

Generation Effect on Free Association Task

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Abstract

This research examined whether a free association task of Watkins, Vache, Verney, Muller and Mathews (1996) was a conceptually driven task. To judge whether the free association task was a conceptually driven task, the generation effect was examined. In Experiment 1, the generation effect in the free association task indicated that the free association task could be classified as a conceptually driven task. In Experiment 2, generation effects in the free association task and the word-fragment completion task were examined. As a result, the generation effect occurred in the free association task only. It was judged from these results that the free association task was a conceptually driven task, thereby supporting the prediction of Roediger and McDermott (1990).

Generation Effect on Free Association Task

Free association has been used a tool to explore human ability and mental disorders. For example, psychoanalysts have been used the free association to test and treat mental illness.

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This study focused on the generation effect on free association. In implicit memory research, researchers examined the influence of depression on implicit memory (see review by Hertel, 1994). For example, Ruiz-Caballero and Gonzalez (1994) found a mood-congruent effect on implicit memory. However, some researchers did not find a mood-congruent effect (e.g., Danion, Kauffmann-Muller, Grange, Zimmerman, & Greth, 1995; Denny & Hunt, 1992; Ilsley, Moffoot, & O'Carroll, 1995; Watkins, Mathews, Williamson, & Fuller, 1992). Roediger and McDermott (1992) were interested in the results that the mood-congruent effect related to depression did not occur in implicit memory, and speculated on the reason for inconsistent results relating to depression in implicit memory. Roediger and McDermott (1992) considered that the reason might be that the implicit memory task was a data-driven task. In addition, Roediger and McDermott (1992) predicted that the mood-congruent effect would occur if a conceptually driven task was used to measure implicit memory. A conceptually driven task is a task that primarily needs processing related to concept or meaning for carrying out the task. A data-driven task is a task that primarily needs processing related to physical features of a stimulus for carrying out the task. These tasks are defined operationally (Blaxton, 1989, p.659). A conceptually driven processing task is defined as a task in which the generation effect has occurred. The data-driven task is defined as a task that shows the opposite pattern to the generation effect. This pattern was called the reverse generation effect.

Watkins et al. (1996) examined the mood-congruent effect on implicit memory based on this prediction. Watkins et al. used the free association task as a conceptually implicit memory task. As a result, a mood-congruent effect relating to depression occurred in the free association task. The prediction of Roediger and McDermott al. (1992) was supported.

However, is the free association task a conceptually driven task? This point is taken up by Watkins et al. (1996). In Watkins et al., the grounds that the free association task is a conceptually driven task was not mentioned. In explicit and implicit memory research, research that examined whether the free associative task of Watkins

et al. is a conceptually driven task was not found. Schacter and McGlynn (1989), Java (1996), and Srinivas and Roediger (1990) relate to this problem.

In Schacter and McGlynn (1989), there was reported to be a difference between a synonym generate condition and a letter counting task condition in a free association task. These results suggested that the free association task is conceptually driven processing. Moreover, in Schacter and McGlynn (1989), the performance of some orienting task conditions that would demand processing related to concept and meaning was higher than that of the letter counting task condition that would demand processing related to physical features. This result suggested that the free association task could be classified as a conceptually driven task. However, Schacter and McGlynn (1989) reported a case of no statistical differences between these orienting task conditions in the free association task. Moreover, the experimental procedure of Schacter and McGlynn (1989) was different from the general procedure of generation effect. In general, an experiment of generation effect compares performances between the condition to generate a word in context and the condition to read a word. In this respect, it cannot be simply said that a free association task is a conceptually driven task from Schacter and McGlynn (1989).

Java (1996) compared the generation effect in young participants and old participants by using an implicit word-association task. This task is similar to the free association task in term of associating freely from a cue. In the results of this experiment, it was not reported that a significant interaction between the orienting task (read, generate) and the memory task (implicit word-association task, explicit word-association task) was shown. That is, a generation effect was not found in the implicit word-association task. This result suggests that the implicit word-association task is not a conceptually driven task. From this result, it can be assumed that a free association task similar to a implicit word-association task is not a conceptually driven task.

The result of Java (1996) is important with respect to examining the generation effect in free association. However, the experiment

of Java (1996) has some problems. First, it uses an intentional study paradigm to examine the effect of an orienting task. In an intentional study paradigm, it is not made clear whether the generation of the word or intentional encoding improves performance. The experiment is not appropriate for examining the generation effect. Second, the calculation to compare the explicit memory task and the implicit memory task in a statistical analysis is peculiar. In general, the performances between an implicit memory task and an explicit memory task are not compared directly.

