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Collaborative Remembering of Emotional Autobiographical Memories: Implications for Emotion Regulation and Collective Memory

Raeya Maswood

Stony Brook University

Anne S. Rasmussen

Aarhus University

Suparna Rajaram

Stony Brook University

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(raeya.maswood@stonybrook.edu), Anne S. Rasmussen (annesr@psy.au.dk), or Suparna Rajaram (suparna.rajaram@stonybrook.edu). We thank Anastasia Barcari, Yvonne Chanda, Nimra Choudhry, Michele Ebner, Michelle Lee, Sang Yeon Pak, Siddhi Parikh, Victoria Trapani, and especially Matthew Tilton, at Stony Brook University for their research assistance.

Abstract

People frequently engage in conversation about shared autobiographical events from their lives, particularly those with emotional significance. The pervasiveness of this practice raises the question whether shared memory reconstruction has the power to influence the memory and emotions associated with such events. We developed a novel paradigm that combined the strengths of the methods from autobiographical and collaborative memory research traditions to examine such consequences. We selected a shared, real-life autobiographical event of an exam, and asked students to recall their memory of taking a recent exam where they provided a group and/or personal narrative of this autobiographical event. Students first recalled the event either collaboratively (C) or individually (I), followed by a final individual (I) recall by all. Valence ratings as well the emotional tone of the narratives converged to show that prior collaborative remembering down-regulated negative emotion and enhanced the positive emotional tone of the memories. The recalled detail in the narratives indicated that at initial recall members of collaborative groups reported fewer internal details than those who recalled alone, and reported more external details in a later recall when working alone. Earlier collaboration also increased collective memory such that more of these details were shared among prior group members in their later individual recall compared to those who did not collaborate before. We discuss the influence of collaborative remembering on shaping memory and emotion for autobiographical events as well as the potential mechanisms that promote collective autobiographical memory.

Keywords: *Collaborative remembering, Autobiographical memory, Emotion regulation, Collective memory*

Collaborative Remembering of Emotional Autobiographical Memories: Implications for Emotion Regulation and Collective Memory

Autobiographical memory encompasses knowledge about oneself and recollections of specific personal events (e.g., Conway & Pleydell-Pearce, 2000; Conway & Rubin, 1993; Talarico, Berntsen, & Rubin, 2009). Such personal memories are typically formed in a social environment and are frequent topics of conversation and social sharing (Alea & Bluck, 2003; Bluck, Alea, Habermas, & Rubin, 2005; Nelson & Fivush, 2004). It is particularly common in our daily interactions that we share with others our emotional autobiographical memories, whether it is those of joy or of grief. Examples of such emotional events include large-scale, cultural or collective events such as presidential elections, mass shootings or royal weddings, and also smaller-scale events such as, exams, graduations, sporting events, weddings, or funerals. Despite the social nature of emotional autobiographical memories, questions about how the sharing of such memories influences individual memory are understudied, and most of the existing evidence comes from retrospective reports of personal events and of social sharing.

The present study used a novel approach, combining respective strengths of the methodologies from the collaborative memory and the autobiographical memory areas of research, to investigate the influence of social sharing on emotional autobiographical memories. To achieve these goals, we examined students' memories of a recent exam event during which all the participants were present. Using this methodology, the students' emotional views and memory narratives of the exam as a function of collaborative versus individual recall were examined. By constructing a novel experimental paradigm, the present study aimed to integrate the strengths of autobiographical memory research that explores memory for real-world events with the rigors of laboratory experimentation developed in collaborative memory research

tradition. This novel paradigm enabled "an experiment in the wild" to examine the role of collaborative remembering as an intervention effect for shaping emotional autobiographical memories, with a focus on two potential consequences of such collaboration: emotional regulation and collective memory.

Social Sharing of Autobiographical Memories: Potential Consequences for Emotion

Regulation

Emotion regulation refers to the cognitive and behavioral strategies that influence and regulate the feelings, behaviors and physiological responses that make up the emotion so as to bring about better emotional equilibrium (Gross, 2001). Emotional regulation has been associated with both solitary remembering and social sharing (e.g., Pasupathi, 2003; Rimé, 2009). Because autobiographical memory is reconstructive in nature (Bartlett, 1932; Conway & Pleydell-Pearce, 2000), this process allows collaborative remembering to serve as a potentially effective mechanism for regulating the emotions associated with such memories. Re-experiencing and memory reconstruction create an environment that not only reinstates emotions associated with a past event, it also promotes cognitive appraisal and reframing strategies that are beneficial for regulating emotion, for instance by boosting positive affect or down-regulating negative emotion. These processes may be markedly enhanced in social contexts when people bring diverse perspectives of past events to the discussion. In this study, we investigated whether collaborative as compared with individual remembering can have beneficial regulatory consequences on the memory content as well as on the affective responses associated with memory.

In considering the differences between social and individual remembering, past evidence shows that the emotions associated with an autobiographical memory can change with time, even

through individual reflection. Across ages and ethnicities, the most typical and consistent change observed to occur over time is affective fading such that individuals report emotions associated with memories to be less intense (e.g., Talarico, Labar, & Rubin, 2004; Walker & Skowronski, 2009). The emotional intensity associated with negative events fades even faster over time than the corresponding intensity of positive events (Walker, Skowronski, & Thompson, 2003; Walker, Vogl, & Thompson, 1997). This outcome known as the fading affect bias is part of a more general pleasantness bias in autobiographical memory, which favors the recall of emotionally positive memories and makes them more vivid and more intense than their negative counterparts, as well as being reported more by a ratio of approximately two to one relative to neutral and negative memories (e.g., Bohn & Berntsen, 2007; D'Argembeau & Van der Linden, 2008; Rasmussen & Berntsen, 2009; Walker, et al., 2003; Wilson & Ross, 2003). This fading affect bias may seem counterintuitive at first because other types of memory typically are characterized by a negativity bias in individual memory with enhanced encoding and recall of emotionally negative information (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Kensinger, 2007). In fact, in a recent study, Choi, Kensinger and Rajaram (2017) showed that collaborative as compared with individual remembering of emotionally positive and negative as well as neutral picture stimuli enhanced negative memories. However, importantly, this study did not examine the effect of collaboration on emotional *autobiographical* memory.

Why is autobiographical memory different than memory for other types of information when it comes to valence preferences? One explanation is that autobiographical memory in contrast to most other types of memory involves the storage of self-relevant and self-defining memories and therefore favors personal over information value (e.g. Baumeister, et al., 2001; D'Argembeau & Van der Linden, 2008; Walker, et al., 2003). Support for this explanation comes

from studies showing that the increased vividness of positive relative to negative memories is strongest in positive memories that are self-concordant or self-evaluative (D'Argembeau & Van der Linden, 2008; Werner-Seidler, Tan, & Dalgleish, 2017). Another explanation is that the boosting of positively loaded autobiographical memories and the complementary dampening of negative autobiographical memories serves an emotional regulation function (Walker & Skowronski, 2009). This latter explanation is supported by studies showing a disrupted fading affect bias in dysphoric populations (Walker, Skowronski, Gibbons, Vogl, & Thompson, 2003) as well as reduced vividness of positive memories in people with depression, suggesting that these individuals are limited in their ability to benefit from positive recollection (Werner-Seidler & Moulds, 2011; Werner-Seidler et al., 2017). Of course, it is also possible to benefit from emotionally negative autobiographical memories for instance when learning from past mistakes (e.g., Rasmussen & Berntsen, 2009). However, autobiographical memory generally favors positive events.

The fading affect bias has been reported for individual remembering, but this bias may further accentuate through social sharing. According to this view, the affective intensity of negative events would fade more when negative memories are shared as compared to privately rehearsed whereas the affective intensity of positive memories would fade less (e.g. Alea & Bluck, 2003; Muir, Brown, & Madill, 2015; Pasupathi, 2003; Pasupathi, Lucas, & Coombs, 2002; Ritchie, Skowronski, Wood, Walker, Vogl, & Gibbons, 2006; Skowronski, Gibbons, Vogl, & Walker, 2004). Past work has not experimentally manipulated social sharing through conversational recall, but evidence that comes from disclosing memories or from recall of past conversations support the possibility that social sharing plays an enhanced role in the emotional regulation of memories. In these reports, participants recalled autobiographical memories from

their past and the particular emotional autobiographical event selected for recall varied from subject to subject depending on their personal choice. In a series of studies investigating whether the frequency of discussing memories moderates the fading affect bias (Skowronski, et al., 2004), retrospective ratings showed that memories that had been frequently discussed (10 times or more) and memories that had been discussed with a diverse range of listeners (e.g. spouse, supervisor, friend) showed increased fading affect bias. As the interest of this series of studies was on the frequency of disclosing memories rather than the effect of sharing memories following a discussion, in another experiment, participants recalled their self-generated memories with others 0, 2 or 3 times. Although, this setup did not simulate conversations where all members are free to discuss and provide feedback, an enhanced fading affect bias was again found where the emotions associated with negative memories faded more with the frequency of disclosure whereas emotions associated with positive events did not change in response to disclosure until after the third disclosure (Skowronski, et al., 2004).

