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Sources of Bias in Memory for Emotional Reactions to Brexit:
Current Feelings Mediate the Link between Appraisals and Memories

Susanna Schmidt

Barbara Muzzolini

Linda Levine

Carla Tinti

Susanna Schmidt and Carla Tinti, Department of Psychology, University of Turin, Turin, Italy; Barbara Muzzolini, Department of Psychology, City, University of London; Linda J. Levine, Department of Psychological Science, University of California, Irvine.

Correspondence concerning this paper should be sent to Susanna Schmidt, Università degli Studi di Torino, Via Verdi 10, 10124, Torino, Italy. susanne.schmidt@unito.it

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Abstract

This investigation examined the relation between two sources of bias when people remember how they felt about political events: their current appraisals of the past political event and their current feelings about it. We assessed participants' memories for their emotional response to a major political event: the 2016 UK referendum on European Union membership. Participants reported their emotional experience and appraisals within two weeks after the outcome. Eighteen months later, they reported their current appraisals and emotions concerning the referendum's outcome and their remembered past emotional response. Results showed that current negative emotions fully mediated the link between current appraisals and remembered negative emotions. We discuss this result within a feeling-is-for-doing approach.

Keywords: appraisal, emotion, memory bias, political events

Sources of Bias in Memory for Emotional Reactions to Brexit:

Current Feelings Mediate the Link between Appraisals and Memories

Remembering life events is an act of subjective mental time travel in which registered scenes can change. In fact, the recall of past events often comes with inaccuracies and imperfections, as people strive to maintain consistency between their past and current selves (Conway, Singer, & Tagini, 2004). In the process of remembering, not only memory of the event itself, but also memory of what the person felt in a given situation, can change over time (Levine, Schmidt, Kang, & Tinti, 2012). Previous empirical research suggests that the way past emotions are remembered depends on an individual's current cognitive evaluation (i.e., appraisal) of the past emotionally eliciting event (e.g., Kaplan, Levine, Lench, & Safer, 2016; Levine, 1997; Levine, Prohaska, Burgess, Rice, & Laulhere, 2001). Hence, biases in memory for emotions could be attributed to changes over time in appraisals of the past event. On the other hand, individuals' current appraisal of an event also determines their current emotions (Scherer, Schorr, & Johnstone, 2001). But what is the relationship between current appraisals, current emotions, and memory for past emotions? To address this question, the present research focused on the appraisals and emotions related to a specific event soon after it occurred, appraisals and emotions felt long after the event had occurred, and remembered emotions. We assessed how these variables interacted to explain bias in memory for emotions. Specifically, across a test-retest study, we investigated how British citizens appraised, experienced, and remembered their emotional response to the outcome of the 2016 UK referendum on European Union (EU) membership.

Sources of Bias in Memory for Emotion

It was once argued that intense emotion is stored permanently in memory (LeDoux, 1992). However, diary studies in which participants were asked to recall emotions over several specific time points revealed a general tendency to overestimate in recalling negative emotional states (Cutler, Larson, & Bunce, 1996; Feldman Barrett, 1997; Parkinson, Briner, Reynolds, & Totterdell, 1995). A similar pattern was observed also among clinical populations. For example, psychiatric

patients recalling their symptoms of depression tended to overestimate past negative emotions (Schrader, Davis, Stefanovic, & Christie, 1990); chronic pain patients overestimated prior feelings of anxiety and depression (Bryant, 1993); and so did former smokers when recalling their negative response to their first relapse (Shiffman et al., 1997).

To explain these biases in memory for emotions, appraisal theorists have proposed that they depend on how people judge the significance of a given event in the present (see Scherer, Schorr, & Johnstone, 2001, for a review on appraisal theories). For instance, remembered emotions might be biased when appraisals and attitudes toward a past event have changed (Levine, 1997), when there is new post-event information (Safer & Keuler, 2001), or most broadly, when people's goals, beliefs, and motivations have shifted over time (Loftus, 1992). More generally, remembered emotions may change in a direction that is consistent with current appraisals. For example, Levine and colleagues (2001) assessed participants' memory for their emotional response to the verdict in the murder trial of O. J. Simpson. Two months after an initial assessment, participants who currently appraised Mr. Simpson as guilty of the murder of his wife and her friend, overestimated their past feelings of anger and underestimated their past feelings of happiness. Participants who currently evaluated the verdict as unexpected, overestimated their initial levels of surprise. This approach is compelling, as it takes into account the malleability of human memory, and argues that emotional memories, just like episodic memories of past autobiographical events, are subject to biases (Levine, 1997). Importantly, however, researchers have not yet fully uncovered the relationship between current appraisal, current emotion and remembered emotion.