Srinivas and Roediger (1990) compared three orienting conditions (generation, context, non-context) in four memory tasks (category association task, anagram solution task, word-fragment completion task, and free recall task). In these memory tasks, the category association task is similar to the free association task that Watkins et al. (1996) used. The main difference between these two memory tasks was in the instructions of association from a cue. In Watkins et al., participants were instructed to do free association from a cue. In addition, participants were told to produce many instances of category as possible. In Srinivas and Roediger (1990), participants were instructed to associate a category example from a cue. As a result, the generation effect occurred in the category association task. Then, Srinivas and Roediger (1990) considered the category association task as a conceptually driven task.

Caution is required when making the judgment that the free association task of Watkins et al. (1996) is a conceptually driven task based on Srinivas and Roediger (1990). This is because Srinivas and Roediger (1990) used a intentional study paradigm as in Java (1996). Moreover, Watkins et al. (1996) and Srinivas and Roediger (1990) vary slightly in the instruction of the memory task.

Is the free association task a conceptually driven task? The generation effect in the free association task of Watkins et al. (1996) needs to be examined under the same conditions as Watkins et al. (1996). This research examined whether the generation effect occurred in the free association task of Watkins et al. under the following conditions: use of the incidental learning paradigm, comparison between the generate condition and the read condition,

and the same instruction as Watkins et al. Through this examination, it was discussed whether the free association task was a conceptually driven task, and the validity of the prediction by Roediger and McDermott (1992).

Experiment 1

In Experiment 1, it was examined whether the free association task was a conceptually driven task. It was predicted that the generation effect occurs if the free association task is a conceptually driven task. There is a strong possibility that the free association task is a conceptually driven task based on the occurrence of the mood-congruent effect in depression (Watkins et al., 1996) according to Schacter and McGlynn (1989) and Srinivas and Roediger (1990). The procedure of Experiment 1 basically followed Watkins et al. To examine the generation effect, a comparison between the read condition and the generate condition in the study phase was designed.

Method

Participants. The participants were 14 Hiroshima university undergraduates and graduates. They received a videotape worth of 350Yen for their participation.

Design. This study used a 1 (orienting task: read condition, generate condition) within-subject factorial design. In Experiment 1, an unstudied condition was not included in the orienting task factor, because the sizes of the priming effect between memory tasks did not need to be compared.

Materials. The materials were selected by the following procedure. First, the category names that were used in Srinivas and Roediger (1990) were translated into Japanese. Second, the examination of category examples for those category names was conducted. In the examination, participants were required to generate five category examples for a category name. In these

answers, participants gave words that were not included in a certain category and that were improper as the example of the category. For example, frog, newt, and salamander were answered for reptiles. Petrol was answered for the part of a car. Those examples were included in the total. This was because that subjective generation of category examples was important. The frequency of the category example for 52 category names was investigated from 20 participants. These participants were different from the participants of Experiment 1.

Third, the materials of Experiment 1 were selected based on a list of frequency. The maximum frequency score of the list was 20. Cues in the free association task were the same cues as in the neutral condition in Watkins et al. (1996). These cues were category names. Target words in the free association task were category examples. The target words were selected based on the following two criteria: (a) low frequency (range 2–5, this range was based on the use of low-frequency words as materials in Watkins et al.), (b) word length of four or more letters in the rounded Japanese phonetic syllabary. Finally, 16 cues and 16 target words were selected.

These 16 cues and 16 target words were divided into two word sets (word set A, word set B). Each word set was allocated equally to two conditions. The mean word frequency of the target words was 3.12.

The experimenter adjusted the difficulty of sentence generating in the study. The adjustment of difficulty was based on the correct answer rate of an investigation in which 10 participants answered words from the generated sentences. Finally, the generated sentences were adjusted so that the correct answer rate of each generated sentence become 80% or more.

Procedures. Experiment 1 could be divided into three phases. These consisted of an orienting task in the study phase, a distractor task to prevent rehearsal, and a free association task.

In the study phase, participants performed two kinds of orienting tasks. Participants were not informed that they would receive a memory task later. That is, this was an incidental learning paradigm. First, participants received a form on which the orienting

tasks were printed. In the read condition, target words were presented in the rounded Japanese phonetic syllabary. Participants read the presented word aloud. In the generate condition, participants generated a word that fit a sentence. A portion of the sentence was blank. A word fit in to that portion. To generate the word, the first letter of the word was presented. The length of the word was shown by the number of boxes (e.g., □). For instance, if the target word consisted of four letters, three boxes were shown (e.g., し□□□).

After the study phase, participants performed the distractor task. Participants received a form on which words written in the rounded Japanese phonetic syllabary were printed. Participants found the letters of ma, mi, mu, me, mo in the presented words, and encircled the letter.