In a similar line of work, but not directly investigating the fading affect bias, it has been reported that conversations serve emotion-regulatory functions by enhancing positive views associated with a negative event (Pasupathi, 2003). In this study, participants recalled a recent emotional event that they had previously discussed with someone and once again the particular emotional event selected for recall varied from subject to subject. As both the event and the conversation were drawn from the past and prior to their participation in the study, participants rated retrospectively their emotional response to the original event as well as to the conversation. Participants rated stable emotional intensity for positive memories across the original event and their subsequent conversation about it whereas their reported emotional intensity for negative memories declined across the original event and the subsequent conversation. Furthermore, the

main motives participants reported for having engaged in a conversation about the event were to receive support, gain a new perspective on the event, or simply to get closure (Pasupathi, 2003).

Taken together, evidence shows that individual remembering can alter the emotions associated with autobiographical memories, and that social sharing may accentuate such changes particularly for negative memories by reducing the emotional intensity reported for these memories. However, no previous study has empirically investigated the direct consequences of exchanging emotional autobiographical memories in conversation by examining memories of a naturalistic event that all participants had jointly experienced and by tracking their emotional views of the event as well as the potential collective memory representation that may result from such social sharing. The present study was designed to address these questions.

Social Sharing of Autobiographical Memories: Potential Consequences for Collective Memory

Collective memory refers to a phenomenon where groups of people who have experienced the same event in the past develop overlapping memories of that event such that the shared information speaks to their cultural, political or group identity (Hirst & Manier, 2008; Roediger & Abel, 2015; Zaromb, Butler, Agarwal, & Roediger, 2014). In experimental studies, collective memory has been operationalized as shared memories, that is, details or items that all group members remember or that all group members forget, but without reference to their group identity (Choi, Blumen, Congleton & Rajaram, 2014; Cuc, Ozuru, Manier, & Hirst, 2006; Luhmann & Rajaram, 2013, 2015; Stone, Barnier, Sutton, & Hirst, 2010). In our study, we used this latter definition. Studies using traditional laboratory stimuli such as word lists, pictures, or narratives have reported that group remembering has the potential to create a collective memory representation among group members (e.g., Choi, et al., 2014; Choi, et al., 2017; Congleton &

Rajaram, 2014; Cuc, et al., 2006; Hirst & Manier, 2008; Roediger & Abel, 2015; Zaromb, et al., 2014). For instance, as the process of collaboration exposes the conversational partners to one another's recollections, or induces mutual forgetting, it can increase the similarities in their event memory (see Rajaram & Pereira-Pasarin, 2010 for a review).

In the context of the present study, group remembering may serve as an intervention, providing an opportunity to re-experience and evaluate past experiences differently than when recalling alone. This shared reconstruction of memories also has the potential to alter, modulate and increase convergence in the memories that are reported later. These changes can occur by altering the content of the experience that is discussed, or omitted from discussion, as well as by regulating the emotions associated with these memories.

Investigating Emotional Autobiographical Memories in a Social Context

By their very nature, autobiographical memories occur in the participants' personal past, thus limiting experimenters' direct access to the actual event and the details surrounding it (but see Pasupathi, Alderman, & Shaw, 2007; Pasupathi, & Hoyt, 2009). Consequently, a gap exists such that a lack of access to the initial autobiographical event makes it difficult to track the changes in the participant's affective responses. The most common method, that of self-generating emotional autobiographical memories from one's personal past, typically involves participants reflecting on their past and selecting a few positive or negative memories from their lives (e.g., Rasmussen & Berntsen, 2009). In turn, these memories often do not reflect a shared event experienced by all participants, and can vary from participant to participant.

The limited research on social sharing of autobiographical memories is characterized by similar constraints as the studies on autobiographical memory in general. For instance, previous studies have examined participants' retrospective reports of memories that they report they have

often shared in conversation (e.g., Harris, Barnier, Sutton, & Khan, 2017; Muir, et al., 2015; Pasupathi, 2003; Skowronski, et al., 2004) or analyzed disclosures of unshared past events (e.g., Beike, Brandon & Cole, 2016; Pasupathi, 2003; Skowronski, et al., 2004). As such, the selection of the recalled events likely varied across participants in addition to how far in the past they were from (i.e., differences can span several years), thereby giving the experimenter no control over the range of events recalled.

The few notable real-life studies, where the experimenters had knowledge of the original events, are those of flashbulb memories. Flashbulb memories are memories of one's personal circumstances (i.e., where you were, what time it was, who you were with, and what you were doing), when learning the news of an important public event such as the assassination of President Kennedy or the fall of the Berlin Wall (e.g., Bohn & Berntsen, 2007; Brown & Kulik, 1977; see also Harris, Barnier, Sutton & Keil, 2010). However, although flashbulb memories are related to the same event, they are not necessarily autobiographical memories of the exact same event. For example, while a flashbulb event may be shared among participants, personal circumstances surrounding the moment of hearing the news of the public event can differ widely with regard to time and place. Also, since flashbulb events are typically unpredictable and surprising events (e.g. 9/11 tragedy), they are widely publicized on television and by other news media outlets (Hirst & Phelps, 2016; Hirst, Phelps, Meksin, Vaidya, Johnson et al., 2015). Therefore, gaining access to a participant's own retrospective experience of the event unpolluted by the effects of extensive public discourse and media coverage remains a challenge.

While these methodological challenges exist, it is also clear that social sharing of autobiographical memories is a frequent and functional part of human existence. Following collective events in society, we share our memories and emotional reactions in the community.

Similarly, in order to inform, seek support, or gain perspective, we share our emotional events from our personal lives with friends, family members, partners and co-workers. Therefore, when autobiographical memories are shared in conversation, individual patterns of memory retrieval may be altered by cognitive consequences described earlier that emerge from social interaction.

The Present Study

In the present study, we investigated whether sharing emotional autobiographical memories changes the emotional response and type of details people recall about an autobiographical event. To address this question, we integrated the real-world aspects of autobiographical memory research with the experimental paradigm used in the study of collaborative memory (B.H. Basden, Basden, Bryner, & Thomas, 1997; Rajaram, 2011; Weldon & Bellinger, 1997). Very few studies have applied the collaborative memory paradigm to an emotional *and* autobiographical event and even fewer in combination with a naturalistic context. In two studies that examined the effect of collaboration on emotional real-life events (i.e., public versus private events, respectively), the recalled events were not simultaneously shared by all participants as the participants did not experience the event together at the same time and place, and, these studies were also not designed to differentiate between the biased fading of positive and negative affect (Harris et al., 2010; Harris, Keil, Sutton, Barnier, & McIlwain, 2011). Here, we constructed a novel design where we compared individual and group recall of autobiographical memories of a recent, real-life emotional event that all participants had recently experienced at the same time and in the same place and that they either collaboratively or individually recalled in an experimental setting.

In taking this approach, we chose classroom exams as the autobiographical event and asked participants to narrate their memories of this event. Exams can serve as collective

emotional events as they are highly relevant events in students' lives and the same exam event can often evoke a range of affective responses across student participants. As such, the present study provided a unique opportunity to study the influence of collaborative remembering of emotional autobiographical memories characterized by distinct and naturally occurring emotional responses. By selecting an autobiographical event with real-time access, we were able to ensure that the participants were recalling the same exam event as their partners (or their counterparts in the individual recall condition). This was especially important to control for in the context of the present study because students take multiple different exams. Additionally, we were able to track and assess possible changes in the affective responses within two weeks following the exam, thereby reducing, even if not eliminating, retrospective biases. In contrast, earlier studies have typically examined the memory of socially disclosed events that had happened months or years previous to the study (e.g., Harris, et al., 2010; 2011; Pasupathi, et al., 2003; Skowronski, et al., 2004).

