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The effect of negative mood intensity on autobiographical recall: Evidence for the underlying role of affect in mood congruence effect

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In the present study we test the hypothesis that affective state underlies the effect of mood congruence in autobiographical recall. Forty-five participants were subjected to negative and neutral mood inductions, and then asked to recall one personal memory. We also introduced another negative mood condition in which participants were exposed to the same mood inducing material (i.e., pictures), but were supposed to feel a less intense affective state. We replicated the congruence effect between the mood inductions and the valence of the participants' recalled memories. Furthermore, mood congruence was influenced by the intensity of negative mood inductions. Although the participants in negative mood conditions were exposed to the same semantic material, the recalled memories were more negative in standard (strong) than in moderate negative mood condition. 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.

Key words: mood intensity, autobiographical recall, mood congruence effect, mood induction

Different 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).

Usually, three main explanations have been offered to account for mood congruent recall of autobiographic memories (e.g., Drace & Desrichard, 2013). The associative network theory (Bower, 1981) posits that emotions form nodes that are organized into memory networks containing information that shares the same valence. For instance, Bower states that events learned in one psychic state can be remembered better when one is put back into the same state. Relying on classic network theories (e.g., Anderson, 1983) where it is posited that activation presumably spreads from one concept to another, or from one proposition to another, through associative linkages between them, a clear analogy with memory and emotion can be made. Each distinct emotion has a specific node or unit in memory. These emotions can be activated by many stimuli and activation of an emotion node also spreads activation throughout the memory structures. Thus, 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. Another explanation of the mood congruence effect is drawn from the affect-as-information model (Schwarz, 2001). According to this approach, people use their momentary feeling states as diagnostic information for making evaluative judgments about a specific object. For example, when asked to recall an autobiographical memory related to a specific period in one's life, people's initial reactions are evaluative in that they ask themselves the question: "What was my life like at that time?" As a result, people who are in a good mood will make more positively biased assessments of the life period in question and people who are in a bad mood will make more negatively biased assessments. This general appraisal will then cue the search for relevant autobiographical episodes, so the recall is more likely to be mood congruent.

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However, an alternative explanation that is frequently proposed in the literature questions the reliability of affect-based explanations. 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 materials in memory (e.g., Blaney, 1986; Rholes, Riskind, & Lane, 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 & King, 1980), which is independent of an individual's affective state.

Does affect really play role in mood congruence effect? When addressing this question, researchers have usually tried to isolate the influence of the affective state by selecting mood induction procedures that are not supposed to activate semantic concepts, congruent with the material to be recalled. However, as suggested by some authors (e.g., Drace & Desrichard, 2013) there are 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, Gayle, Meehan, & Haarman, 1990; Rholes et al., 1987; Riskind, 1983; Riskind, Rholes, & Eggers, 1982), and others suggesting the opposite (Ehrlichman & Halpren, 1988; Kumari, Hemsley, Cotter, Checkley, & Grey, 1998; Schnall & 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 nonintrusive (e.g., pleasant vs. unpleasant odours), can incidentally activate cognitions whose effect could be mistaken for the effect of mood (Ehrlichman & Halpren, 1988).

To disentangle the role of affective and semantic processes, Drace (2013) recently proposed an alternative method, which consisted in utilisation of the hot and cold mood inductions (Lantermann & Otto, 1996; Siemer, 2005). In both conditions participants were asked to look at a series of positive or negative pictures while listening to music. Those in the hot induction conditions were exposed to the standard procedure asking them to look at the pictures and try to vividly imagine themselves as witnesses of each situation (Drace, Desrichard, Shepperd, & Hoorens, 2009; Drace, Ric, & Desrichard, 2010). Participants in the cold induction condition 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 pay attention to the person's description (e.g., age, gender, clothes, etc.), as well as the background details (e.g., objects, colours, places, etc.). In line with previous research, the author found a congruency between the valence of the induced mood and the valence of the autobiographical memories. Importantly, the interaction between mood and induction method was also significant. Although participants were exposed to the same semantic material, only the hot mood induction (i.e., the condition in which mood was changed) congruently influenced autobiographical recall. Finally, the effect of the hot mood induction on autobiographical recall was mediated by the participants' affective state.