Next, participants performed the free association task. In the free association task, participants were told that their task was to produce as many one-word associations to the cue words as possible. In addition to this instruction, participants were instructed to generate category examples as much as possible. If the presented cues were not clear categories, participants produced associations related to the word. These instructions were the same as in Watkins et al. (1996). The time allocated to answer was 30 s, the same as in Watkins et al. The answers of the participants were recorded on a tape-recorder. The cue word was printed on the center of a place of a white paper (21.0cm × 29.6cm). The experimenter signaled the end of the answer time. At the same time, a new cue word was presented. The cue words were presented in a different random order for each participant.

Results

The rate of word generation under the generate condition was 95.6%. All analyses used a significance level of $p < .05$ in this article.

The words that became correct answers in the free association task were target words in the read conditions and the generate conditions. Table 1 shows the number of correct answers of each

condition in the free association task. A single ANOVA indicated that the performance of the generate condition was significantly higher than that of the read condition ($F(1,13)=8.00$, $MSe=1.14$).

Table 1 *Mean Number of Correct Answers in Experiment 1*

Condition	<i>M</i>	<i>SD</i>
Read	1.93	0.80
Generate	3.07	1.53

Note. Maximum mean score=8.

Discussion

In the result of the free association task, the generate condition showed higher performance than the read condition. This result indicated a generation effect in the free association task. This occurrence of a generation effect suggested that the free association task that Watkins et al. (1996) used might be a conceptually driven task. In addition, this result supported the prediction of Roediger and McDermott (1992).

However, this conclusion has the following problem. It was reported that the occurrence of the generation effect could change with some factors in implicit memory (e.g. Fujita, 1994). Moreover, occurrence of the level-of-processing effect that reflects conceptual processing of the memory task was easily manipulated (e.g., Challis & Brodbeck, 1992). Therefore, it is necessary to note that a certain task is classified as a conceptually driven task based on the occurrence of the generation effect in a single task. It is necessary to examine generation effect between two or more memory tasks (e.g., Roediger, Weldon, Stadler, & Riegler, 1992; Srinivas & Roediger, 1990; Tajika & Neumann, 1992). It is important to place a memory task within the whole of various memory tasks. For instance, Srinivas and Roediger (1990) compared the generation effect among a category association task, anagram solution task, word-fragment completion task, and free recall task. The features of memory task are clarified by a

comparison between two or more memory tasks under the same experimental conditions.

Experiment 2

In Experiment 2, the free association task was compared with the word-fragment completion task. This comparison was done for the following reasons. Many researchers have used the word-fragment completion task from early stage of implicit memory research. Therefore, the word-fragment completion task can be positioned as a standard task in implicit memory research. In addition, it is assumed that the word-fragment completion task is a data-driven task in general. On the contrary, it is assumed that the free association task is a conceptually driven task from the result of Watkins et al. (1996), Schacter and McGlynn (1989), and Experiment 1 of this article. The features of the free association task can be made clear by comparison with the task with a task having different features.

If the generate condition and the read condition are compared in the free association task and the word-fragment completion task, the following results are predicted. The generate condition will show higher performance than the read condition in the free association task because this task is a conceptually driven task. The read condition will show higher performance than the generate condition in the word-fragment completion task because this task is a data-driven task.

Methods

Participants. The participants were 12 Hiroshima university undergraduates and graduates. They were received a videotape worth of 350Yen for their participation.

Design. A 3 (orienting task: read, generate, or unstudied) \times 2 (implicit memory task: word-fragment completion task, free association task) within-subjects factorial design was used.

Materials. The materials were selected according to the same procedure as Experiment 1. Forty-eight cues and 48 targets were selected from the list that prepared in Experiment 1. These cues and targets were divided into six word sets. Each word set was allocated equally to all conditions. The mean word frequency of target words was 3.00. The cues of the word-fragment completion task were made to leave 50% of the letters of each word. For instance, a word of four letters in length was removed of two letters, and two letters were left. A word of five letters in length was removed of two letters and three letters were left. The removed letters were decided at random.

Procedure. In Experiment 2, the same procedure as Experiment 1 was used except for the word-fragment completion task. Participants received a booklet in which 16 words and 16 sentences were printed. Participants read the words aloud, and generated a word that applied to the sentence. Participants carried out the same distractor task as Experiment 1 after the study phase. The word-fragment completion task and the free association task were used as implicit memory tasks. The cues of both tasks were arranged in random order, and were presented in a booklet. In the word-fragment completion task, participants generated a word that applied to the cue.

Results

The rate of word generation under the generate condition was 88.0%. The number of correct answer in the word-fragment completion task and the free association task were shown in Table 2.