Based on prior findings indicating that sharing memories in a social context promotes emotion regulation (Alea & Bluck, 2003; Pasupathi, 2003), we predicted that collaboration may serve as an intervention and influence both the emotional views associated with the exam event as well as the memory details recalled in the narrative for the event. With regard to emotional views, we predicted that collaboration would impact those with positive or negative views differently. For those with initial negative valence ratings of the exam event, we expected that the affective intensity of the negative memory of the exam was expected to fade to a greater degree for those who collaborated compared to those who did not collaborate during first recall. For those with initial positive valence ratings, a fading effect was expected but no differential effect of social remembering was predicted (Pasupathi, 2003; Skowronski, et al. 2004). Finally, for

those with initial neutral valence ratings, previous work did not give rise to specific predictions with regard to the fading affect nor with regard to any differential effects of social versus individual remembering. However, because of the naturalistic approach we took, we expected that participants could fall into all three valence categories (i.e., positive, negative and neutral).

With regard to the recalled narratives, we expected the narratives of post-collaborative individuals to have a more positive tone following collaboration compared to the control condition. With regard to the memory itself, we selected two types of memory details to examine within each narrative; external, observable details related to the event and its environment, and internal, subjective details pertaining to personal experience, which are unobservable to others (Berntsen, 2002). It has been suggested that negative or highly arousing memories are associated with facilitating attention to internal details, such as emotional, metacognitive or physiological responses (Berntsen, 2002; Mandler, 1975). For this reason, we examined all narratives for potential differences in the extent to which the narratives focused on the internal reflections of the participant versus external and observable details of the events. Finally, we expected that participants who had collaborated about the exam event, as compared with participants who had only remembered individually, would later recall more shared details, both external and internal, thus providing evidence for the emergence of collective memory.

Method

Participants and Design

One hundred and ninety two students participated in the study, with a total of 32 triads (collaborative condition) and 96 individuals (individual condition), for experimental credit. All participants were fluent English speakers and undergraduate volunteers from Stony Brook University who were enrolled in PSY 310 (Research Methods in Psychology), 260 (Cognitive

Psychology) or 103 (Introduction to Psychology), with each course having a minimum of 105 enrolled students.

The study consisted of two groups that recalled the exam event either individually or collaboratively. We also divided the participants according to those with initial negative, positive, or neutral emotional valence towards the exam in order to examine the natural variation in affective responses and the effect of collaborative recall on these initial responses. Furthermore, we considered the participants' arrival as to whether they were tested before or after receiving their grades. This was done to evaluate whether participants would report different initial emotional tone towards the exam depending on whether they participated in the experiment before or after receiving grades. We did not have any a priori hypotheses regarding the before/after grades variable, but needed to consider it for practical reasons, since it was not feasible to recruit all participants within a week after the exam, before they had received their grade. As initial analyses revealed no differences between the before and after grades groups, we collapsed the data across time of grade in the remaining analyses (see the Results section below).

With regard to the choice of sample size, since our study incorporated aspects from both autobiographical memory and collaborative memory studies, we surveyed relevant studies in both literatures for information. Our study differs from prior work in both the experimental design used as well as the dependent measures that were of interest. Typically, the literature on autobiographical memory does not take an experimental approach or report a direct comparison between collaborative and non-collaborative recall conditions; similarly, collaborative memory literature by and large has not used autobiographical content. Furthermore, because the comparison between individual and group recall has been investigated with far greater frequency in the studies using the collaborative memory paradigm, and since the present study took a

similar approach to investigate consequences of collaboration using a similar design as previous studies (i.e. the collaborative memory paradigm), we first turned to the collaborative memory studies for information regarding sample size. This line of work has investigated both the effects during collaborative recall as well as the consequences of collaboration on later recall, with sample size varying from 10-16 groups per condition (B. H. Basden, et al. 1997; Finlay, Hitch, & Meudell, 2000; Weldon & Bellinger, 1997; Weldon, Blair, & Huebsch, 2000). Turning next to collaborative recall studies that have particularly focused on emotional and/or autobiographical information, we noted that in a recent study, where the consequences of collaborative recall were tested for emotional, non-autobiographical information, 24 triads were used per condition due to the complexity of their design (Choi, et al., 2017). A similar range of sample size (20 triads per condition) was used in two recent studies that examined the consequences of collaborative recall of an emotional film (Bärthel, Wessel, Huntjens, & Verwoerd, 2017; Wessel, Zandstra, Hengeveld & Moulds, 2015), whereas a study that measured the affective fading of a real-life event in response to collaboration (but without differentiating between positive, neutral and negative affect) included 10 triads per condition (Harris, et al., 2010).

In the present study, as the laboratory comparison of collaborative versus individual recall with the recall of a real-life event was novel, and different dependent measures of interest were used, we chose a sample size of 16 triads per condition that eventually resulted in 32 triads per Type of Recall condition when we collapsed across grades. Whereas the Type of Recall condition was predetermined and assured an equal number of participants across groups, the Initial Valence condition depended on the participants' natural initial emotional response to the event and could therefore not be fixed a priori. However, based on the standard [pleasantness bias](#) in autobiographical memory (Walker, et al., 2003), we expected to see a distribution with

approximately twice as many positive as compared to neutral and negative memories based on the participants' initial emotional responses to the event.

The Type of Recall variable consisted of participants recalling the exam events either collaboratively in a group and subsequently individually during a final recall phase (C-I condition), or individually during both recall phases (I-I condition). Members within each collaborating group (or, in the control condition where nominal groups were constructed) were always from the same course and collaborated after and about the same exam. Furthermore, collaborating triads consisted of students who were not personal friends prior to the collaborative sessions. Experimental sessions were conducted within two weeks following each exam. As ongoing correspondence with the instructors was maintained throughout the semester, we had access to the dates of the exams and for grade postings. Experimental sessions before grades were posted starting with the day after the exam and ran for at most a week until grades were made available to students. Experimental sessions after grades were posted began one week after the exam starting the day when grades were made available to students and ran for a week.

Materials

Our main measure for emotional valence was from the *Autobiographical Memory Questionnaire* (e.g., Rubin, Boals, & Klein, 2010; Rubin, Schrauf, & Greenberg, 2003): *The feelings I experience when I recall the event are (-3 = extremely negative, 3 = extremely positive)*. We used this question to assess the emotional change in valence following collaborative and individual recall, for which reason it was administered both pre and post the experiment phase. In addition, to check for potential group differences we included a number of pre experimental measures of general mood for the past week (PANAS; Watson, Clark, & Tellegen, 1988), overall worry and anxiety felt towards exam related events (Westside Test

Anxiety Scale; Driscoll, 2007), and individual differences in psychological inflexibility (Bond et al., 2011)ⁱ.

Positive and Negative Affective Schedule (PANAS)

The PANAS is commonly used to measure positive and negative affective states across various times (e.g. the present day, the last week, month or year or for a specific event). We used the instructions for the last week in the present study. The PANAS consists of 20 items, 10 items addressing positive affect, and 10 items addressing negative affect. Each item is rated on a 5-point scale (1 = not at all; 5 = extremely). The reliability as measured by Cronbach's alpha was good ($\alpha = 0.85$ for positive affect, and $\alpha = 0.84$ for negative affect).

Westside Test Anxiety Scale

The Westside Test Anxiety Scale is used to identify worry and anxiety in students due to events before, during, and after an exam. These measures are important for gaining insight into individual test anxiety differences among the participants. The scale consists of 10 items addressing issues of anxiety in relation to studying and exams (e.g. The closer I am to a major exam, the harder it is for me to concentrate on the material.) Items are rated on a 5-point scale (5 = extremely always true; 1 = not at all never true). The reliability as measured by Cronbach's alpha was good ($\alpha = 0.86$).

Acceptance and Action Questionnaire II

The Acceptance and Action Questionnaire (AAQ-II) is used to assess various constructs related to psychological inflexibility and experiential avoidance such as thought suppression and distress tolerance. Each item is rated on a scale of (1 = never true; 7 = always true). The reliability for the recommended seven-item version as measured by Cronbach's alpha was good ($\alpha = 0.89$).

Overall, there were no differences between individuals and groups scores for these pre-experimental measures. Participants in both conditions scored similarly on the Westside Test Anxiety Scale, positive and negative PANAS ($p > .38$) as well as the recommended version of the AAQ-II for psychological inflexibility ($p = .16$; Bond, et al., 2011) Altogether, this suggests that students in the individual (II) and group (CI) conditions were generally comparable at the start of the main recall portions of the experiment.

