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Evidence for the role of affect in mood congruent recall of autobiographic memories

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Abstract In the present study we test the hypothesis that the effect of mood congruence in autobiographical recall is underlain by affective state. Fifty-one participants were subjected to positive and negative mood inductions, and then asked to recall one personal memory. One half of the participants was in a condition that mirrored a hot (standard) mood induction procedure and the other half was in a condition that mirrored the so-called cold-mood induction procedure, which involved a more descriptive focus on mood inducing stimuli, expected to reduce affect induction. We replicated the congruence effect between the mood inductions and the valence of the participants' recalled memories. Although participants in different conditions were exposed to the same semantic material, only hot mood induction congruently influenced autobiographical recall. Furthermore, this effect was mediated by mood, as measured by the self-report questionnaire. The results suggest that affect influences the mood congruence effect in a way that cannot be explained by semantic priming alone.

Keywords Mood induction · Autobiographical recall · Mood congruence · Semantic priming · Affective priming

Introduction

Many studies have shown that when a subject is asked to recall autobiographical memories, the affective valence of the recalled memories is congruent with the subject's mood (for a review, see Blaney 1986). For instance, Snyder and White (1982) observed that participants who were exposed to a positive mood induction tended to recall happy personal experiences (e.g., getting a good grade), whereas those exposed to a negative mood induction recalled fewer happy and more unpleasant personal experiences (e.g., break up of a romantic relationship).

Two main explanations have been offered to account for these findings. The associative network theory (Bower 1981) posits that emotions form nodes that are organized into memory networks containing information that shares the same valence. When an emotion node is activated by emotional information in the environment (e.g., a mood induction procedure), congruent thoughts in memory are activated and thus become more accessible. Consequently, negative memories come to mind more easily when individuals are in a negative mood and positive memories come to mind more easily when individuals are in a positive mood.

An alternative explanation that is frequently proposed in the literature questions the reliability of affect-based explanation. According to this explanation, the mood congruence effect can be explained by semantic priming. Some authors argue that the mood-inducing situation also carries semantic content that can directly prime similar cognitions and material in memory (e.g., Blaney 1986; Rholes et al. 1987). Subsequently, the cognitions activated by the situation can semantically prepare or guide cognitive processes such as recalling autobiographical episodes. As a result, the mood congruency observed in the literature can be seen as a form of the classic semantic priming effect (Higgins and King 1980), which is independent of an individual's affective state. From a theoretical point of view, the affective and cognitive explanations of mood congruency are not incompatible. Nevertheless, if mood

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congruence is solely due to cognitive effects, studying mood congruency would not further research into the relation between emotions and cognitions (Ehrlichman and Halpern 1988).

Does affect play a role in mood congruence? When addressing this question, researchers have usually tried to isolate the influence of affect by selecting mood induction procedures that are supposed not to activate semantic concepts that are congruent with the material to be recalled. There are, however, two problems with this approach. First, studies of this type often produce contradictory findings, with some concluding that the mood congruence effect is not caused by an individual's affective state (Mayer et al. 1990; Rholes et al. 1987; Riskind 1983; Riskind et al. 1982), and others suggesting the opposite (Ehrlichman and Halpern 1988; Kumari et al. 1998; Schnall and Laird 2003). Second, the methodology used in this type of study does not allow us to confirm the validity of the affective hypothesis. In fact, even more naturalistic mood-induction procedures, which are supposed to be semantically unintrusive (e.g., pleasant vs. unpleasant odors), can incidentally activate cognitions whose effect could be mistaken for the effect of mood (Ehrlichman and Halpern 1988). Despite much research into the subject, the debate over the role of mood has not been satisfactorily resolved (see Wyer et al. 1999).

The present research

The question of whether the mood congruence effect is a consequence of an individual's affective state or a result of semantic priming remains to be answered. As stated above, the roles of these two mechanisms cannot be distinguished using mood induction procedures that minimize the possibility for semantic priming (Ehrlichman and Halpern 1988); therefore, other methods must be developed if we are to determine the influence of affect. In the present study we applied a method that consisted in exposing individuals to the mood-inducing stimuli but preventing the participants from having emotional reactions to them. Thus, half of the participants was in a condition that mirrored a hot-mood induction procedure. The other condition mirrored a so-called cold-mood induction procedure. In most cases, the goal of this manipulation has been to rule out that obtained mood effects were the result of cognitive side effects of the mood induction procedure (Lantermann and Otto 1996; Siemer 2005; Strack et al. 1985). In the present case, this manipulation was introduced to rule out the possibility that any mood congruence effect was merely the result of a semantic activation by mood induction procedure inducing moods and simultaneously priming mood-congruent cognitions. In line with the results of previous studies, we expected the valence of the recalled memory to be congruent with the induced mood. Based on the assumption that affect plays a role in the mood congruence effect, we hypothesized that mood congruence effect should be observed in standard mood induction conditions but not in cold mood induction conditions.

