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Short Report

Effects of self-complexity on mood-incongruent recall[1]

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Abstract: Some people cope with negative moods by retrieving positive memories, which is mood-incongruent recall. Though mood-incongruent recall is helpful for mood-regulation, the factors that influence people's ability to utilize mood-incongruent recall are not well understood. This study investigated whether complex knowledge structure is a factor for the ability of mood-incongruent recall, based on self-complexity. In the experiment, 50 participants were requested to recall positive memories in both neutral and negative moods. The results of this study indicated that self-complexity was an important factor associated with participants' ability to recall positive memories while they were in negative moods. Participants who rated high in self-complexity were those whose knowledge is structured in a complex way, recalled more highly positive memories in negative moods than in neutral moods. On the other hand, participants who were rated low in self-complexity with simple knowledge structures recalled memories with a lower extent of positivity in negative moods than those in neutral moods.

Key words: mood-incongruent recall, self-complexity, mood-regulation, affect and memory, knowledge structure.

The impact of mood on memory is a central concern for researchers who are interested in the relation between affective and cognitive processes. To date, the majority of studies of the relationship between mood and memory have focused on mood-congruent recall, and indicated that moods enhance people's recall of memories associated with similar moods (e.g., Natale & Hantas, 1982; see Blaney, 1986 and Bower, 1981 for reviews). According to this mood-congruent recall literature, persons who experience negative moods enter into a potentially self-defeating cycle wherein their negative moods prime unpleasant memories, which in turn may exacerbate their distress. Thus, mood-congruent recall in negative moods may further contribute to serious negative moods (Blaney, 1986).

On the other hand, several studies indicated that persons voluntarily retrieved positive memories even in negative moods (e.g., Parrott & Sabini, 1990) which is mood-incongruent recall. Mood-incongruent recall is a technique for improving negative moods, because it can

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interrupt the vicious cycle between negative moods and negative memories and may mitigate serious negative moods or depression. In fact, it was found that mood-incongruent recall is helpful for mood-regulation (Erber & Erber, 1994; Josephson, Singer, & Salovey, 1996; Rusting & DeHart, 2000).

In spite of the usefulness of mood-incongruent recall, people's ability to recall mood-incongruent memories for mood-regulation is not well understood. Previously, this ability has been only considered to be a motivational factor. Researchers have focused on the motivation for mood-regulation, showing that persons who had this motivation were enabled to retrieve positive memories while in negative moods (e.g., Smith & Petty, 1995; see Forgas, 1995; for a review). Although the motivation is not sufficient for explaining the exact mechanism for mood-incongruent recall, there is little research that indicated the other determinants for mood-incongruent recall.

However, according to two reasons, we can think that complex knowledge structures promote mood-incongruent recall. First, previous research suggested that complex knowledge structures are resistant to the interference of negative moods in positive memories. Since negative moods selectively enhance accessibility of negative memories, which are connected to positive memories by inhibitory links (e.g., Bower, 1981), persons have difficulty in recalling positive memories in negative moods. That is, negative moods interfere with access to positive memories. However, complex knowledge structures have been considered to prevent such interference. For example, Anderson and McCulloch (1999) indicated that when persons form many connections among memories, the interference in recalling memories is eliminated. According to these studies, persons with complex knowledge structures would be able to recall positive memories easily even in negative moods, because their positive memories are resistant to the disturbance of moods.

Second, it was also suggested that persons with complex knowledge structures regulated their moods more effectively than those with simple knowledge structures. Previous research demonstrated that complexity of knowledge structures mediates much emotional reactions (see Rafaeli-Mor & Steinberg, 2002; for a review) such as mood swings (e.g., Linville, 1985) and the vulnerability to depression (e.g., Dixon & Baumeister, 1991; Linville, 1987; Woolfolk, Novalany, Gara, Allen, & Polino, 1995). These studies suggested that complex knowledge structures enable persons to retrieve mood-incongruent memories easily, which would result in the mediation effects of knowledge structures on emotional reactions.