Method of Recall

Written Narrative

Recall involved providing a written narrative of participants' personal experiences of the exam event. Participants were told to try to recall the exam event in as much detail as possible and to include as much information as possible in the written narrative. They were additionally told to feel free to include anything tangentially related to the exam. To encourage natural, free recall, minimal instructions were given on the format of the narrative. Participants began the narrative by first providing a basic run-through of the exam event starting from the moment they entered the classroom to when they submitted their exam and left the room. A list of examples of additional topics of discussion was also included in the instructions to promote rich discussion, such as recalling the material and questions included in the exam, grade expectations, any distractions during the period as well as how they felt before and after the exam (full recall instructions included in Appendix A).

Differences in the instructions given to groups and individuals were restricted to the collaborative component of the task, where groups were instructed to freely discuss among themselves their experiences from the exam and to write a group narrative. Instructions for groups emphasized working together as a group to write a single, group narrative. They were told

that they would be working with their partners during this phase to provide a group narrative of what they remember from the specified exam, and that they would be sharing one computer to type the group response. No further instructions were given to groups in order to allow free-flowing discussion. Based on pilot testing for the procedure, individuals and groups both were given 10 minutes to recall/discuss and type the narrative and all participants found this to be a sufficient amount of time.

Procedure

The experimental procedure consisted of the following phases in sequence: pre-experimental emotional valence question (AMQ) and emotion questionnaires (i.e., Westside Test Anxiety Scale, PANAS, AAQ-II) (completed individually); initial recall phase (completed individually or collaboratively); final recall phase (always completed individually); post-experimental emotional valence question (completed individually). Both recall phases involved providing a written narrative as described above. Subsequent to the written narrative, participants were also asked to provide a list of details from the exam amounting to a segmentation of their narrative (Berntsen, 2002; Talarico, et al., 2009), but large differences in the way participants interpreted this task rendered these data useless for further analyses. This variability among participants was most likely due to difficulty in following instructions for recalling an event that was less emotionally and personally significant than in previous work where this task was used for highly intense emotional personal events or events from farther into the past.

Prior to the start of the experiment, participants were first screened to verify that they were students who took the corresponding course exam for the experimental session. Participants were further asked whether they checked and received their exam grade. After informed consent, participants began the experiment by individually completing a series of questionnaires. The next

phase, initial recall, involved participants working either in a collaborative group (C-I) or individually (I-I), providing a group or an individual narrative of the exam event and their personal experiences from that event. In the collaborative group, three participants sat around one computer and were instructed to work with their partners to provide a group narrative of what they remember from the specified exam. All collaborative recall sessions were audio recorded. Participants were assured that the narratives were confidential and that the instructor or the teaching assistants of the course would not have access to the narratives or recordings.

Next, collaborative group members separated and all participants worked individually for the remainder of the experiment. In the following 5-minute break, participants played Solitaire on the computer. After this break, all participants wrote individual narratives, once again for 10 minutes, in the second, final recall phase, and then completed the emotional valence item of the AMQ once more. Finally, participants were debriefed and asked not to discuss the experiment with others.

The procedure was identical for students participating in the experiment both before and after receiving grades. All phases of the experiment were completed within one session in the laboratory, and took about 90 minutes.

Coding procedure

Narratives were coded for three key types of information: Emotional tone, the number of internal and external details, and the total number of words. The two coders started out by coding the same 20 % of the 320 narratives. Sufficient intercoder reliability was obtained at this point for all coding schemes, as noted below. A small number of disagreements that occurred was resolved by a third independent coder. Each coder was then allowed to continue independently.

First, each narrative was coded for the overall emotional tone the narrative conveyed. Emotional tone was rated in the following way. The narrative was coded as “0”, if it had none or very little emotional tone. Otherwise, it was rated on a 5-point scale (1 = positive, 3 = mixed, 5 = negative). Cohen's kappa on the agreement between the two coders was high ($\kappa = 0.81$, $p < 0.001$). Emotional tone was computed to measure the influence of collaborative remembering on the memory of the autobiographical event. Second, narratives were coded for internal versus external details about the memory for the exam event, since it has been suggested that heightened attention on negative memories may facilitate attention to inner mental states over external stimuli (Mandler, 1975; see also Berntsen, 2002). Following Berntsen (2002), we segmented the narratives into detail based on sentences. That is, one sentence from punctuation mark to punctuation mark was defined as a detail. We then classified internal details as those that refer to a psychological, mental or physiological state not observable by anyone other than the individual (e.g., I was nervous) and all other details as external (e.g., I dropped my pencil). For the internal and external details, the agreement rates were high, yielding with 91% and 92% agreement, respectively.

Results

Results are presented as follows: (1) effects of collaboration on emotional valence, (2) effects of collaboration on the final memory narratives for the emotional tone and on the type of details recalled in the initial as well as final narratives, and (3) evidence for the emergence of collective memory. Overall, students' emotional view ratings, as measured on the valence item on the AMQ (e.g., Rubin, et al. 2003; 2010) had a mildly positive view ($M = .61$, $SD = 1.31$) of the exam events, and did not differ between students participating prior to receiving grades ($M =$

.56, $SD = 1.34$) versus after receiving grades ($M = .66$, $SD = 1.30$), $t(190) = -0.49$, $p = .62$ $d = .07$, 95% CI = $[-.47, .28]$. Therefore, we collapsed across the factor of time of grades for all subsequent analyses. For the three courses from which participants were drawn, a one-way ANOVA revealed that initial valence differed among the courses, with students from PSY 310 reporting slightly higher positive views ($M = .99$, $SD = 1.25$, 95% CI = $[.72, 1.26]$) than PSY 103 ($M = .42$, $SD = 1.29$, 95% CI = $[.06, .78]$) and PSY 260 ($M = .19$, $SD = 1.29$, 95% CI = $[-.17, .54]$), $F(2, 189) = 7.38$, $p = .001$. Nonetheless, the initial views for all courses were on the positive side. Therefore, all subsequent analyses included all courses taken together.

Effects of Collaboration on Emotional Valence

As described in the Introduction, this study aimed to capture naturally occurring variations in the affective responses (positive, neutral, or negative) to the autobiographical event of taking an exam and to investigate potential changes in the memory for and affective response to this event as a function of collaborative recall. Therefore, key analyses separated participants based on their initial positive, neutral or negative views towards the exam to assess possible changes in memory content and valence ratings after the recall sessions. The positive group of participants rated their emotional view when recalling the event as positive, very positive or extremely positive (+1/+2/+3, on a 7-point scale from -3 to +3). The negative group rated their emotional view as negative, very negative or extremely negative (-1/-2/-3), whereas the neutral group consisted of participants who gave a rating of 0. Overall, prior to the recall phase, 56.25% of participants had a positive view of the exam (Individuals: 59, Group members: 49), 22.4% had a neutral view (Individuals: 21, Group members: 22), and 21.35% of participants had a negative view (Individuals: 16, Group members: 25). This distribution is consistent with the standard pleasantness bias in autobiographical memory (Walker, et al., 2003) with a large number of

participants reporting positive as compared to neutral and negative memories, thus validating this study's aim of capturing naturally occurring affective responses to a real-world event. Due to the nature of the a priori predictions, Type of Recall (Individual, Group) x Time of Valence (Initial Valence, Final Valence) ANOVAs were conducted for each valence group, i.e., students who reported a positive, negative or neutral view towards the exam before they engaged in event recall in either the individual or the collaborative condition. Specifically, negative valence was expected to fade more following collaborative but not individual recall. For positive valence, no differences were expected for the fading of affect following collaborative versus individual recall. There was no a priori prediction for initial neutral valence but the naturalistic approach taken to separate initial affect meant we needed to include this category. ⁱⁱ

Negative View. The Type of Recall x Time of Valence ANOVA revealed marginal main effects of Time of Valence, $F(1, 39) = 3.74, p = .06, \eta^2 = .09$, and Type of Recall, $F(1, 39) = 2.93, p = .10, \eta^2 = .07$. Relevant to the hypotheses, the interaction between Type of Recall x Time of Valence was significant, $F(1, 39) = 5.30, p = .03, \eta^2 = .12$. Follow-up analyses showed that from initial to final reports the negative emotional intensity significantly declined for those who previously worked in groups, $t(24) = -2.82, p = .009, d = .57, 95\% \text{ CI} = [-1.25, -1.19]$, whereas the negative emotional intensity did not change for participants who recalled in the individual condition, $t(15) = .44, p = .67, d = .11, 95\% \text{ CI} = [-.24, .37]$.