To address this gap, in the present research we also investigate how current emotion is related to current appraisal and remembered emotion. Building on the feeling-is-for-doing approach (Zeelenberg, Nelissen, & Pieters, 2007), we argue that emotions serve the critical functions of making appraisals salient and driving people's future behaviors. Here, emotion can be better understood as a behavioral guidance that helps the individual to make a decision, solve a motivational conflict, or resolve ambiguity (Zeelenberg, Nelissen, Breugelmans, & Pieters, 2008).

Indeed, drawing on the hypothesis that current emotion is the most immediate representation of current appraisals (Schmidt, Tinti, Levine, & Testa, 2010; Zeelenberg et al., 2008), we predict that current appraisals determine current emotions, and that current emotions account for bias in remembered emotions. Thus, the broad goal of the present research is to clarify the respective roles of current appraisals and current emotions in explaining biases in remembered emotions. To do this, we test the direct effect of current appraisals on remembered emotions. Then we test the mediating role of current emotions in the interplay between current appraisals and remembered emotions.

The Present Investigation

We examined sources of bias in people's memories of their emotional reactions to the 2016 UK referendum on EU membership using a within subject design. At Time 1 (T1), within two weeks after the outcome of the referendum was announced, participants reported their emotional reaction to, and their appraisals of, the outcome. At Time 2 (T2), about 18 months after the referendum, participants recalled their emotional reactions and reported their current feelings and appraisals of it. Participants were British supporters of the party that favoured remaining as part of the EU. We tested whether remembered emotions at T2 would be biased in the direction of current emotions at T2, the latter being conceived as the outcome of appraisals at T2, or whether current appraisals at T2 directly predicted remembered emotions at T2 (Kaplan et al., 2016; Levine, 1997; Levine et al., 2001).

Method

Participants

Undergraduates and community members in London, UK, participated in the study. Undergraduates were contacted through announcements in courses and received partial course credit for participating. Community members were invited to volunteer through posts on Facebook and Twitter. Of the 253 participants who completed the T1 survey, 109 also completed the T2 survey 18 months later. Most participants supported the Remain party in the referendum, leaving too few participants in other groups for analyses. Therefore, we excluded the small number of

participants who expressed no voting preference ($n = 8$), or a preference for the Leave party ($n = 5$). The final sample consisted of 96 supporters of the Remain party (33.3% undergraduates and 66.7% community members) who completed both surveys through the Qualtrics online platform. Preliminary analyses showed no significant differences between the students and community members with respect to their ratings of emotions or appraisals (all $ps \geq .084$), therefore we combined the two groups for analyses. At T1, participants' ages ranged from 18 to 74 ($M = 27.7$, $SD = 14.4$); 80.2% were women.

Time 1 Questionnaire

Appraisals. Within two weeks after Brexit was announced (24 June 2016 – 7 July 2016), participants rated how important the outcome was for the UK on a scale from 0 (*not important at all*) to 10 (*extremely important*), and they rated, from 0 (*not at all*) to 10 (*a lot*), how much the outcome would have consequences for the UK: (a) politically, (b) economically, and (c) socially. The mean of these four items was used as a measure of importance/consequentiality for the UK ($\alpha = .78$). Participants also rated, from 0 (*not at all*) to 10 (*a lot*), how much: (a) it was important for them personally to be part of the EU, (b) the outcome of the referendum was currently important for them personally, and (c) the outcome of the referendum had consequences for their personal life. The mean of these three items was used as a measure of personal importance/consequentiality ($\alpha = .80$; see Appendix A for the means and standard deviations of individual appraisal ratings).

Emotions. Participants were asked how they were feeling the moment they learned the news about the UK leaving the EU. They rated the intensity from 0 (*not intense at all*) to 10 (*extremely intense*) with which they had experienced 12 emotions (see Appendix B for the means and standard deviations of individual emotion ratings). The order of presentation of emotions was randomized. We ran several factor analyses to aggregate experienced emotions into two composite measures according to positive versus negative valence (see more detailed explanations about the steps of the factor analyses in Appendix C). The first factor was composed of sadness, anxiety, anger, shame, and powerlessness. The mean rating of these emotions was used as a measure of negative emotion

($\alpha = .87$). The second factor was composed of happiness, hope, satisfaction, pride, and excitement. The mean rating of these emotions was used as a measure of positive emotion ($\alpha = .83$).