The present research

As noted above, recent research suggests that affective state influences the mood congruence effect in a way that cannot be explained by semantic priming alone. However, this research seems to be characterized by an important limitation that we propose to address in the present study. As described in Drace's (2013) procedure, participants in the cold induction condition were instructed to pay attention to various situational details whereas participants in the hot condition had to vividly imagine themselves as a witness of each situation. Considering these differences, it is possible that participants in the hot condition were accidentally led to think more about positive or negative consequences, or implications of the situation presented in the picture, which are different semantic concepts from the ones activated in the cold condition (i.e., objects, colours, places; which could be more neutral). Therefore, the instructions in the hot and cold inductions could activate different semantic content, which in turn might exert corresponding influence on autobiographic recall.

In order to address these concerns, we designed an experiment that follows a procedure similar to the one used by Drace (2013) with substantial changes. Considering that different instructions could engender different levels of semantic activation we chose a standard procedure that mirrored the hot induction procedure. Unlike Drace's study, one group of participants was in a neutral mood condition while the other group was in a standard negative mood condition. Crucially, we introduced another negative mood condition in which participants were exposed to the same semantic material (i.e., pictures) but were induced to feel less intense negative affective state by applying a shorter version of the same mood inducing method. In that manner we could test the mood congruence hypothesis by opposing different conditions in terms of valence (i.e., comparison between neutral and both the moderate and strong negative mood conditions) and the intensity (i.e., comparison between moderate and strong negative mood conditions). We made this methodological choice primarily because negative mood inductions have been shown to be more effective than positive ones (Westermann, Spies, Stahl, & Hesse, 1996). These differences in inductions are probably due to the fact that subjects from a normal population usually enter the experiment in a rather positive mood and that such a positively biased basic mood is harder to enhance than to depress. Considering this, we expected that it was more difficult to manipulate the in-

tensity of positive, rather than negative mood. Importantly, the specific features of this experimental design allow us to test directly, the affective and semantic priming explanations against each other. To be precise, if the semantic priming explanation is true, then participants in moderate and strong negative mood should indifferently recall less positive memories than those in the neutral mood condition. However, even though participants in the two negative mood conditions are exposed to the same semantic material they do differ in terms of intensity of induced affective state. Therefore, based on the assumption that affective state plays a role in the mood congruence effect, then the mood congruence effect should wary with valence but also with the intensity of negative mood. Thus, participants in the neutral mood condition should recall less negative memories than those in moderate negative mood condition who in turn should recall less negative memories than those in the strong negative mood condition.

METHOD

Participants

Participants were 45 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 three mood conditions: neutral, moderate negative, and strong negative mood.

Mood induction procedure

The mood induction procedure was similar to the one used by Drace and his colleagues (Drace, 2013; Drace et al., 2009; Drace et al., 2010). During a period of 10 minutes, 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, Bradley, & Cuthbert, 1995)[1]. The music was drawn from selections used in prior research (Niedenthal & Setterlund, 1994). Participants in the neutral mood condition listened to selections from Brahm's *Symphony No. 1 in C Minor*. Participants in the negative mood conditions listened to selections from Mahler's *Adagietto*.

1 The following pictures were used for the mood inductions. Neutral mood: 2190, 2385, 2514, 2516, 2749, 2840, 2890, 5510, 5531, 5534, 7004, 7006, 7009, 7010, 7020, 7050, 7160, 7170, 7175, 7185, 7187, 7207, 7211, 7217, 7233, 7235. 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.