Method

Participants

Participants were 51 psychology undergraduates (42 females; *mean* age = 19.2, *SD* = 2.3) from the University of Sarajevo whose participation was a partial fulfilment of their study requirements. Participants were randomly assigned in one of four conditions of 2 (mood induction: positive vs. negative) × 2 (induction type: hot vs. cold) between subject factorial design.

Mood induction procedure

The mood induction procedure was similar to the one used by Drace and his colleagues (Drace et al. 2009, 2010). During a period of 10 min, participants were asked to look at a series of pictures while listening to music. We selected pictures from the *International Affective Picture System* (IAPS; Lang et al. 1995).[1] The music was drawn from selections used in prior research (Drace et al. 2009, 2010; Niedenthal and Setterlund 1994). Participants in the positive mood condition listened to selections from Mozart's *Eine Kleine Nachtmusik* and *Divertimento #136*, and from Vivaldi's *Mandolin Concertos*. Participants in the negative mood condition listened to selections from Mahler's *Adagietto*.

Measures

Mood

Participants' mood was assessed using the Brief Mood Introspection Scale (BMIS; Mayer and Gaschke 1988). Participants had to rate on 4-point scales the extent to which he or she was feeling at "the very moment" each of the 8 positive (e.g., *happy, lively*) and 8 negative (e.g., *sad, gloomy*) feeling states. A BMIS score was calculated for each participant by subtracting the sum of the scores

[1] The following pictures were used for the mood inductions. Positive mood: 1460, 1463, 1610, 1710, 1721, 1750, 2057, 2070, 2080, 2091, 2165, 2304, 2311, 2340, 2341, 2345, 2360, 2530, 2550, 2660, 5779, 5780, 5982, 7580, 8370, 8420. Negative mood: 2205, 2710, 2750, 2900, 3180, 3220, 6212, 6213, 6530, 6550, 6570, 9000, 9041, 9050, 9220, 9280, 9415, 9421, 9520, 9560, 9611, 9630, 9830, 9910, 9911, 9920.

obtained for negative items (Cronbach's alpha = 0.79) from the sum obtained for positive items (Cronbach's alpha = 0.78). The higher a participant's BMIS score, the more positive his mood.

Valence of recalled memory

Three independent judges, who were blind to the hypotheses and to the participants' mood induction conditions, rated the recalled memory on a 7-point scale (1 = *very negative*; 7 = *very positive*). As the consistency between judges was very high (Cronbach's alpha = 0.97), we calculated a valence score for recalled memory by averaging the evaluations of the three judges.

Procedure

Participants took part individually. Each participant was randomly assigned to one of the mood induction conditions. In order to disguise the purpose of the research, the experimenter described the study as examining eyewitness testimony. Participants were told that the experiment would have three stages. Stage one involved viewing a series of pictures. Stage two consisted of a set of tasks in which the participants were asked to complete some questionnaires, ostensibly to simulate real eyewitness report situations, in which there is a time delay between seeing an event and describing it, during which a witness's attention is diverted by other stimuli. In stage three, the participants were asked to answer questions about the pictures. The participants were told that the music they would be listening to throughout the experiment was designed to isolate them from environmental noises and to facilitate concentration on the pictures.

Mood induction

When a participant had understood the procedure, he put on the headphones and the mood induction procedure began. Participants were shown each of the pictures for their condition for 15 s, with a gap of 5 s between pictures, during which time the screen was black. Participants in *hot induction* conditions were exposed to the standard procedure (e.g., Drace et al. 2009, 2010) asking them to look at the pictures and try to vividly imagine themselves as witnesses of each situation. The *cold induction* condition was designed to mirror the standard mood induction in that participants were watching the same stimuli but in a more distant way. In order to minimize the mood-inducing effect of pictures, participants were instructed to memorize maximum of details from each picture. The experimenter particularly underlined to participants to pay attention to the person's description (e.g., age, gender, clothes, etc.), as well as the background details (e.g., objects, colors, places, etc.). We expected this instruction to keep participants' attention on the semantic content of pictures but at the same time to prevent emotional contamination because they were not involved in imagination as were the participants in standard induction conditions.