Time 2 Questionnaire

Appraisals. About 18 months after the referendum (November - December 2017), participants rated their current appraisals of the outcome of the referendum using the same items as at T1. These ratings were combined into a mean reflecting attributed current importance/consequentiality for the UK ($\alpha = .83$) and current personal importance/consequentiality ($\alpha = .84$; see Appendix A for the means and standard deviations of individual appraisal ratings).

Current and remembered emotions. At T2, participants indicated their current feelings about the outcome of the referendum by rating the intensity of the same 12 emotions as at T1. To assess remembered emotions, participants were asked how they were feeling in the moment they learned the news about the UK leaving the EU. For both sets of ratings, the order of emotions was randomized. As was done for Time 1 ratings, based on principal components factor analyses, we used the mean of participants' ratings of sadness, anxiety, anger, shame, and powerlessness as the measure of T2 current negative emotions ($\alpha = .88$) and T2 remembered negative emotions ($\alpha = .86$). We used mean ratings of happiness, hope, satisfaction, pride, and excitement as the measures of T2 current positive emotions ($\alpha = .87$) and T2 remembered positive emotions ($\alpha = .79$). Appendices B and C provide means and standard deviations for individual emotion ratings at T1 and T2 (current and remembered), and the results of factor analyses on emotion ratings.

Results

Change in Appraisals over Time

Participants appraised the outcome of the referendum as important/consequential for the UK and for themselves both at T1 (UK: $M = 8.50$, $SD = 1.41$; Personal: $M = 6.80$, $SD = 2.16$) and T2 (UK: $M = 8.73$, $SD = 1.40$; Personal: $M = 6.55$, $SD = 2.55$). A repeated measures ANOVA revealed no effect of time, $F(2, 94) = 2.60$, $p = .080$, $\eta_p^2 = .05$. This means that, as a group, participants evaluated the importance/consequentiality of the event for UK and for them personally in a

consistent way at the two time points. However, at an individual level, 32.3% of participants at T2 evaluated the event as less important/consequential for UK than at T1, 18.8% of them attributed the same importance/consequentiality for UK at T2 and T1, and 49% judged the outcome of the referendum as more important/consequential for UK at T2 than at T1. Also for personal importance/consequentiality, there were changes in appraisals over time: 50.0% of participants evaluated the event as less important/consequential for themselves at T2 than at T1, 12.5% of them attributed the same personal importance/consequentiality at the event at T2 and T1, and 37.5% judged the outcome of the referendum as more important/consequential for themselves at T2 than at T1.

Changes in Current Emotions and Memory for Emotions Over Time

As expected, given that all participants were supporters of the remain party they reported intense negative emotions when they first learned about the outcome of the referendum at T1 ($M = 6.03$, $SD = 2.79$) and they also reported feeling intense current negative emotions about the outcome at T2 ($M = 5.16$, $SD = 2.77$). In addition, at T2 they remembered having felt intense negative emotions at T1 ($M = 5.89$, $SD = 2.49$). Conversely, the intensity of positive emotions was low at T1 ($M = 1.13$, $SD = 1.42$) and T2 ($M = 1.15$, $SD = 1.51$), the intensity of remembered positive emotions at T2 was also low ($M = 1.20$, $SD = 1.31$).

To assess the consistency of felt emotions and memory for emotions over time, we performed a repeated measures ANOVA with current negative and positive emotions at T1 and T2, and remembered negative and positive emotions at T2, as dependent variables. The results showed a main effect of emotion measure, $F(4, 92) = 6.63$, $p < .001$, $n_p^2 = .22$. In particular, univariate statistics showed a significant effect of emotion measure on negative emotions, $F(2, 190) = 9.89$, $p < .001$, $n_p^2 = .09$: current negative emotions at T2 were less intense than current negative emotions at T1 ($M_{CurrentT2} - M_{CurrentT1} = -.87$, $SE = .26$, $p < .01$) and remembered emotions at T2 ($M_{CurrentT2} - M_{RememberedT2} = -.73$, $SE = .14$, $p < .001$), while no significant difference was found between remembered negative emotions at T2 and current negative emotions at T1 ($M_{RememberedT2} - M_{CurrentT1}$

= -.14, $SE = .21$, $p = .52$). As to positive emotions, their intensity remained stable and low over time both for current and remembered emotions, $F(2,190) = 0.18$, $p = .83$.

On average, then, participants neither over- nor underestimated in remembering negative or positive emotions. However, as with appraisals, this does not mean that memories were consistent for individual participants. Indeed, comparing T1 experienced and T2 remembered negative emotions revealed that 46.9% of the participants remembered less intense negative emotions over time, 42.7% remembered more intense negative emotions over time, and 10.4% remembered the same intensity of negative emotions at T2 as felt at T1. As to positive emotions, 36.5% of participants remembered less intense positive emotions over time, 39.6% participants remembered more intense positive emotions over time, and 24.0% remembered the same intensity of positive emotions at T2 as felt at T1.