Based on these arguments, complexity of knowledge structures should influence mood-incongruent recall. That is, even when persons have the motivation for mood-regulation, complexity of their knowledge structures would determine whether they can recall mood-incongruent memories. Since persons with complex knowledge structures are resistant to the interfering effects of negative moods on positive memories (e.g., Anderson & McCulloch, 1999), they would be able to readily access positive memories even in negative moods. Then, the motivation for mood-regulation would be able to perform effectively in negative moods, and therefore, they would be able to recall more positive memories in negative moods than in neutral moods. In contrast, persons with simple knowledge structures would have more difficulty in recalling highly positive memories in negative moods, because they are vulnerable to the interference of negative moods on positive memories. Then, even if they have the motivation for mood-regulation, they would be unable to access positive memories, and they would recall less positive memories in negative moods than in neutral moods. Thus, we can predict that persons with complex knowledge structures can recall mood-incongruent memories easily, while persons with simple knowledge structures have difficulty in recalling those memories. In this study, we aimed to investigate these effects of complex knowledge structures on mood-incongruent recall, based on self-complexity.

Self-complexity, which was proposed by Linville (1985, 1987), is one of the measures for complexity of knowledge structures. More specifically, it is defined by two components:

one is the number of self-aspects and the other is the degree of differentiation between self-aspects. Persons with high self-complexity (high-*SC*) have many self-aspects with a high level of differentiation, and then, they can organize their experiences using these many self-aspects, which may provide many links for their experiences (e.g., Sato, 1999). Thus, the high-*SC* persons associate their memories with many self-aspects in a complex way. On the other hand, persons with low self-complexity (low-*SC*) have a few self-aspects with large overlap. Then, they can use only a few self-aspects to organize their experiences. Therefore, each of their memories has only a few connections to self-aspects, which results in simple knowledge structures. Thus, the high-*SC* persons have more complex knowledge structures than the low-*SC* persons.

In the experiment, we used this self-complexity as a measure of whether participants' knowledge structures are complex ones or simple ones. Then, we exposed participants to a mood-induction (negative or neutral moods), asked them to recall positive memories, and assessed the positivity of their recalled memories. According to our hypothesis, the high-*SC* persons were expected to recall more highly positive memories in negative moods, compared to those in neutral moods, but the low-*SC* persons were expected to recall memories with a lesser extent of positivity in negative moods, than those in neutral moods.

Method

Participants

The participants were 50 Japanese undergraduates and graduate students (30 men and 20 women; mean age = 21.28, $SD = 1.34$). They took part in the experiments individually on two occasions. In the first session, recall in neutral mood was examined, which provided baseline condition, and in the second session, about 2 weeks later, recall in negative mood was examined, which provided negative mood condition.

Measure of self-complexity

To measure self-complexity, a trait-sorting task (Linville, 1985, 1987) was conducted. Participants were provided a list of 40 traits, which included eight traits from each of the five dimensions of the Big-Five personality theory. This list was mostly obtained from the work of Hayashi and Horiuchi (1997). We modified some words on their list to exclude ambiguous words, considering the studies of the relation between the Big-Five dimensions and Japanese words (Hayashi & Oda, 1996; Kashiwagi, Wada, & Aoki, 1993; Wada, 1996). After participants received this list, they were requested to think about themselves, to form groups of traits that described aspects of themselves or their lives, and to provide a label for each group. They were allowed to create as many groups as they wanted, and to assign the same trait to different groups. They had no time limit to complete this task.

From the results of the trait-sorting task, we computed measures that indicated two components of self-complexity (Rafaeli-Mor, Gotlib, & Revelle, 1999). One is the measure of the quantity of self-aspects, which is simply the number of groups formed by the participant (NASPECTS). The other is defined as the quantity of overlap between groups, which is the average overlap between two groups, over all possible pairs of groups (OL). It is calculated by following formula.

$$OL = \frac{(\sum_i (\sum_i C_{ij}) T_j)}{n(n-1)} \quad (1)$$

In this formula, C is the number of common traits in two aspects; T is the total number of traits in the referent aspect; n is the total number of aspects formed by the participant and i and j vary from 1 to n (i and j are unequal).

Based on these two measures, a single measure of self-complexity (SC = NASPECTS/OL) was evaluated. In the experiment, we conducted the trait-sorting task both in the baseline condition and in the negative mood condition, and then, the measure of self-complexity was, respectively, calculated in both of two conditions.

