickly as possible before the interpretative feature was distinguished. A reaction of "meaningful" was indicated by pressing the "1" button of a ten-key pad, and a not-meaningful reaction was to press the "3" button. If the participants could not react in 1500 ms, the red text "Time Over!" was presented in the center of the screen as a time-over message. In a meaningful decision, the participants were instructed to ignore the comparative vehicle, but were required to memorize all the sentences presented in the MDT, and to recognize the sentences in the sentence-recognition task, which was ostensibly to be conducted after the MDT trials were finished. However, the recognition task was not actually conducted. The next trial was started 2000 ms after the end of the trial.

The MDT trials included 36 dummy trials and 72 target trials. The dummy trials were identified as non-meaningful. On the other hand, all the target trials were identified as meaningful, and be defined by the 2 (vehicle type: control/comparative) x 2 (vehicle position: after topic/before topic) design, as mentioned above.

Results and Discussion

Two participants identified less than 60% of the trial pairs as non-meaningful, so their data were excluded from analysis. In the end, 84 participants' data were analyzed.

Meaningful Decision Proportion Data were analyzed by a 2 (vehicle type: control/comparative) x 2 (vehicle position: after topic/before topic) repeated-measures ANOVAs with participants (F_p) and items (F_i). Mean meaningful-decision percentages are shown in Table 4.

Table 4: Mean meaningful decision proportion of the MDT (*SD*)

Vehicle position	Control	Comparative
after topic	80% (12)	88% (10)
before topic	81% (13)	88% (10)

The main effect of the vehicle type was significant ($F_p(1, 83) = 43.31$, $F_i(1,71) = 24.37$, $ps < .001$). However, the interaction between vehicle type and vehicle position was not significant ($F_p(1, 83) = 0.27$, $F_i(1,71) = 0.50$, $ps > .10$). The result showed that the comparative vehicle helps the participants judge the pair of topic and interpretative feature as meaningful regardless of vehicle position.

Decision Time Before analysis, we excluded meaningful-decision data exceeding two standard deviations from the mean (4% of the data were excluded). The data were analyzed via a 2 (vehicle type) x 2 (vehicle position) repeated-measures ANOVAs with participants (F_p) and items (F_i). Mean decision times are shown in Figure 2.

The main effects of vehicle position ($F_p(1, 83) = 4.60$, $F_i(1,71) = 9.79$, $p < .05$, $p < .005$) and vehicle type ($F_p(1, 83) = 36.74$, $F_i(1,71) = 42.05$, $ps < .001$) were significant. The interaction between vehicle type and vehicle position

was also significant ($F_p(1, 83) = 15.09$, $F_i(1,71) = 7.48$, $p < .001$, $p < .01$). The test of the simple main effect revealed that the comparative vehicle helps the participants judge the pair of topic and interpretative feature as meaningful more quickly than the control vehicle both in the after-topic ($F_p(1, 166) = 7.60$, $F_i(1,142) = 9.48$, $p < .01$, $p < .005$) and before-topic ($F_p(1, 166) = 51.76$, $F_i(1,142) = 44.63$, $ps < .001$) conditions. On the other hand, in the control condition, the difference between after-topic and before-topic was significant ($F_p(1, 166) = 17.37$, $F_i(1,142) = 16.90$, $ps < .001$), although the difference in the condition of comparative vehicle presented was not significant ($F_p(1, 166) = 0.87$, $F_i(1,142) = 0.00$, $ps > .10$). This suggests that the presentation timing of the topic is related to the difficulty of topic comprehension. If the topic is presented early in the period during which comprehension is in progress, the topic activates its possible meaning more than if presented relatively late in this period. This is suggested by the control-vehicle data on the difference between after-topic and before-topic. But this difference disappears in the comparative-vehicle condition. This suggests that the comparative vehicle activates the interpretative feature in the topic, especially in the before-topic condition. The results that the before-topic sentence activates the metaphor-relevant meaning more than the after-topic sentence are contrary to our predication. This might be caused by the topic of the before-topic sentence in which the process of vehicle precedes the topic, thus the sentence activated the metaphor-relevant meaning only of the vehicle, not the topic, which might accept all the vehicle meaning.

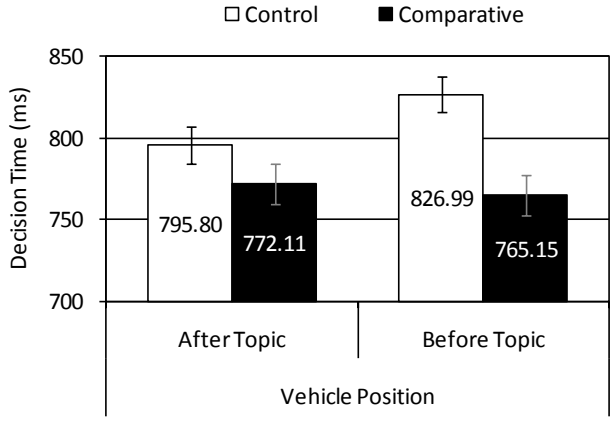

Figure 2: Mean decision time in the MDT
Note: Error bars represent the SE of the mean.