Measures

Mood. Participants' mood was assessed using the Brief Mood Introspection Scale (BMIS; Mayer & 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 eight positive (e.g., *happy, lively*) and eight negative (e.g., *sad, gloomy*) feeling states. A BMIS score was calculated for each participant by subtracting the sum of the scores obtained for negative items (Cronbach's alpha = .79) from the sum obtained for positive items (Cronbach's alpha = .78). The higher a participant's BMIS score, the more positive his mood.

Semantic activation. To control for the quality of semantic activation in different mood conditions participants had to make lexical decisions for series of negative and neutral words (Niedenthal & Setterlund, 1994). The shorter the participant's decision response latency for specific word category, the more accessible the corresponding semantic concepts.

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 = .97), we calculated a valence score for recalled memory by averaging the evaluations of the three judges.

Procedure

Participants took part individually. 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.

After the participant had understood the procedure, the experimenter put on the headphones and the mood induction procedure began. Participants were shown each of the pictures for their condition for 15 seconds, with a gap of 5 seconds between pictures, during which time the screen was black. Participants in the neutral and strong negative mood 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 witness-

es of each situation. Participants in the moderate negative mood condition received the same instructions but were exposed to shorter inductions during which they watched only 8 pictures, which were randomly selected from a set of 24 pictures used in the strong condition. Prior work showed that sustained presentation of a series of pictures of similar valence produces emotional reactions that are sensitized across the temporal intervals (Bradley, Cuthbert, & Lang, 1996; Smith, Bradley, & Lang, 2005) and that it could be an efficient method to manipulate the intensity of negative mood (Drace et al., 2009).

After the mood induction, participants were first asked to fill in the BMIS and once they finished they were instructed to position themselves in front of a response box on the same table. A computer monitor was anchored 70 cm in front of them. The lexical decision task was then described to participants and they were acquainted with the procedure by performing 20 trials. Practice trials contained 10 nonwords and 10 neutral words. Participants then performed 48 experimental trials presented in two blocks of 24. Half of the 24 experimental trials were nonwords trials. Nonwords were pronounceable letter strings. Mean and variance of the length of the nonwords were matched to those of the words. The 12 word trials contained six words from each of the two categories: sad (negative) and neutral, which were drawn from prior research (Niedenthal & Setterlund, 1994). The letter strings were presented in one random order to all subjects. The onset of each trial was signalled by a 300-ms presentation of a fixation point. Following the 200-ms blank screen, the letter string appeared for a maximum of 3000 ms. A button press terminated the trial. The buttons on the response box were labelled word and nonword. For half of the participants the former label was positioned by the participant's right hand and for the other half this order was reversed.

After participants had completed the lexical decision task they were given a sheet of paper bearing the instructions: "Try to remember two specific events 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.

In the final stage of the procedure, the participants were asked to view a mixture of pictures, some of which had already been presented during the mood induction stage, along with pictures that had not been presented in the 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

To test the efficacy of mood inductions we conducted one-way ANOVAs with two orthogonal contrasts: a planned comparison testing the linear model and a contrast testing the remaining variance (i.e., the only contrast that should not be significant if the model tested fit the data). The planned comparison, which opposed the neutral and strong negative mood conditions (neutral = -1, moderate = 0, strong = 1), was significant, $F(1, 42) = 14.95$, $p = .001$, MSE = 54.22, $\eta_p^2 = .26$. Importantly, the orthogonal contrast, opposing moderate negative mood condition to both the neutral and strong negative mood conditions (neutral = 1, moderate = -2, strong = 1) was not significant, $F < 1$. As expected, participants in the strong negative mood condition reported less positive moods ($M = -3.26$, $SD = 8.05$) than participants in the moderate negative mood condition ($M = 1.93$, $SD = 6.47$), who, in turn, reported less positive moods than participants in the neutral mood condition ($M = 7.13$, $SD = 7.47$).