Manipulation of mood

To manipulate participants' moods, two kinds of tests were constructed similar to the Raven Progressive Matrices. One was an extremely

easy test and the other was a very difficult test. Both tests consisted of 10 questions with a 10-min limit. In the first session (the baseline condition), the extremely easy test was employed without any comments that indicated how well participants answered to the test questions. Such a test would keep participants' moods neutral, because participants could solve it perfectly with neither a feeling of happiness nor a sense of failure. In the second session (the negative mood condition), participants were requested to solve the difficult test, which they could not solve perfectly. After this difficult test, participants received a performance feedback sheet with the raw score = 44 and the *T*-score = 39.29. They were told that a perfect performance on the test was a raw score of 100.

Memory task

Two nouns were used as retrieval cues. In preliminary test, 16 Japanese undergraduate students rated each of 40 abstract nouns on a scale of the positivity from 1 (*extremely negative*) to 7 (*extremely positive*). To avoid the effects of valence of the retrieval cues, we selected two nouns, *human relationship* and *school* that were rated neutral. The mean score of positivity for *human relationship* was 3.81 ($SD = 1.28$), and *school* was 4.19 ($SD = 1.11$). Then, to counterbalance the order of retrieval cues, half of participants were presented *school* in the baseline condition and *human relationship* in the negative mood condition, and the other half were presented *human relationship* in the baseline condition and *school* in the negative mood condition.

Participants were provided the retrieval cue and told to recall five positive memories, which were related to the cue, and asked to write briefly about them. After recalling, participants rated each memory for positivity (1 = *extremely negative* to 7 = *extremely positive*).

Procedure

Participants were tested individually. They were told that the purpose of the experiment was to examine the relationship between personality and memory. The experiment was conducted in two individual sessions. The first session was the baseline condition. In the second session, about two weeks later, the negative mood condition was conducted. Participants were blind to these experimental conditions.

Baseline condition. First, participants were asked to complete the trait-sorting task, which provided us with the measure of self-complexity. Most of them finished it in about 15 min. After participants finished this trait-sorting task, the experimenter gave them the easy test. Participants were informed that this test assessed thinking ability and that it would be used to control for influences of intelligence on the results. All participants perfectly solved this test. Then, participants were handed the questionnaire, which included seven mood items obtained from McFarland and Buehler (1997) with several dummy items. In this questionnaire, participants rated their moods for the seven items (*happy*, *satisfied*, *pleased*, *proud*, *competent*, *disappointed*, and *sad*) on a scale of 1 (*not at all*) to 7 (*extremely*). After they completed the questionnaire, they were provided the retrieval cue. Then, they were asked to recall five positive events related to the cue, and to write briefly about them. Finally, participants were requested to rate each of their recollections for the positivity.

Negative mood condition. The procedure of the negative mood condition was identical to the baseline condition, except for the mood manipulation. First, participants were informed that the aim of the second session of the experiment was to ascertain the stability of the results. Then, participants began with the trait-sorting task. Based on the results of this task, we obtained the measure of self-complexity as did in the baseline condition. After they completed this task, they were given the difficult test to induce negative moods. They were told that they would receive the performance feedback after the test because some of participants had wanted to know the result of the test in the first session. When participants finished the test, the experimenter retrieved the test and left the room. After a brief delay, the experimenter re-entered, and showed participants the negative performance feedback sheet, with

a raw score of 44 and a T score of 39.29. Participants then rated their moods and completed the memory task, as in the baseline condition.

Participants were debriefed after the negative mood condition was completed. The experimenter had ascertained that there were no lingering effects of the negative feedback, and the participants were thanked and dismissed.

Results

The *SC* score showed a high consistency between the two sessions ($r = 0.86$), so the average value was computed. The mean for this measure was 41.59 and the standard deviation was 28.34. The score of two participants proved to be outliers ($SC = 161.7$ and $SC = 110.2$). In order to reduce the influence of the outliers on the results, the following analyses were made without these participants' scores.