To explain these individual changes in memory for emotions, we conducted mediation analyses to test whether current emotions at T2 would explain the relationship between current appraisals at T2 and remembered emotions at T2, or whether current appraisals at T2 have a direct influence on remembered emotions at T2. The analyses controlled for the relevant appraisals and emotions at T1.

Mediation Analyses

We used PROCESS Model 4 (mediation test), with 5,000 bootstrap samples, to estimate the indirect effect of T2 current appraisals on T2 remembered negative (see Figure 1) and positive (see Appendix E Figure 1) emotions through T2 current emotions (Hayes, 2013). Two models were computed to explain biases in memory for negative and positive emotions respectively: the first considering appraisals of importance/consequentiality for the UK, the second considering appraisals of personal importance/consequentiality. All models controlled for the relevant appraisals and emotions at T1.

As the top panel of Figure 1 shows, at T2, the more participants appraised Brexit as important/consequential for the UK, the worse they currently felt about Brexit. In turn, the worse

they currently felt, the more negative emotions they remembered having felt at T1. After controlling for current emotions at T2, the association between appraised importance/consequentiality for the UK and remembered emotions was no longer statistically significant. Even when controlling for T1 appraisals and emotions, current emotions at T2 fully explained the association between appraised importance/consequentiality for the UK and remembered emotions at T2. Similarly, the bottom panel of Figure 1 shows that, at T2, the association between appraised personal importance/consequentiality and remembered emotions was fully explained by current emotions at T2. The indirect effect was significant even after adjusting for T1 appraised personal importance/consequentiality and T1 emotions.

As Appendix E shows, there was no effect of T2 appraisals (importance/consequentiality for UK or personal importance/consequentiality) on remembered T2 positive emotions. Moreover, there was no effect of T2 appraisals on T2 current emotions. For this reason, it was not possible to test the mediation effect of T2 current positive emotions on remembered positive emotions.

These data are correlational, limiting inferences about causal direction. However, for remembered negative emotions we also tested a reverse mediation model (see Figure 2). We entered appraised importance/consequentiality for the UK and appraised personal importance/consequentiality respectively and assessed whether T2 appraisals accounted for the association between T2 current emotion and remembered emotion. The models controlled for T1 emotions and appraisals. A much poorer fit was found for the two models. Current appraisals did not serve as mediator, supporting our hypothesis that memory of past negative emotions is shaped by current appraisals, and that this relationship is mediated by current emotions.