Positive View. The Type of Recall x Time of Valence ANOVA showed a significant main effect of Time of Valence for positive ratings, with both individuals and groups exhibiting a decrease in positive emotion from initial to final valence, $F(1, 106) = 65.33, p < .001, \eta^2 = .38$, thus supporting a fading effect. Furthermore, there was neither a significant main effect of Type of Recall, $F < 1$, nor a Type of Recall x Time of Valence interaction, $F(1, 106) = 1.27, p = .26$,

$\eta^2 = .012$, suggesting that the decrease in emotional intensity for individuals and groups was comparable in positive ratings.

Neutral View. There was no change for individuals from initial ($M = 0$, $SD = 0$) to final ($M = -.14$, $SD = .73$) ratings, and similarly groups remained the same in their initial ($M = 0$, $SD = 0$) and final ($M = 0$, $SD = .93$) ratings. Accordingly, there were no significant main effects of Time of Valence, Type of Recall, and no Time of Valence x Type of Recall Interaction, $F_s < 1$.

As presented in Figure 1, taken together these findings show that those with a negative view of the exam benefited from collaboration such that their negative view of the exam event decreased significantly after collaborative recall. The valence ratings for those who started out with a positive or a neutral view did not change as a function of collaborative recall, and as predicted based on past research, affect fading between initial and final recall was observed for those who started out with a positive view both in the individual and collaborative recall conditions. Unexpectedly, this decrease was not observed for individuals with a negative view towards the exam event who recalled alone twice. According to the fading affect bias, we would expect to see affect fading for both individual and collaborative recall in the negative condition (Pasupathi, 2003; Skowronski, et al. 2004). Here, we observed only the latter. We return to this point in the discussion. Critically, and consistent with our overarching hypothesis, these findings support the hypothesis that collaborative recall reduces negativity associated with autobiographical events.

Effects of Collaboration on Memory Narratives

Differences between Individual and Group Narratives at Initial Recall. With respect to our main focus of recall content, i.e., the type of details recalled, individual narratives ($M = 6.84$, $SD = 4.20$) consisted of more internal details than group narratives ($M = 3.72$, $SD = 3.71$), $t(126)$

= 3.75, $p < .001$, $d = .79$, 95% CI = [1.47, 4.78]. Individuals and group narratives demonstrated a similar numeric pattern for total details ($M = 17.22$, $SD = 5.65$; $M = 15.25$, $SD = 5.63$, respectively, $t(126) = 1.71$, $p = .09$, $d = .35$, CI = [-.31, 4.25]) and no difference for external details, ($M = 10.38$, $SD = 5.38$; $M = 11.53$, $SD = 5.51$, respectively, $t(126) = -1.05$, $p = 0.30$; $d = .21$, CI = [-3.343, 1.03]). With respect to the overall quantity of recall, these narratives at initial recall exhibited a somewhat different pattern from what has been found in earlier work using the collaborative remembering paradigm. Previous studies have typically found that groups remember more material relative to individuals at initial recall but it is worth noting that the past findings were observed for memory stimuli that were non-autobiographical in nature such as word lists or emotional films and that were presented by the experimenter rather than generated by the participants (e.g., Weldon & Bellinger, 1997, Wessel, et al., 2015). We return to this point in the discussion, and now turn to the findings from the critical stage, i.e., the second, final recall.

Emotional Tone of the Final Individual Memory Narratives. To assess the effects of individual versus collaborative remembering on the emotional response in later (individual) recall of the autobiographical event, we coded each recall narrative from Recall 2 (final individual recall) for the overall emotional tone it conveyed – positive (scores 1 and 2 on emotional tone), negative (scores 4 and 5 on emotional tone), mixed (score 3 on emotional tone), or none (score 0 on emotional tone). A chi-square analysis revealed that the emotional tone of the final narrative varied significantly as a function of type of recall condition, $\chi^2(3, N=96) = 10.51$, $p = .02$. Participants who had collaborated before were more likely to write positive narratives (29%; i.e., 28 out of 96) than participants who previously recalled alone (13%; i.e., 12 out of 96). In contrast, but consistent with this pattern in emotional tone, participants who previously recalled alone were more likely to have negative narratives (40%; i.e., 38 out of 96) or mixed

narratives (28%; i.e., 27 out of 96) than those who previously collaborated (26%; i.e., 25 out of 96 and 21%; i.e., 20 out of 96 respectively). Finally, 20% (i.e., 19 out of 96) and 24% (i.e., 23 out of 96) of narratives were non-emotional for individuals and groups, respectively. In brief, prior collaborative recall was associated with a more positive emotional tone in later recall than no prior collaboration (see Figure 2). This result converges on the finding we reported earlier that collaborative recall preferentially reduced the intensity of negative valence towards the exam event (see Figure 1).

Recalled Details in the Final Individual Memory Narrative. We next examined the types of details reported in the individually written narratives of participants who previously collaborated versus individuals who previously recalled alone. As shown in Table 1, the final narratives of previous collaborators had more total number of details, $t(190) = -2.12, p = .04, d = .31, 95\% \text{ CI} = [-4.09, -.14]$, compared to individuals who did not collaborate before. This difference was observable for external details such that the narratives of those who previously collaborated included more external details about the event than those who previously also recalled alone, $t(190) = -2.52, p = .01, d = .36, 95\% \text{ CI} = [-4.12, -.50]$, whereas participants from these two conditions recalled similar number of internal details, $t(190) = .30, p = .76, d = .04, 95\% \text{ CI} = [-1.03, 1.41]$ (see Table 1).

These results for the final memory narratives, for both the emotional tone and the type of details recalled, converge with the effects of collaboration on the changes in emotional views we observed. Following collaboration, group member's final individual narratives carried a more positive tone and they contained more external details, compared to those who did not collaborate.

Collective Memory

Collective memory was calculated by comparing the shared details in the final individual narratives of those who previously collaborated as a group in the Collaborative condition with the shared details in the final narratives of a nominal group, an equal number of participants from the Individual condition who had previously also recalled alone. Nominal groups provided a baseline for shared details that can arise in the absence of prior collaboration. Nominal groups formed for non-collaborators were matched for course, exam, and time of receiving grades (before/after). Shared details were those that at least two members from a previously collaborative group or from a nominal group recalled in the final individual narrative, unless otherwise specified. For example, if two or all three members within a former collaborative group or the nominal group reported that the professor made an announcement before collecting exams this detail was counted as a shared detail.

As shown in Figure 3, members who had previously collaborated ($M = 6.89$, $SD = 2.01$) recalled a significantly greater number of total shared details than those who did not collaborate ($M = 3.63$, $SD = 1.64$), $t(52) = 6.53$, $p < .001$, $d = 1.78$, 95% CI = [2.26, 4.26] and this pattern was observed for both internal details ($M = 1.89$, $SD = 1.50$ versus $M = .93$, $SD = .92$, respectively), $t(52) = 2.84$, $p = .006$, $d = 0.77$, 95% CI = [.28, 1.64], as well as external details ($M = 5.00$, $SD = 1.96$ versus $M = 2.70$, $SD = 1.75$, respectively), $t(52) = 4.54$, $p < .001$, $d = 1.24$, 95% CI = [1.28, 3.31]. Additionally, we examined the number of shared details as a function of details shared either by two or three group members, and found greater shared details recalled by former collaborators regardless of whether we examined this effect for dyads (Collaboration condition, $M = 5.33$, $SD = 1.78$ versus Individual condition, $M = 3.11$, $SD = 1.37$; $t(52) = 5.15$, $p < .001$, $d = 1.40$, 95% CI = [1.36, 3.09]), or triads (Collaboration condition, $M = 1.56$, $SD = 1.55$

versus Individual condition, $M = .52$, $SD = .89$; $t(52) = 3.01$, $p = .004$, $d = .82$, 95% CI = [.34, 1.73]). Together, these results for final memory narratives show that prior collaboration increased collective memory, and that this outcome was observed for both external details and internal details.