Manipulation check

Two ratings (*disappointed*, *sad*) were reversed, and it was found that the seven mood items had high internal consistency in both the baseline condition (Cronbach's $\alpha = 0.73$) and the negative mood condition (Cronbach's $\alpha = 0.83$). The scores for the seven items were averaged to create a single mood index of each condition. Five participants who reported more positive mood in the negative mood condition than in the baseline condition were excluded. The remaining 43 participants reported more negative affective reactions in the negative mood condition ($M = 3.2$, $SD = 0.83$) than in the baseline condition ($M = 4.9$, $SD = 0.85$; $t(42) = 10.01$, $p < 0.0001$). This result indicated that the mood induction was effective.

Relation between self-complexity and mood

The intensity of the manipulated moods was defined to be the mood score in the negative mood condition minus the mood score in the baseline condition. Participants who scored at or above the median ($SC = 33.8$) on the self-complexity score (13 men and 9 women) were classified as the high-*SC* participants, and those who scored below the median (14 men and 7 women) were classified as the low-*SC* ones. The intensity of manipulated mood did not differ between high-*SC* ($M = 1.6$, $SD = 1.1$) and low-*SC* participants ($M = 1.8$, $SD = 1.1$; $t(41) = 0.58$). This finding indicated that the mood induction was equivalently effective for the high-*SC* and the low-*SC* participants.

Relation between self-complexity and recall positivity

We defined the recall positivity index to be the mean positivity of five recalled memories, which represents how positive memories were recalled. First, a 2 (mood induction: negative vs. baseline) $\times$ 2 (order of retrieval cues: *school* in the baseline condition, *human relationship* in the negative mood condition vs. *human relationship* in the baseline condition, *school* in the negative mood condition) analysis of variance (ANOVA) was conducted on the recall positivity index. Mood induction was a repeated measure factor, and order of retrieval cues was a between-subject variable. There were no significant effects ($F(1,41) = 0.06$, $F(1,41) = 0.70$, $F(1,41) = 1.71$), so the order of cues was not entered into following analysis.

To examine the relation between self-complexity and recall positivity, we perform a 2 (self-complexity: high-*SC* vs. low-*SC*) $\times$ 2 (mood induction: negative vs. baseline) ANOVA on the recall positivity index. Self-complexity was a between-subject variable, and mood-induction was a repeated measure factor. This analysis revealed a significant interaction between mood induction and self-complexity ($F(1,41) = 4.42$, $p < 0.05$). The means relevant to this interaction are presented in Table 1. As predicted, the high-SC participants recalled more positive memories in the negative mood condition than in the baseline condition, and the low-SC participants recalled lesser positive memories in the negative mood condition than in the baseline condition. Neither the main effect for self-complexity nor mood induction was significant ($F(1,41) = 0.20$, $F(1,41) = 0.72$).

To test our hypothesis differently, we created an alternative index of recall positivity, which was the recall positivity in the negative mood condition minus the recall positivity in the baseline

Table 1. Mean positivity of recall as a function of mood induction and self-complexity[a]

	Mood induction	
Self-Complexity	Baseline	Negative
High ($n = 22$)	5.60	5.89
Low ($n = 21$)	5.87	5.74

[a] Higher means indicate more positive recollections.

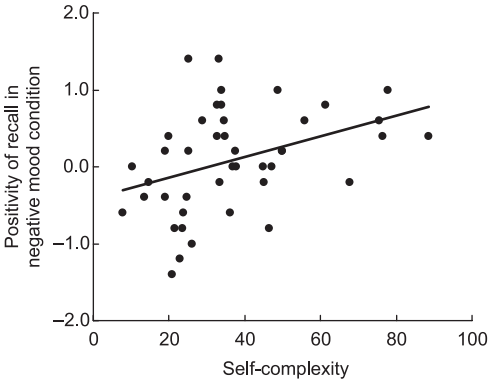

Figure 1. Influence of self-complexity on the recall positivity in negative mood (i.e., the recall positivity in negative mood minus the recall positivity in neutral mood).