To compare different implicit memory tasks, priming scores were computed. A 2×2 (implicit memory task \times orienting task) ANOVA was conducted on the priming scores. This ANOVA did not reveal a main effect of implicit memory task and orienting task, $F(1,11)=0.59$, $MSe=2.22$, and $F(1, 11)=3.44$, $MSe=1.56$, respectively. This ANOVA revealed significant interaction between the two factors, $F(1,11)=8.46$, $MSe=1.92$. Simple effects analysis revealed that the generate condition showed higher performance

than the read condition in the free association task, $F(1,22)=11.58$, $MSe=1.74$, and the read condition in the word-fragment completion task showed higher performance than the read condition in the free association task, $F(1,22)=6.49$, $MSe=2.07$.

Table 2 *Mean Number of Correct Answers in Experiment 2*

Condition	<i>M</i>	<i>SD</i>
Word-fragment completion task		
Read	4.50	1.50
Generate	4.00	1.53
Unstudied	2.33	1.31
Free Association task		
Read	1.75	1.16
Generate	3.58	1.38
Unstudied	1.08	0.86

【Note.】 Maximum mean score=8.

Discussion

In Experiment 2, the generation effect in the free association task and the word-fragment completion task was examined. As a result, a generation effect was observed in the free association task. The free association task will be classified as a conceptually driven task based on this result and the operational definition of Blaxton (1989).

In the word-fragment completion task, neither the generation effect nor the reverse generation effect was observed. The word-fragment completion task in Experiment 2 cannot be classified as a conceptually driven task or a data-driven task. However, it is suggested that the word-fragment completion task has a strong feature as a data-driven task from the result that the read condition in the word-fragment completion task showed higher performance

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than the read condition in the free association task.

General Discussion

Roediger and McDermott (1992) predicted that mood-congruent effect related depression occurs if a conceptually driven task is used to measure implicit memory. Watkins et al. (1996) reported on the mood-congruent effect related depression by using a free association task as an implicit memory task. However, there was no evidence that a free association task of Watkins et al. is a conceptually driven task. This research examined whether the free association task of Watkins et al. was a conceptually driven task. Whether a certain task is a conceptually driven task was defined operationally by the occurrence of the generation effect (Blaxton, 1989).

In Experiment 1, the generation effect was examined by using the free association task that Watkins et al. (1996) used. As a result, the generation effect occurred in the free association task. In Experiment 2, the occurrence of the generation effect in a free association task and a word-fragment completion task was compared directly. As a result, the generation effect occurred only in the free association task. The free association task that Watkins et al. used can be classified as a conceptually driven task. Thus, it is seemed that the prediction of Roediger and McDermott (1992) is valid.

Next, the problems of this research are discussed. First, why did the reverse generation effect not occur in the word-fragment completion task in Experiment 2? The nature of the materials in Experiment 2 may have caused the reverse generation effect not to occur. This was a categorical relation between words of the materials in Experiment 2. The categorical relation among the materials promoted conceptual processing in the word-fragment completion task, and decreased processing related to physical features of materials. Therefore, the reverse generation effect did not occur.

Second, the name of the task of Watkins et al. (1996) is discussed. In Watkins et al., participants were instructed to produce

associations and the instances of the category as much as possible. If this instruction is given, there is a possibility that participants do not associate freely, but only generate category examples. That is, it may be more suitable to name the task of Watkins et al. as a category generation task or a category association task.

However, the possibility that instruction of answering category examples does not influence the answers of free association task cannot be denied, either. Therefore, it cannot be generally stated that the task of Watkins et al. (1996) is not a free association task. It will be necessary to examine this possibility in the future.

Third, the usefulness of the classification of a conceptually driven task and the data-driven task is discussed. Some researchers have reported that the occurrence of the generation effect in a task assumed to be a data-driven task can be manipulated easily (e.g., Fujita, 1994). As a result, it is not appropriate to classify a certain task as a conceptually driven task based on the occurrence of the generation effect. Is it improper to classify a memory task based on the occurrence of the generation effect? For example, in one memory task, it is not appropriate to judge whether a task is a conceptually driven task based on the occurrence of the generation effect. Therefore, it becomes important to compare the generation effect between two or more memory tasks under the same conditions. Chaotic phenomena related to implicit memory can be understood clearly if the classification of memory tasks is carried out on the basis of the result of such comparison. Although there are various restrictions, it might be effective and important to classify a memory task positively with respect to producing an effective tool and standard to understand implicit memory. When implicit memory tasks are compared, it seems that the word-fragment completion task becomes a standard.

This research supported Watkins et al. (1996) that examined the prediction of Roediger and McDermott (1992). Consequently, it became clear that the free association task of Watkins et al. is a conceptually driven task, and the prediction of Roediger and McDermott (1992) is valid. Examination of the following aspects is necessary in the future: (a) Validity of the naming of the memory

task that Watkins et al. used, (b) Examination of whether the same result as Watkins et al. (1996) is obtained if other conceptually driven tasks are used

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