Mood inductions and semantic activation

Subjects made lexical decision errors on about 1% of the trials. Response latencies to incorrect word category as well as those lower than 300 ms and higher than 1500 ms were eliminated from the data set (cf. Niedenthal & Setterlund, 1994). Latencies that were greater than three standard deviations from the mean of their word category were also eliminated. So defined outliers constituted 2% of the data. According to the semantic priming explanation, mood-inducing situations can directly prime and make more accessible similar material in memory, which in turn can semantically prepare future cognitive processes. Thus, we expected participants in negative mood conditions to faster process, semantically congruent material and therefore display shorter lexical decision time for negative words than participants in neutral mood condition. We expected the opposite pattern of results for neutral words. To test this hypothesis the data were submitted to a 3 (mood induction; neutral, negative moderate, negative strong) x 2 (word category; negative, neutral) mixed-design analysis of variance (ANOVA). Mean response latencies and standard deviations for each word category averaged across item are reported in Table 1. The predicted Mood Induction x Word Category interaction was not significant, $F < 1$, which means that participants in the three mood conditions made lexical decisions in a similar way for neutral and negative words. We also didn't obtain the main effect of mood induction, $F(1, 42) = 2.53$, $p = .092$, MSE = 26290, $\eta_p^2 = .10$. The only significant, but relatively uninformative effect, was the main effect of word category, $F(1, 42) = 17.96$, $p = .001$, MSE = 39346, $\eta_p^2 = .29$. As we can see in the Table 1, participants were gener-

Table 1
Mean lexical decision response latencies in milliseconds (and standard deviations) as a function of mood induction and word category

Mood	Word category	
	Negative	Neutral
Neutral	604.24 (114.56)	598.79 (130.93)
Negative moderate	520.09 (77.07)	546.62 (73.81)
Negative strong	546.57 (86.41)	599.66 (124.29)

ally faster to make lexical decisions for negative words (M = 556.1, SD = 114.6) than for neutral words (M = 598.8, SD = 130.9).

Mood inductions and autobiographical recall

We expected the variations in the valence of the autobiographical memories to be congruent with the valence and the intensity of the mood inductions. The test for the planned comparison, which opposed the neutral and strong negative mood conditions (neutral = -1, moderate negative = 0, strong negative = 1), was significant, $F(1, 42) = 13.94$, $p = .001$, MSE = 1.35, $\eta_p^2 = .25$. Importantly, the orthogonal contrast, opposing moderate negative mood condition to both the neutral and strong mood conditions (neutral = 1, moderate = -2, strong negative = 1), was not significant, $F(1, 42) = 2.31$, $p = .135$, $\eta_p^2 = .05$. Consistent with our expectations, the participants in the strong negative mood condition reported less positive memories (M = 2.36, SD = 0.73) than participants in the moderate negative (M = 3.27, SD = 1.33) mood condition, who, in turn, reported less positive memories than participants in the neutral mood condition (M = 3.95, SD = 1.32).

Mediation analysis

To test the mediating role of mood in the relation between mood induction and autobiographical recall, the regression procedure advocated by Baron and Kenny (1986) was followed. First, the main effect of the independent variable (i.e., mood induction) on the dependent variable (i.e., autobiographical recall) was significant, ($\beta = .49$, $p = .001$). Second, the main effect on the expected mediating variable (i.e., mood) was also significant, ($\beta = .51$, $p = .001$). 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 mood was statistically controlled ($\beta = .29$, $p = .052$). Moreover, the effect of mood on autobiographical recall remained significant even when the effect of mood induction was statistically controlled ($\beta = .39$, $p = .010$). The Sobel test also revealed a significant mediation ($z = 2.27$, $p = .023$).

DISCUSSION

The purpose of this study was to determine whether the impact of mood induction on memory accessibility varies as a function of affect. Our approach consisted in exposing individuals to the mood induction method, which varied in valence and mood intensity. As expected, participants in the strong negative mood condition reported less positive mood than participants in the moderate negative mood condition, who, in turn, reported less positive moods than participants in the neutral mood condition. 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; Drace, 2013). Importantly, mood congruence was also influenced by the manipulation of the intensity of affective state. Although participants in the negative mood conditions were exposed to the same semantic material, those in the strong negative condition recalled less positive memories than participants in the moderate negative condition. Furthermore, the effect of mood inductions on autobiographical recall was mediated by the participants' affective state measured by BMIS. Thus, using a different method, our study shows that affective state plays a role in mood congruence effect, which seems to support both the associative and the affect as information approaches (Bower, 1981; Schwarz, 2001).