condition. This difference positivity index represents how positive memories were recalled in the negative mood condition compared to those in the baseline condition. A regression analysis was conducted with *SC* as a predictor and the difference positivity index as the dependent variable. As expected, the *SC* score positively contributed to the variance in the difference positivity index ($F(1,42) = 6.95,\ p < 0.05$; see Figure 1). This result also supports our hypotheses, showing that higher-*SC* persons are able to recall more highly positive memories in the negative mood condition (compared to their baseline condition) than lower-*SC* persons.[4]

Discussion

The findings from this study indicated that the high-*SC* persons recall more highly positive memories in negative moods compared to those in neutral moods, and that the low-*SC* persons recall memories with a lower extent of positivity in negative moods than those in neutral moods. It was also revealed that the greater self-complexity, the more positive memories the person recalls in negative mood states. These results suggested that mood-incongruent recall was determined by complexity of knowledge structures.

There are, however, some limitations to our findings. First, one might feel that the present study has a limitation concerning the mood induction procedure. In this study, the experiment was conducted under one mood induction procedure, the false performance feedback procedure. Although this procedure was effective in inducing strongly self-relevant moods, it was semantically related to one of the retrieval cues (*school*), which was used in the memory task. One might be afraid that mood induction procedure had specific effects on the recall with this cue, and that these specific effects distorted the results of this study. In the present experiment, however, the order of the retrieval cues was counterbalanced. Moreover, as described in the previous section, we found neither the significant main effect for the order of the retrieval cues on the recall positivity nor the significant interaction between the order of

[4] According to the additional analysis, self-complexity did not influence contents of recalled memories. We classified memories into three categories by the KJ method. The first category was "relationships," such as "when I was in college, I went to a concert with my girlfriend;" the second was "academic success," such as "I passed the college entrance examination;" and the third was "group activities in school," such as "I enjoyed relays in our school's field day." 2 (self-complexity: high-*SC* vs. low-*SC*) × 2 (mood induction: negative *vs.* baseline) × 2 (order of retrieval cues: *school* in the baseline condition, *human relationship* in the negative mood condition *vs. human relationship* in the baseline condition, *school* in the negative mood condition) ANOVA was conducted on the amount of memories in "relationship." Then, we found neither significant main effects for self-complexity nor significant interaction between self-complexity and mood induction ($F(1,40) = 2.06$; $F(1,40) = 0.11$). Similar analyses indicated that there were no significant effects in respect of the amount of memories in "academic success" and "group activities in school" ($F(1,40) = 1.16$, $F(1,40) = 2.91$, $F(1,40) = 1.48$, $F(1,40) = 0.01$).

the retrieval cues and mood induction on the recall positivity. These results show that the present mood induction procedure does not disturb the results of this study.

Second, the results of this study cannot ensure that self-complexity influences mood-incongruent recall. In the experiment, after participants recalled their experiences, they were asked to rate each memory for positivity, and then, these scores of positivity were used in the analyses. Then, we cannot distinguish the effects of self-complexity on recall from the effects of self-complexity on ratings of memories. Thus, it was possible that self-complexity does not influence mood-incongruent recall, but mood-incongruent rating. To conclude more strictly on the relation between self-complexity and mood-incongruent recall, further research, in which participants' memories are objectively coded by several raters on the positivity, is needed.

Third, the results of this study cannot tell us whether the result patterns would be replicated under positive moods. Although our hypothesis was applicable to positive moods, we conducted only negative mood condition and the baseline (neutral mood) condition. Therefore, in order to confirm the validity of our hypothesis we need to test it under positive moods.

Conclusion

Recent research of the relation between affective and cognitive processes has examined the role of mood-incongruent recall in mood-regulation (Erber & Erber, 1994; Forgas & Ciarrochi, 2002; Rusting & DeHart, 2000). In these studies, researchers argued that the motivation for mood-regulation was responsible for mood-incongruent recall. However, the motivation may only provide a starting point for recall of mood-incongruent memories. Other factors may also influence mood-incongruent recall. The present study indicates that self-complexity is such a factor influencing mood-incongruent recall, suggesting that complex knowledge structures enable persons to recall mood-incongruent memories. This suggests new areas for research on mood-incongruent recall, which may lead to better understanding of the mechanism of mood-incongruent recall and facilitate its use in the management of negative mood.

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