Discussion

The aim of the present study was to investigate the role of collaborative remembering in shaping emotional autobiographical memories. In contrast to previous studies, the present study took a novel approach by using a recent real-life event as recall stimuli; that is, an event in which all participants took part and that could be experienced from different emotional perspectives. Three measures were used to determine whether collaborative remembering influenced recall - valence ratings before and after collaborative (or individual) remembering, emotional tone of the recalled narratives, and the type of details (internal/external) that were recalled in the narratives. Taken together, collaborative remembering was found to regulate the emotions felt towards the autobiographical event as well as how the event was later remembered. With respect to the valence ratings participants provided, for initial negative ratings, individuals who recalled alone throughout reported similar negative ratings before and after recall whereas the negative emotions of those who previously worked in groups faded to a greater extent after sharing their memories with others. Collaborative remembering had no differential effect on students' positive emotions towards the exam compared to those who recalled alone. With respect to the narrative coding of emotional tone, when participants later recalled the event, memories were more likely to show positive emotional tone if previously shared with others. In contrast, memories were more likely to show negative emotional tone if participants had previously recalled the event alone. Finally, with respect to the remembered details, participants who had previously

collaborated in groups later provided individual narratives that contained more external details, and they also produced a collective memory with more shared internal as well as external details as compared with a baseline, nominal group. Overall, these findings suggest that collaboration had an effect on later individual recall by making those memories more positive and externally focused.

These findings support the predictions that arise from the works of Pasupathi (2003) and Skowronski, et al. (2004) who reported similar patterns of the fading affect bias, with emotions fading for participants recalling negative memories after social rehearsal. Unlike Pasupathi (2003) and Skowronski, et al. (2004), who found positive emotions to remain stable or increase following social remembering, we found positive emotions to fade for both individuals and those in groups in a manner that is consistent with the fading affect bias reported in other work not involving social rehearsal (e.g., Walker, et al., 2003 for a review). A possible explanation for these discrepancies is that we only examined two recalls. In contrast, Skowronski, et al. (2004; Study 4) examined 6 or more recalls of the same event, and it was only after participants recalled the memory a third time that the positive emotion did not fade, whereas recalling twice was associated with fading of positive emotion, suggesting that only with considerable increase in social disclosures positive emotions are maintained. This may have been the case also for the study by Pasupathi (2003), where participants were likely to have self-selected previously socially rehearsed events from the distant past, for which reason the positive affect associated with those events had already been stabilized. Another possible explanation for these discrepancies could be the nature of the recall stimuli used in the present study, which - although clearly autobiographical in nature when compared with word or picture stimuli - differ from earlier studies on several parameters. By designing the study so that the recall stimuli concerned

a recent event that was the same spatio-temporal experience for all participants, we successfully reduced potential biases of retrospection and increased experimental control. By the same token however, we may have lost some of the characteristics associated with the type of remembered events examined in other naturalistic work where self-selected autobiographical memories, presumably with high relevance to self and identity, served as emotional content. An additional discrepancy between the present study and previous work refers to the passage of time. One might argue that the fading affect bias is a healthy coping mechanism that works over longer periods of time (i.e., months or years), whereas the gap between the two recalls in the present study was 45 minutes. However, it is still unknown how long it takes for the fading affect bias to present itself, and there is evidence to suggest that it can happen within 12 hours after the original event (see Gibbons, Lee, & Walker, 2011). Future research needs to address the exact timing of the fading affect bias.

Critically, we found that positive valence towards the event faded after both collaborative and individual recall, whereas negative valence only faded after collaboration. In that important respect, we observed findings that are consistent with the autobiographical memory literature showing that social rehearsal increases the fading affect bias by selectively dampening negative emotions (Skowronski, et al., 2004). In contrast, previous work from the collaborative remembering literature [has](#) shown no differential effects of collaboration on emotional stimuli that are non-autobiographical in nature, i.e., positive and negative word or picture stimuli (e.g., Choi, et al, 2017).

Another difference from earlier work involves the comparisons between the initial group recall and initial individual recall. Whereas previous studies have typically found that groups composed of strangers - as in our study as well - remember more material relative to individuals

at initial recall, we found that initial group narratives in the present study contained a similar amount of details in comparison with initial individual narratives. The most likely explanation for these discrepancies is that the past findings have been reported for different memory stimuli that were non-autobiographical in nature, such as word lists or emotional films presented by the experimenter (e.g., Weldon & Bellinger, 1997, Wessel, et al., 2015). Autobiographical recall stimuli also likely present a different challenge for the social and work dynamics involved in group recall, because the remembered information is personal rather than strictly informative. For instance, later individual recall of group members who had a negative exam experience may depend on the responsiveness of listeners during collaboration (e.g., Hoyt, Pasupathi, Smith, Yeater, Kay, & Tooley, 2010; Pasupathi & Hoyt, 2009; Pasupathi, Stallworth, & Murdoch, 1998) or the speaker-listener dynamics in general (e.g., Coman, Manier, & Hirst, 2009; McLean & Pasupathi, 2011; Pasupathi, 2001; Pasupathi & Oldroyd, 2015). Furthermore, previous work has shown that listeners' responsiveness and disagreement during conversational remembering can affect the amount of interpretive and factual detail (i.e., a distinction similar to that between internal and external detail) expressed in later individual recall (Pasupathi & Hoyt, 2009), or have long-term effects on autobiographical memory recollection (Pasupathi & Oldroyd, 2015). Future research is needed to examine these issues in relation to the collaborative remembering paradigm.

Overall, while the methodological details of our study might have led to these deviations with respect to the fading of positive affect and the amount of information recalled by groups relative to individuals, several key findings aligned with the predictions from the past work as well as shed light on the consequences for the collective emotional recollections. We turn to these findings next.

Potential Consequences of Collaboration for Emotion Regulation

We show that collaboration serves as a form of emotion regulation to those remembering in groups. Our findings across several measures converged to show that prior collaborative remembering regulated emotional intensity such that collaboration was associated with more positively toned memories and the fading of negative emotions. Furthermore, collaboration led to later remembering for external details, suggesting a less introspective and more regulated recall of the event. The present findings correspond well with previous work (Pasupathi, 2003) showing that narratives of socially shared events as compared with narratives of non-shared events are characterized by more positive emotion as well as words that indicate less involvement of the self and temporal distance from the event itself. Together, these findings suggest that collaborative remembering can indeed influence how individuals later remember an autobiographical event as well as the emotions associated with the event.

Remembering allows the individual choice in revisiting specific memories, recalling isolated details and re-experiencing distinct emotions to further individual goals of emphasizing, preserving or diminishing certain aspects of a memory. However, unlike individual remembering, collaborative remembering provides the additional evaluative and perspective opportunities available in a group setting that can challenge and influence not only an individual's original memories themselves and the details that individual members may choose to share, but also break existing cognitive and ruminating patterns associated with a memory in beneficial ways. The diversity of memories and perspectives afforded by the listening audience in social remembering has also been associated with promoting an enhanced fading affect bias (Muir, et al., 2015; Skowronski, et al., 2004) that reduces negative valence towards the autobiographical event.

In the present study, group members were more likely to revisit the event such that they recalled more shared, objective, and observable actions from the event in their group narrative. In contrast, those that did not collaborate focused less on the external aspects of their personal experience, thereby presenting a more introspective focus in their narratives. Group members appeared to benefit from these different perspectives such that when group members later revisited their own experiences in the final narrative, they did so through a positive lens. Compared to individuals, former group members wrote similar numbers of internal details but they produced more external details about the event, thereby showing a focus in remembering not only their personal experiences but also other aspects of the event itself. These benefits were found not only in the memory narrative, but also in the emotions felt towards the event. Those who initially felt negatively towards the event, following collaboration they felt less so. This is in accordance with the goals of successful emotion regulation in attenuating negative emotions. Together, just as cognitive reappraisal that is a popular and effective emotion regulation strategy involves the individual to actively reinterpret an emotional situation or response, the diverse perspectives involved in collaboratively sharing memories can similarly aid in reinterpreting a situation for improved emotion regulation.

Potential Consequences of Collaboration for Collective Memory

One of the consequences of collaborative remembering is that a collective memory representation may be formed, and it is possible that the reconstructive nature of autobiographical memory enhances this effect even further, when groups remember a shared real-life event together. We examined this question in the present study and found that collaboration resulted in the emergence of a collective memory that consisted of a greater

amount of shared detail among previous group members as compared with a nominal group consisting of participants who had previously recalled alone.

What are the potential functions of such a collective autobiographical memory?