One could argue that the results we obtained could be due to the difference in the semantic activation in moderate and strong negative mood conditions. As we know, participants in the moderate negative mood condition watched eight pictures whereas participants in the strong negative condition watched 24 pictures. Therefore, the later condition could prime more negative material in memory than the moderate condition. As a consequence, these differences in semantic activation could be responsible for the corresponding effects on the autobiographical recall. Unfortunately, the results that we obtained on the lexical decision task did not provide us with valid insights to further address this issue. Indeed, although we didn't found any difference in lexical decisions between negative mood conditions, the absence of the Mood Inductions x Word Category interaction suggest that the semantic activation measure perhaps was not sensitive enough. Nevertheless, even when considering that this assumption is possible, it still cannot explain why the effect of induction was completely mediated by mood measure. Of course, it could be argued that the participants' verbal responses to the BMIS items were also contaminated by the content of the IAPS pictures. If this was the case, it would mean that the BMIS was merely an indirect measure of the semantic aspects activated by the situation: a hypothesis

that seems to be disproved by several factors. For example, Drace and Desrichard (2013) found that BMIS correlated with a non-verbal measure of affect (i.e., EMG activity of muscles corrugator supercilia and zygomaticus major) that should be less sensitive to semantic priming and that both measures mediated the relation between mood inductions and autobiographical recall. On the other side, the BMIS has been found to be sensitive to mood manipulation using a variety of induction procedures, even those with low semantic content (e.g., Niedenthal & Setterlund, 1994). In addition, research has shown that exposing participants to positive or negative cognitive material plays a role in subsequent cognitive tasks, but does not change a participant's mood as assessed by the BMIS (e.g., Innes Ker & Niedenthal, 2002). Taken together, these findings suggest that potential confounds due to the differences in semantic activation can hardly explain the differences in mood captured by the BMIS.

Another potential explanation for our results could be that they are artefacts of experimenter demand. In line with this idea previous research showed that individuals possess lay theories consistent with the mood congruence effect (Eich & Macauley, 2000). Consequently, rather than being due to the participants' affective state, our findings may simply reflect a social desirability bias. However, although this explanation could apply to the mood congruence involving conditions with different mood valence, it cannot account for the effect of the intensity of mood. Indeed, if participants responded to the situational (i.e., experimental) demand, then, in moderate and strong conditions we should observe a similar pattern of autobiographical recall because these participants were exposed to the same situational cues (i.e., negative pictures). As we could see, this assumption is disconfirmed by our results.

Finally, one limitation of our study could be the absence of a positive mood condition. Although, this could question the generalization of our findings on positive affective state we don't see any theoretical reason that supports this assumption. Indeed, it has been shown that mood congruence in autobiographical recall is a general and well-established effect (Blaney, 1986). In addition, research suggests that this effect occurs more easily in positive than in negative mood because people often recall mood incongruent cognitions to neutralize their aversive affective state (Isen, 1985; Parrott & Sabini, 1990). Taken together, previous evidence gives us considerable reason to speculate that our findings could be extended to positive mood.

CONCLUSION

The present study contributes to the literature on mood and memory and shows that affective state plays a causal role in the relationship between mood inductions and autobiographical recall. The next theoretical question that deserves more attention concerns the specification of the mechanisms through which mood influences autobiographical recall. Indeed, although affective explanations (Bower, 1981; Schwarz, 2001) assume that the person's affective state is the factor causing the mood congruence they are divergent about the mediating mechanisms involved (mood as information vs. mood as primer). Therefore, the challenge for future research could be to identify which of these mechanisms is involved in the mood congruence effect.

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