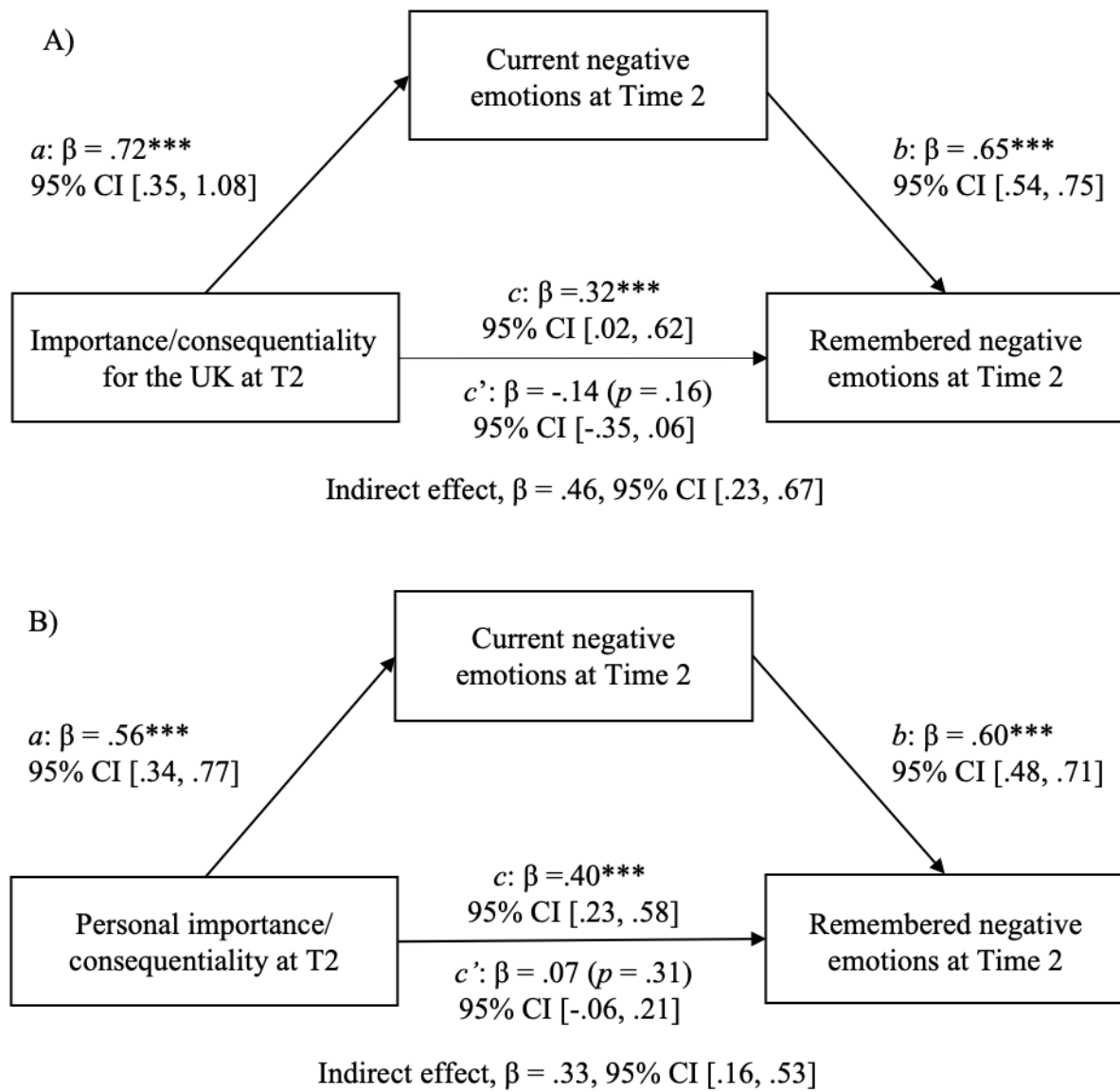


Figure 1. Results of the mediation model estimating the indirect effect of T2 current appraisals on T2 remembered negative emotions through T2 current negative emotions. The top panel shows results for appraised importance/consequentiality for the UK and the bottom panel shows the results for appraised personal importance/consequentiality. Both models controlled for T1 emotions and appraisals. Numbers in parentheses refer to the beta after the mediators were added to the model.