According to a prevalent theoretical model (e.g., Alea & Bluck, 2003; Pillemer, 1992), one of the main functions of autobiographical memory is that of sharing our personal memories with others (e.g., Nelson, 1993), thereby easing communication, and facilitating social bonding (e.g., Alea & Bluck, 2007; Rasmussen & Berntsen, 2009). For instance, Alea and Bluck (2003; 2007) argued that sharing memories is a goal-oriented action. They proposed a conceptual model for the social function of autobiographical memories that includes teaching and informing others, evoking and reciprocating empathy as well as providing and preserving intimacy. This predominant view attributes the social functions of autobiographical memory as facilitating new and strengthening existing social relationships. This may happen, when individuals share events from their personal past with another person or when two or more individuals collaboratively remember a shared event that they previously experienced together as was the case in the present study. The formation of collective memory may also facilitate a shared understanding of the emotional event, thereby eliciting empathy among group members, who experienced the event from different emotional views. In the present study, sharing the exam event and later remembering it together seemed to have had a soothing effect on the participants who experienced the event from a negative view and who had previously collaborated.

If collaborative remembering of a stressful or emotionally negative event can aid the affective fading of later individual recall, it may serve a beneficial intervention effect, for instance by changing the content of the memory. The findings from the present study suggest that one way collaborative remembering may facilitate emotional regulation is by changing the focus

in the memory representation from negatively loaded introspective thoughts such as rumination and brooding to a representation with a more external focus. Future research should examine the potential mechanisms responsible for this shift in attention from internal to external as well as the relative importance of the group constellation in this regard.

Finally, the present study's findings on collective memory may also relate to work on shared reality theory, which focuses on communication dynamics and on how motivations and the awareness of inner states may allow for the successful experience of shared reality in conversations. Specifically, empirical work on shared reality has found that when speakers tune messages to align with an audience's attitudes and knowledge, this can bias their later individual recollection as aspects of the tuned message is incorporated into memory (Echterhoff, Higgins & Levine, 2009). Though our study does not speak to the underlying motivations of communication and the audience-tuning effect, it is possible that the notions of a shared reality and the formation of collective memory may be related in the context of social remembering.

Limitations and Concluding Comments

Building on past work that has used the collaborative memory paradigm on emotional stimuli (e.g., Choi, et al., 2017; Bärthel, et al., 2017; Harris, et al., 2010; Wessel, et al., 2015), the present study consisted of the construction a novel design in an experimental setting. This design enabled us to compare individual and group recall of a real-life emotional event that all participants recently experienced, and which could be experienced from different emotional views. This design combined the strength of naturalistic designs with experimental rigor, and this laboratory preparation makes it possible to evaluate several related features of the tested phenomena in future work. For example, we substantially reduced the delay between the original autobiographical event and its recall (i.e., one to two weeks here compared to weeks, months or

even years in past studies) and we controlled for prior relationships among group members. It could be argued that even shorter delays would further reduce the possibility of interference from intervening events such as the possibility of the to-be group members discussing the exam with others before coming to the experiment. But it would be also difficult to control such elements without compromising the naturalistic aspects of autobiographical memories. Similarly, the naturalistic approach afforded us the opportunity to replicate the pleasantness bias. For the same reason, it led to uneven sample sizes for the initial valence participants reported, demonstrating the characteristics associated with integrating naturalistic and experimental approaches. Finally, though the examination and manipulation of social, communication and interpersonal dynamics during collaboration were not part of the aims of the present study, the design we developed is a useful framework for future work to investigate these rich topics.

In sum, the goal of the current study was to investigate the role of sharing emotional autobiographical memories in influencing individual's memories and emotions later towards an autobiographical experience. We took a novel approach by combining methods from collaborative memory research and autobiographical memory research to test this relationship. We examined students' emotional responses to and memories of a shared, real-life event, that of taking an exam, as a function of collaborative or individual recall. The main findings indicate that collaborative remembering can serve as an intervention effect, as our results converged to show that collaborative remembering regulated emotional valence towards the event, enhanced the positive emotional tone, and increased recall of external details in the memory narratives. The present findings also provide a window into the formation of collective memory for a jointly experienced and discussed autobiographical event.

Context Paragraph

This project emerged from substantive discussions between Professor Rajaram who directs a well-established research program on the nature of collaborative remembering and collective memory and Professor Rasmussen who is a well-known expert in autobiographical memory research. Rasmussen's research compares autobiographical memories of emotionally positive and negative events in a real-life context, and the functions that sharing such memories may serve for emotional regulation. Rajaram's research program investigates the nature of collaborative remembering, emergence of collective memory, how collaboration regulates memory for emotionally valenced information, and how this process can apply to real-life emotional events. Leveraging their respective areas of expertise, Rajaram and Rasmussen developed the idea of bringing autobiographical events into the laboratory to test the potential consequences of collaborative remembering on emotional regulation and collective memory. Ms. Raeya Maswood had just completed a now-published, undergraduate thesis on the relation between cognition and emotion around this time, and she wanted to pursue graduate research on memory for naturalistic emotional information. Building on these converging interests, the present study exploits the strengths of two research traditions to create a novel experimental paradigm that combines experimental rigor with naturalistic autobiographical information. The findings have broad, real-life implications for how social sharing of autobiographical memories may be used to cope with emotionally negative events.

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Table 1.

Mean number of internal, external and total details in final individual narratives as a function of type of recall (collaborative, individual). Standard errors are shown in parentheses and 95% confidence intervals for the mean values are shown below the means.

	Internal Details	External Details	Total Details
Final Recall			
Individuals	5.89 (.46) [4.98-6.79]	9.95 (.63) [8.70-11.19]	15.83 (.72) [14.41-17.26]
Collaborators	5.70 (.42) [4.87-6.53]	12.26 (.67) [10.93-13.59]	17.95 (.70) [16.56-19.33]

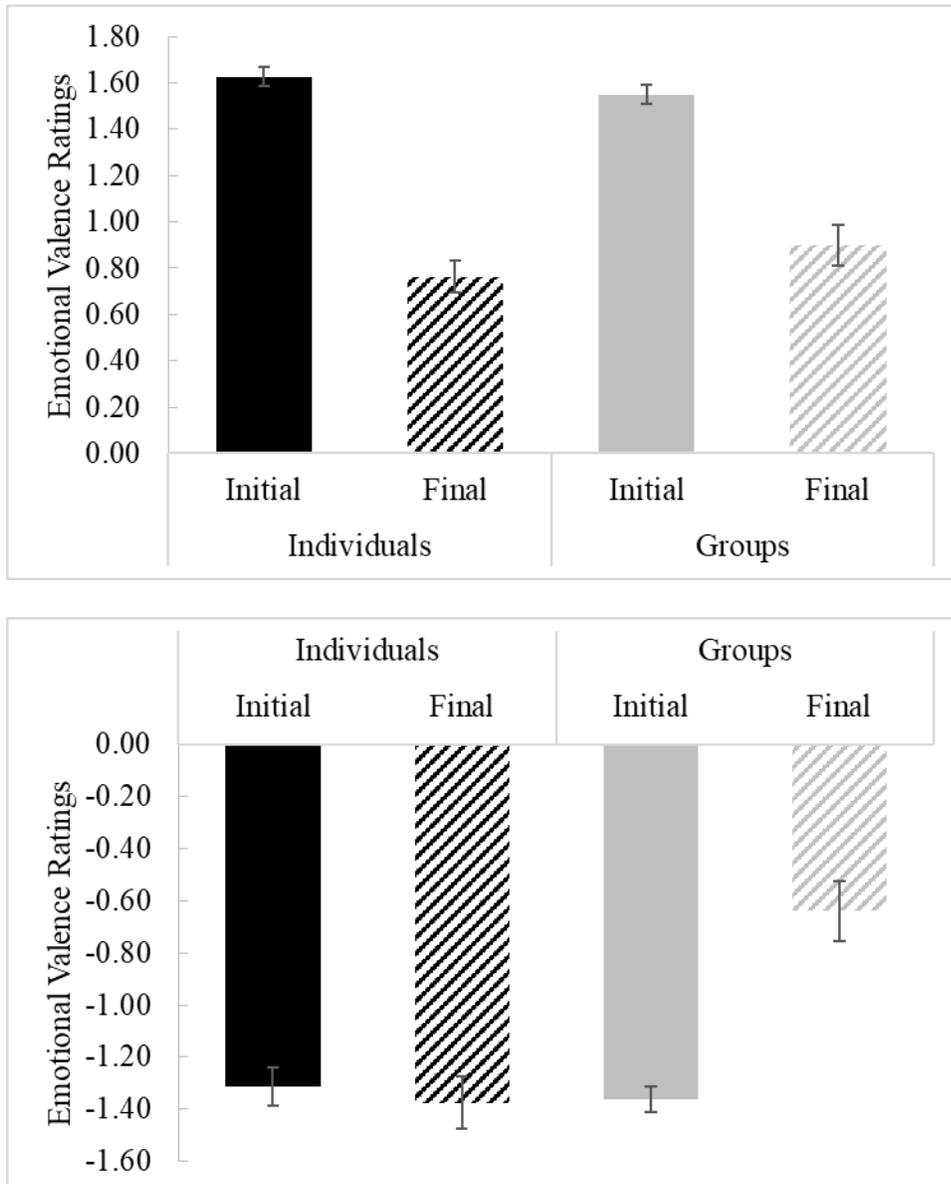


Figure 1. This figure displays mean emotional valence rating changes and standard errors for the emotional valence ratings changes before and after individual or collaborative recall for those with initial positive (1a; top) and negative views (1b; bottom). While the emotional intensity of positive views faded for both individuals and groups, the negative views only for groups.