Mood self report and recall of memories

After the mood induction, participants were first asked to fill in a BMIS, and then they were given a sheet of paper bearing the instructions: "Try to remember one specific event that happened to you during the last year. Write down a brief description of this memory. Your responses will be kept strictly confidential". The instructions were followed by spaces for writing the memory. This task was described as a part of the eyewitness testimony study in which the experimenter was interested in participants' capacity to recall and describe a personal event.

Identification stage

In the final stage of the procedure, the participants were asked to view a mixture of pictures that had and had not been presented during the mood induction stage. The main purpose of the identification stage was to ensure that the participants had paid attention to the affective material. All the participants correctly identified the pictures they had seen and the pictures they had not seen during the mood induction stage. When they had finished, the participants were thanked and debriefed.

Results

Mood manipulation check

The BMIS scores were submitted to a 2 (Mood induction: positive vs. negative) × 2 (Induction type: hot vs. cold) ANOVA. This analysis revealed an effect of mood induction, $F(1, 47) = 20.32$, $p = 0.001$, MSE = 31.61, $\eta_p^2 = 0.30$, with participants in the negative mood condition reporting a less positive mood ($M = 3.83$, $SD = 7.94$) than those in the positive mood condition ($M = 10.92$, $SD = 3.39$). The interaction between Mood induction and Induction type was also significant, $F(1, 47) = 5.65$, $p = 0.022$, $\eta_p^2 = 0.11$. Participants in the negative mood induction condition reported a less positive mood ($M = 1.3$, $SD = 7.9$) than participants in the positive mood ($M = 12.15$, $SD = 2.85$) but only in hot induction condition, $F(1, 47) = 24.18$, $p = 0.001$, $\eta_p^2 = 0.34$. This effect didn't occur in the cold mood induction conditions

($M = 6.33$, $SD = 6.66$ vs. $M = 9.69$, $SD = 3.54$; $F(1, 47) = 2.22$, $p = 0.14$, $\eta_p^2 = 0.05$).

Mood inductions and autobiographical recall

The valence scores for recalled event were submitted to a 2 (Mood induction: positive vs. negative) × 2 (Induction type: hot vs. cold) ANOVA. This analysis revealed no main effect of mood induction, $F(1, 47) = 3.02$, $p = 0.089$, MSE = 2.79, $\eta_p^2 = 0.06$. The Mood induction x Induction method interaction was significant $F(1, 47) = 4.37$, $p = 0.042$, $\eta_p^2 = 0.09$ (see Fig. 1). Participants in the negative mood condition reported less positive memories ($M = 2.74$, $SD = 1.83$) than participants in the positive mood condition ($M = 4.53$, $SD = 1.45$), but only in hot induction condition, $F(1, 47) = 7.48$, $p = 0.008$, $\eta_p^2 = 0.13$. There was no difference between negative and positive mood in cold induction conditions (respectively, $M = 4.13$, $SD = 1.83$ vs. $M = 3.97$, $SD = 1.53$; $F < 1$). No other effect was significant.

Mediation analysis

To test the mediating role of affect in the relation between hot mood induction and recall, the regression procedure advocated by Baron and Kenny (1986) was followed. First, the main effect of independent variable (i.e., mood induction) on the dependent variable (i.e., autobiographical recall) was significant, ($\beta = 0.49$, $p = 0.010$). Second, the main effect on the expected mediating variable (i.e., mood) was also significant, ($\beta = 0.68$, $p = 0.001$). According to Baron and Kenny the final and most basic requirement for mediation is that the mediating variable should predict the dependent variable even when the main effect of mood induction is statistically controlled, while the effect of independent variable on the dependent variable should be significantly reduced when the mediating variable is statistically controlled. As expected, the effect of mood induction on autobiographical recall was not significant when the mood was statistically controlled ($\beta = 0.04$, $p = 0.850$). Moreover, the effect of mood on autobiographical recall remained significant even when the effect of mood induction was statistically controlled ($\beta = 0.65$, $p = 0.004$). The Sobel test also revealed a significant mediation ($z = 2.21$, $p = 0.026$).