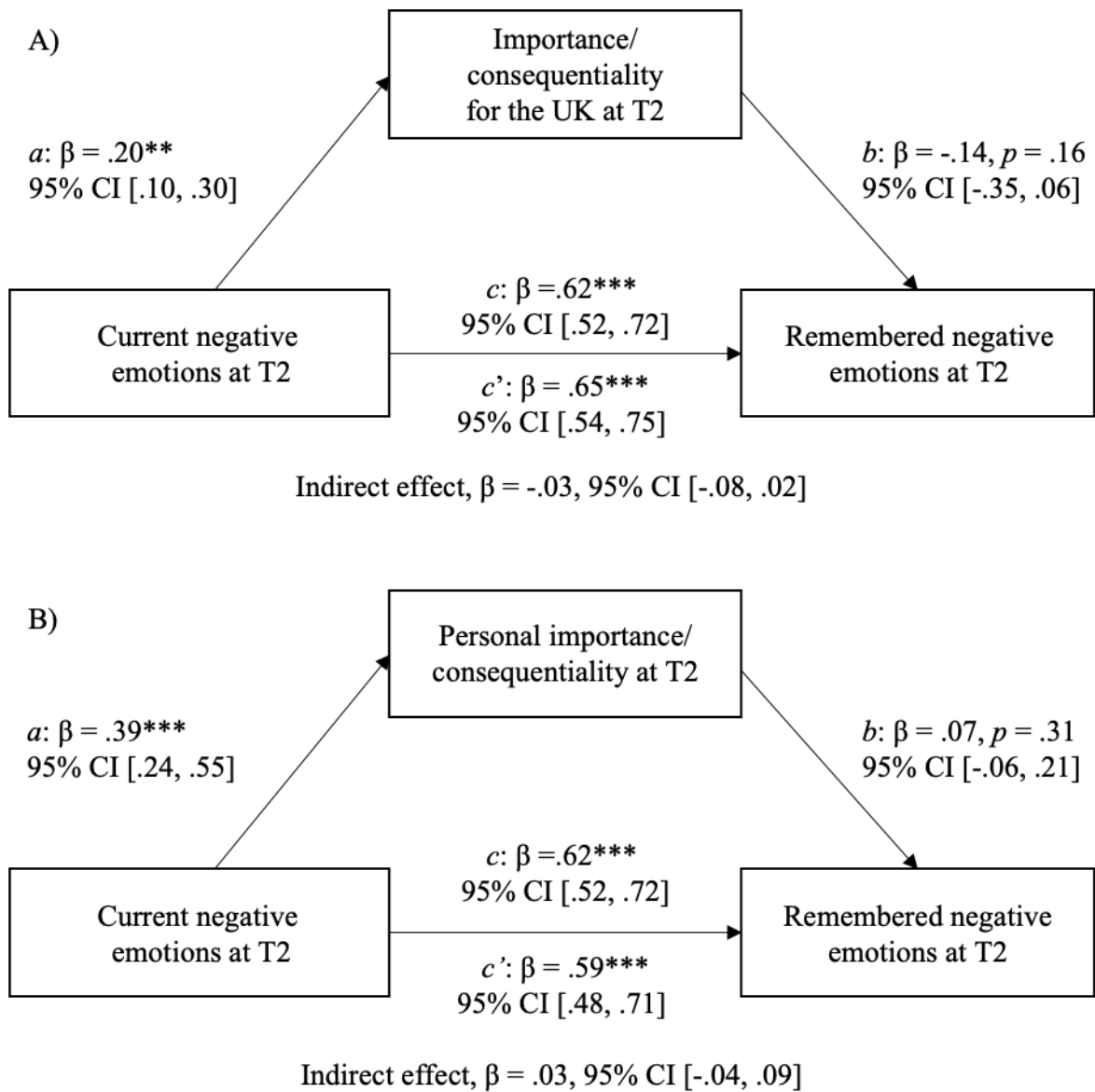


Figure 2. Reverse mediation model testing the null hypothesis that current appraisals at T2 mediate the relationship between current negative emotions at T2 and remembered negative emotions at T2. The top panel shows results for appraised importance/consequentiality for the UK and the bottom panel shows the results for appraised personal importance/consequentiality. Both models controlled for T1 emotions and appraisals. Numbers in parentheses refer to the beta after the mediators were added to the model.

General Discussion

This test-retest study examined sources of bias in memory for emotion by testing whether remembered emotions at re-test (T2) are biased in the direction of current emotions at T2 or whether current appraisals at T2 directly predict remembered emotions. A few days after the result of the 2016 UK referendum on EU membership was announced (T1), British supporters of the ‘Remain in the EU’ campaign indicated how they were feeling about the outcome and how important/consequential this outcome was for them personally and for their country. Eighteen months later, the same participants indicated how they remembered having felt when they first learned the outcome, as well as how they were feeling about, and appraising, the event in the present. Comparisons between initial emotions at T1 and remembered emotions at T2 showed that, as a group, participants remembered both positive and negative emotions fairly accurately and that their appraisals remained rather stable. At an individual level, however, the majority of participants showed biases in their recalled emotions and changes in their appraisals of the event.

To test the predictors of these individual biases, we conducted mediation analyses. Results indicated that, the more participants appraised the event as important at T2, the more negative emotions they remembered having felt at T1, and that this relation was mediated by current negative emotions at T2. Specifically, in the mediation model that included the T2 appraisal of importance/consequentiality for the UK, this relationship was fully mediated by the intensity of current negative emotions at T2. The same result was found for the mediation model that included the appraisal of personal importance/consequentiality at T2. Current negative emotions at T2 fully mediated the relationship between appraised personal importance/consequentiality at T2 and remembered negative emotions at T2. These effects held even after controlling for current emotions and appraisals at T1. For positive emotions, the mediation models were not significant. This could be attributed to the floor levels observed in the intensity of positive emotions.

These findings support the hypothesis that memory of past emotions can be subject to bias (Levine, 1997; Safer, Bonanno, & Field, 2001). To explain this bias, appraisal theories suggest that

the recall of past emotions may change based on people's evaluation of a past-emotion eliciting event in the present: when appraisals have changed over time, people typically show a bias toward recalling emotions that are consistent with their current appraisals (Levine et al., 2001). Here, we extend this perspective by uncovering the mediating role of current emotions in the relationship between current appraisals and remembered emotions showing that people's present feelings about a past emotional event influence the way they remember having previously felt. According to the feeling-is-for-doing approach (Zeelenberg et al., 2007), emotions serve the function of guiding behaviour. Our results can indeed be interpreted within a goal-based framework where emotions have a functional influence on decision-making: they help people by providing quick, salient, and intuitive cues about how to solve motivational conflicts and ambiguities. In addition, our results may be relevant for the clinical practice when patients are asked to remember their past emotions (for example, a trauma or their pre-therapy condition). In this context, it is pivotal for clinicians to be aware that current emotions stemming from the client's current appraisals of past events could be responsible for over- or underestimating their past emotional states.