Is the tendency of the effect of the comparative vehicle the same regardless of the simile type? The answer is probably "no." Table 5 shows the mean decision time divided by the median of vehicle conventionality (high conventionality (e.g., "a thunder strike is like a knife") vs. low conventionality (e.g., "a fashion model is like a rail")). Three way ANOVA showed that the interaction between vehicle type, vehicle position, and conventionality (low conventionality/high conventionality) was significant ($F_i(1,70) = 6.04$, $p < .05$). The test of the simple main effect revealed that the effect of vehicle type was only not significant in the condition of the low-conventionality vehicle presented after the topic ($F_i(1,140) = 0.00$, $p > .10$), and that the comparative vehicles in the other conditions (low-conventionality vehicle before topic, high-conventionality vehicle after topic, and high-conventionality vehicle before topic) were significant ($F_i(1,140) = 24.04$, 19.89, 23.08, $ps < .001$). Furthermore, in the comparative low-conventionality condition, the decision time for vehicles presented after the topic is faster than that for vehicles presented before the topic ($F_i(1,140) = 4.41$, $p < .05$). These results show that the presentation of the vehicle helps the participants judge the pair of topic and interpretative feature as meaningful, but that the topic with low-conventionality vehicle is difficult to judge in the after topic-vehicle condition.

Table 5: Mean decision time (*SD*) divided by the median of vehicle conventionality (ms).

Conventionality	Control	Comparative
Low Conv.		
after topic	798.85 (99.13)	798.66 (94.41)
before topic	840.22 (87.91)	772.66 (96.77)
High Conv.		
after topic	800.55 (100.84)	739.09 (103.69)
before topic	830.31 (103.52)	764.12 (106.78)

$N = 36$

On the other hand, the effect of aptness seems to be less than that of conventionality. Table 6 shows mean decision time divided by median aptness (high aptness (e.g., "a word is like a weapon") vs. low aptness (e.g., "a marriage is like a refrigerator")). Three way ANOVA showed that only the main effects of aptness ($F_i(1,70) = 12.48$, $p < .001$), vehicle type ($F_i(1,70) = 42.64$, $p < .001$), and vehicle position ($F_i(1,70) = 9.80$, $p < .005$) were significant. There was no interaction between vehicle type, vehicle position, and aptness ($F_i(1,70) = 0.06$, $p > .10$). This shows that the participants in the comparative condition could identify the pair of topic and interpretative feature as meaningful regardless of the aptness of the comparative sentence.

Table 6: Mean decision time (*SD*) divided by the median of aptness (ms).

Aptness	Control	Comparative
Low Apt		
after topic	830.08 (105.61)	811.43 (86.41)
before topic	861.60 (96.06)	803.70 (102.26)
High Apt		
after topic	769.31 (83.33)	726.31 (101.48)
before topic	808.93 (88.54)	733.07 (88.22)

$N = 36$

We speculate that this difference between vehicle conventionality and aptness is probably characteristic of simile. The simile, unlike the metaphor, emphasizes the similarity between the topic and vehicle. So, in the simile, it is not necessary for the topic and the vehicle to be the same. That is why the meaning of the topic can be different from the meaning of the vehicle. Furthermore, the topic does not interfere with activation of all the meaning in metaphoric sentences (McGlone, & Manfredi, 2001), so the important process is to interpret the meaning of the vehicle. Thus, the meaning of vehicle is more strongly affected by vehicle conventionality than vehicle aptness, because conventionality is the strength of meaning of the vehicle only, but aptness is the strength of the relationships between the topic and vehicle. The importance of vehicle in simile is indirectly suggested by the vehicle-position results.

General Discussion

The experiment presented in this paper showed experimental results of comparative-sentence processing. From our study, it is shown that the topic of comparative sentence is quickly comprehended as a simile-relevant meaning, and that the topic of low-conventionality comparative sentence is easily understood in a condition where the vehicle is presented before the topic. The aptness is not related to the process of simile.

The definition of aptness in our study, however, is a little different from the definition in the previous studies. The definition in the previous studies is the extent to which the vehicle's figurative meaning expresses an important feature of the topic (Jones & Estes, 2006). This definition does not decide what the figurative meaning refers to. So the important feature is possibly different for each person who evaluates the aptness of the vehicle to the topic. On the other hand, the definition of aptness in our study determines the figurative meaning. In the case of "a word is like a weapon," the aptness of the feature (a weapon hurts someone) is predetermined. In this definition of aptness, however, vehicle conventionality and aptness cannot be independent of each other ($r = 0.53$, $p < .001$; from Taira & Kusumi, 2009b). This suggests that not only vehicle conventionality but also aptness can have an effect on the processing of comparative sentence.

In future research, we will examine the relationships between various factors (not only conventionality and aptness but also familiarity, similarity, difficulty to understand and so on) which is may affect on the process of simile comprehension, using, for example, multiple regression analysis. In addition, we will discuss the difference between the process of simile and metaphor in detail, based on experimental data.

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