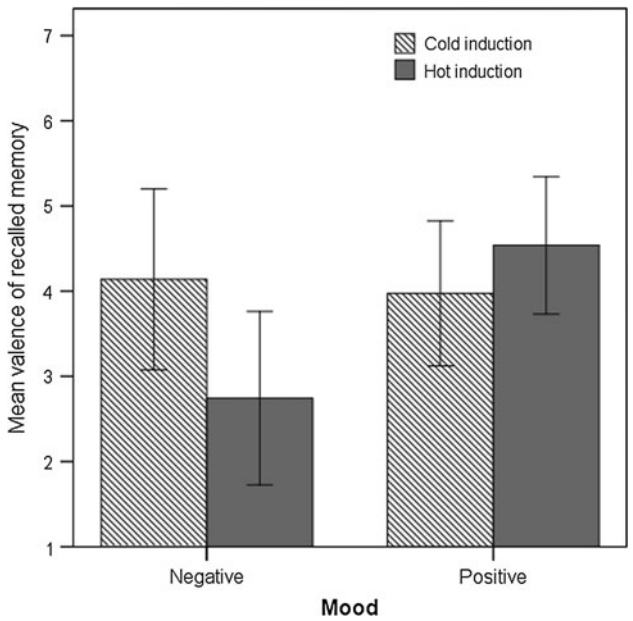

Fig. 1 Mean valence and standard errors of recalled memory as function of mood and induction method

Discussion

The purpose of this study is to determine whether the impact of mood induction on memory accessibility varies as a function of the affect. Unlike many previous studies, we did not try to use a mood induction procedure that was entirely without semantic content. Our approach consisted in exposing individuals to the mood-inducing stimuli but minimizing the presence of mood. In line with previous research, we found a congruency between the valence of the induced mood and the valence of the autobiographical memories (Blaney 1986; Snyder and White 1982). The interaction between mood induction and induction method was also significant. Although participants were exposed to the same semantic material, only hot mood induction congruently influenced autobiographical recall. Importantly, the effect of mood induction on autobiographical recall was mediated by the participants' affective state measured by BMIS. Thus, the results seem to support the affective priming hypothesis proposed by associative network theory (Bower 1981) and they are difficult to reconcile with the semantic priming account.

However, one could argue that the results we obtained could be due to the difference in the quality of semantic activation in hot and cold induction conditions. As we know, participants in cold condition were asked to pay attention to various background details whereas participants in the hot condition had to vividly imagine each situation. Therefore, participants in hot condition could think more about positive or negative consequences, or implications of the situation presented in the picture, which could be different semantic concepts from the ones activated in the cold condition. As a consequence, these differences in semantic activation could be responsible for the corresponding effects (i.e., mood congruence vs. no effect of mood) on the autobiographical recall. Although this

explanation seems plausible, it cannot completely account for the results obtained in hot induction conditions. Even if we suppose that semantic activation in hot induction condition was more appropriate to influence autobiographical recall, this cannot explain why, as our results show, the effect of mood is mediated by affective measure (i.e., BMIS). In the least, this would suggest that both affective and semantic priming are both involved and that mood congruence effect couldn't be explained by semantic priming alone.

One could also argue that the absence of mood congruence in cold induction conditions could be due to the participants' motivation to regulate their mood. Prior research showed that the mood regulation process occurs if individuals think that their mood (positive or negative) could interfere with optimal task realization (Erber and Erber 2001; Parrott 1993). As the cold induction instruction stressed the importance of memorization performance, it was possible that participants in these conditions tried to regulate their mood, for instance, by thinking about mood incongruent material (Erber and Erber 1994; Erber et al. 1996). If this was the case then we should observe mood incongruent recall: a hypothesis that is disproved by our results.

Limitations and directions for future research

One limitation of the present study is that we measured only participants' mood but we had no objective information related to the semantic activation. As we already pointed out, the hot and cold inductions could activate different semantic content, which in turn might exert corresponding influence on autobiographic recall. Thus, although we found that changes in affect mediate mood effect on autobiographical recall, the role of semantic priming in mood congruence effect remains still unclear. Future studies should address this issue more directly by including both the measure of mood and the measure of semantic activation. For instance, this could be realised using an appropriate form of lexical decision task that participants would complete before the autobiographical recall. Not only would this allow us to have better control over the psychological processes expected to be involved in the mood congruence affect, but it would also give us the possibility to test the multiple mediator model in which we could oppose directly affective priming and semantic priming explanations.

Conclusion

The present study contributes to the literature on mood and memory and shows that affective state plays a role in the relationship between the mood inductions and autobiographical recall. However, previous research also suggests that semantic priming does play a role in the mood congruence effect and that cognitive explanations cannot be excluded. Hence, it is likely that both cognitive and affective mechanisms are involved. The challenge for future research is to identify the respective weight of each of these mechanisms in the mood congruence effect.

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