To sum up, our study suggests that bias in memory for emotions stems most directly from current feelings about the past emotion-eliciting event. Besides its importance in clinical practice, this finding raises the question of whether people's decisions in the political sphere rely more on the feelings they actually experienced in the past or on misremembered feelings. For example, in an election campaign, how people actually felt about a candidate's past positions and actions may be less important than how they remember having felt under the current influence of the candidate's reassuring smile. Our findings encourage further study to address the effects of bias in remembered emotion on political behaviour. In addition, it will be important to find out if the same biases are found for political events that evoke positive emotions. As our sample included only supporters of the Remain in the EU party, their emotional response was intensely negative. In conclusion, in the present study, people's feelings at the time of recall fully accounted for the link between their current appraisals of past events and bias in memory for past emotions. Thus, even more than

previously known, political candidates and parties have a lot to gain by appealing to people's gut feelings. Swaying people's emotions in the present helps rewrite the past.

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Appendices

Appendix A

Means and standard deviations of appraisals at T1 and T2.

Current appraisals	M (SD)	
	T1	T2
How important is the outcome of the referendum for the UK as a whole?	9.18 (1.11)	8.71 (1.77)
To what extent do you think this event will have consequences for the UK on a:		
Political level?	8.25 (2.02)	8.89 (1.47)
Economic level?	8.94(1.66)	9.07 (1.42)
Social level?	7.63 (2.27)	8.23 (2.11)
How important is it to you personally that the UK is part of the EU?	7.79 (2.35)	7.46 (2.63)
How important is the outcome of the referendum for you personally?	6.23 (2.65)	6.16 (3.10)
To what extent do you think this event will have consequences on your personal life?	6.39 (2.64)	6.03 (3.02)

Note. Scales range from 0 to 10.

Appendix B

Means and standard deviations of current emotions at T1 and T2 and remembered emotions at T2.

Emotion	<i>M (SD)</i>		
	Current T1	Current T2	Remembered T2
Happiness	0.83 (1.55)	0.91 (1.59)	1.16 (1.74)
Hope	1.59 (1.97)	1.81 (2.15)	1.81 (2.06)
Excitement	1.30 (2.11)	0.97 (1.66)	1.02 (1.48)
Satisfaction	0.93 (1.76)	1.13 (1.97)	1.17 (2.06)
Pride	1.00 (1.77)	0.92 (1.85)	0.86 (1.52)
Interest	6.35 (3.10)	5.65 (3.10)	5.85 (2.79)
Astonishment	7.14 (3.03)	4.41 (2.94)	6.61 (2.69)
Anxiety	6.32 (3.15)	5.49 (3.24)	5.83 (2.85)
Anger	6.45 (3.33)	5.30 (3.24)	6.53 (2.98)
Powerlessness	6.14 (3.57)	5.90 (3.45)	6.40 (3.16)
Sadness	6.41 (3.29)	5.12 (3.50)	5.74 (3.18)
Shame	4.83 (3.88)	3.97 (3.48)	4.97 (3.39)

Note. Scales range from 0 to 10.

Appendix C

Emotions' factors emerging from principal component factor analysis and item loadings

	Current T1		Current T2		Remembered T2	
	Negative	Positive	Positive	Negative	Negative	Positive
Sadness	.847			.863	.840	
Anxiety	.810			.869	.823	
Shame	.802			.737	.764	
Anger	.788			.841	.807	
Powerlessness	.746			.775	.722	
Happiness		.862	.890			.749
Satisfaction		.861	.813			.792
Hope		.771	.752			.663
Pride		.703	.863			.661
Excitement		.641	.771			.797
Eigenvalues	4.24	2.19	3.73	3.05	3.94	2.08
% of variance	42.4%	21.9%	37.3%	30.5%	39.4%	20.8%
Cronbach's α	.87	.83	.87	.88	.86	.79

Note. Factor analyses were performed in two steps. An initial analysis was run to obtain eigenvalues for each factor in the data and to scan the correlation matrix. The solution accounting for all 12 emotions explained 64.7% of the total variance for current emotions at T1, 61.2% for current emotions at T2, and 61.1% for remembered emotions at T2, showing three factors for current emotion at T1 and remembered emotions at T2, and two factors for current emotions at T2. In all solutions the first two factors suggested a distinction between positive and negative emotions, while the third factor in current emotions at T1 and remembered emotions at T2 reflected emotions of neutral valence, i.e. interest and astonishment. Thus, to gather a solution that could fit the three observations, we re-ran the analyses excluding these two emotions. The solution accounting for 10 emotions explained 64.3% of the total variance for current emotions at T1, 67.8% for current emotions at T2, and 60.2% for remembered emotions at T2. Importantly, the three analyses yielded the same two factors (negative vs positive emotions) with the same emotions loading on the two factors.

Appendix E

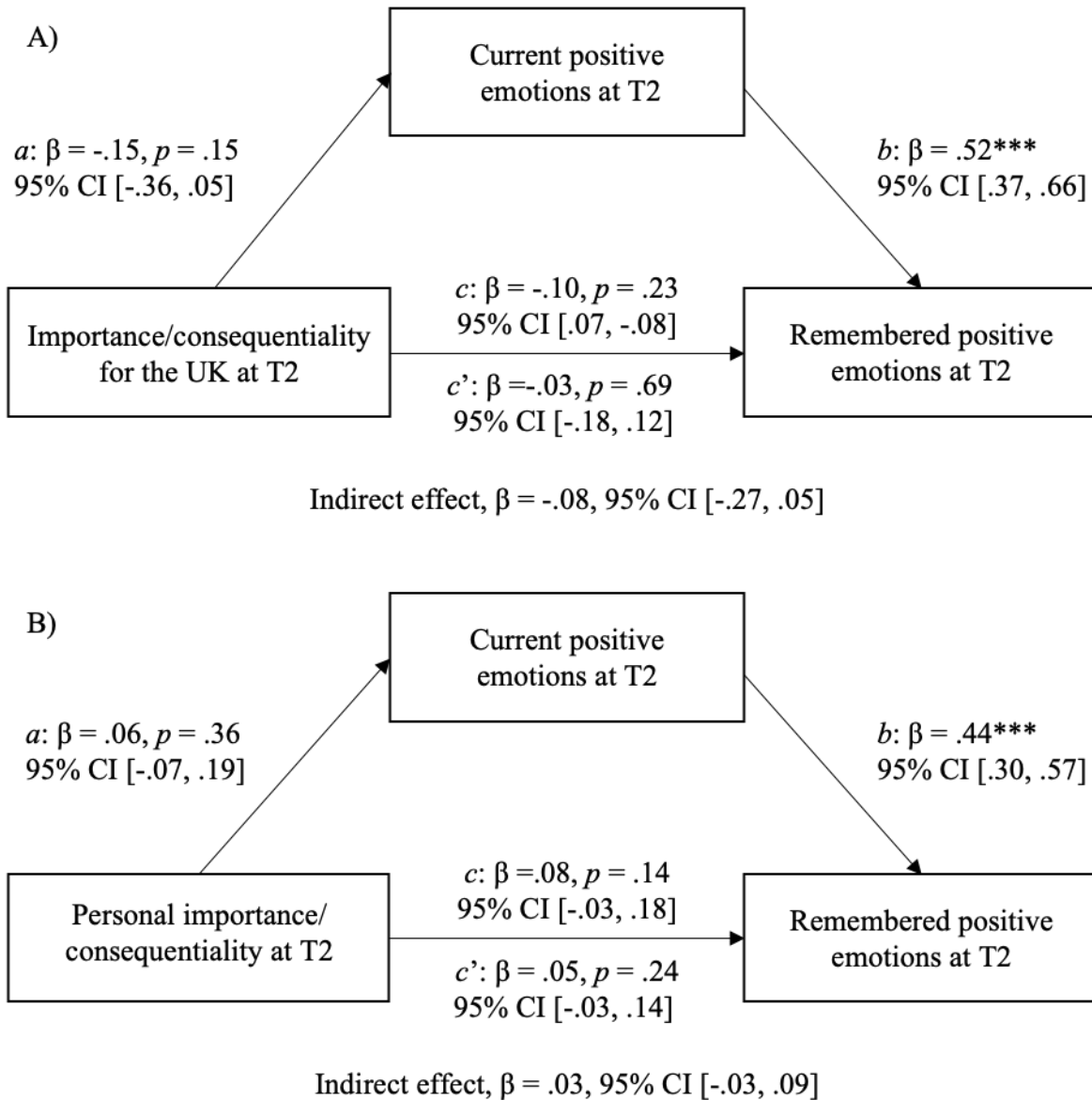


Figure 1. Results of the mediation model estimating the indirect effect of T2 current appraisals on T2 remembered positive emotions through T2 current positive emotions. The top panel shows results for appraised importance/consequentiality for the UK and the bottom panel shows the results for appraised personal importance/consequentiality. Both models controlled for T1 emotions and appraisals. Numbers in parentheses refer to the beta after the mediators were added to the model.