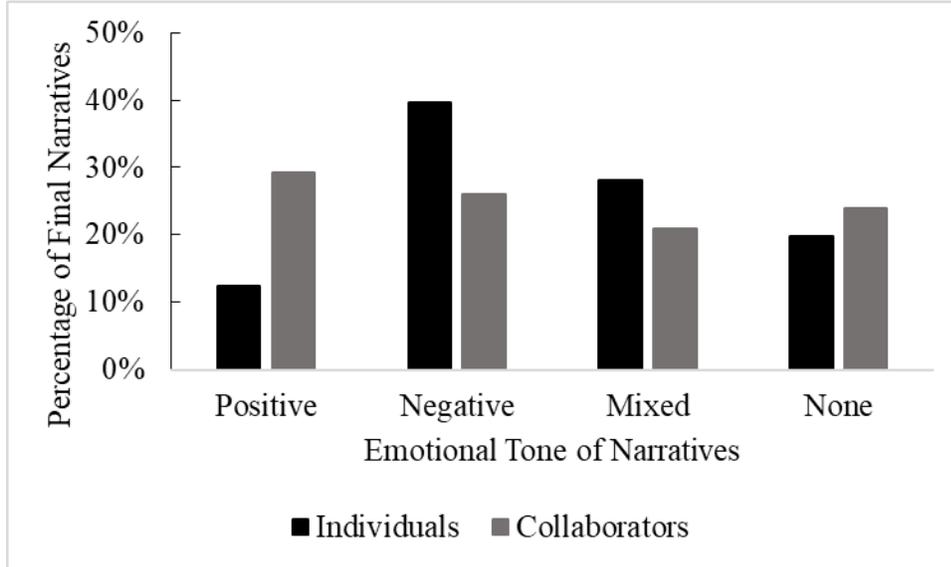


Figure 2. Emotional tone of the final individual memory narratives. The distribution of emotional tone of final narratives differed for individuals and collaborators. A greater proportion of final narratives of previous collaborators were positively toned compared to the final narratives of individuals.

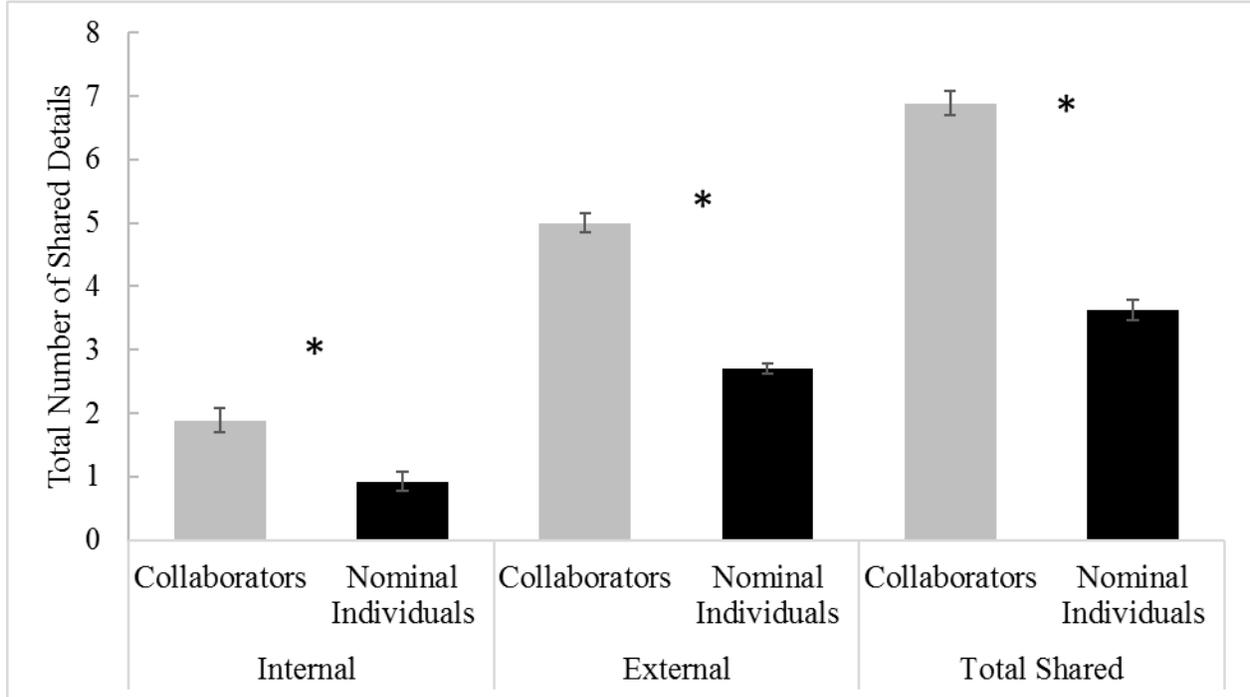


Figure 3. Emergence of collective memory. This figure displays mean total number of shared details and standard errors from the final individual narratives of previous collaborators and nominal individuals. In the final individual memory narrative, previous collaborators later recalled more shared internal, external and total details than narratives of the nominal individual counterparts.

Appendix A

Collaborative Recall Instructions

During this part of the experiment, as a group please recall and provide -
A written narrative of the events during the testing period for Exam # for PSYCH 310/103/260, and your personal experiences from that event.

Please begin by giving a basic run through of the events during the testing period. For instance, describe everything you remember from when you first walked into the classroom to when you submitted your exam and left the room. Please include as much information as you can remember and try to recall this event in as much detail as possible. Please be descriptive. Topics can include, but are not limited to: a run through of the events during the testing period; the material and questions included in the exam; the overall testing environment; any interruptions or unusual occurrences during the exam; details about how many proctors and TAs were present during the exam; and also the format of the exam. For instance, do you remember if there were different versions of the exam? Do you remember what version you might have had? Furthermore, do you remember if the instructor made any announcements at any time during the exam period? Was there anything projected on the board or on the screen? Moreover, what are your grade expectations? How did you feel before and after you took the exam? How do you feel about the exam now? What are your overall views and opinions of the exam and the course PSYCH 310/103/260 itself?

Please be an active participant in the discussion and feel free to jump into the conversation whenever you have something to share. Furthermore, feel free to discuss topics tangentially related to the exam and PSYCH 310/103/260.

For this part of the experiment, you will be using one computer to work together to type the group written narrative response. Please write freely and in as much detail as possible.

As a group, please begin by freely discussing your experiences from the testing period for Exam 1. In your narrative, please work together and be sure to begin with the basic run through of the exam. Please be thorough and descriptive, and include everything you can remember about the events from Exam # and your personal experiences from that event.

Please note that your narrative will be completely confidential, and that the instructor for the course is not affiliated with this study. Narratives will be identified with a confidential number ID, and only the principal and co-investigators will have access to them. So please be open and honest in your narratives.

This part of the experiment will be 10 minutes.

Collaborative List Instructions

During this part of the experiment, as a group please recall and provide-

A list of all the details you recall from the testing period for Exam # for PSYCH 310/103/260, and your personal experiences from that event.

For this part of the experiment, please think back to the exam event and take 5 minutes to provide a list of details you recall from the testing period for Exam #. Consider a 'detail' as any natural unit of information you recall from this event. Please provide any and all kinds of details you remember, including both major occurrences from the event as well as minor, insignificant details.

Please number the recorded details in succession.

Please note that your narrative will be completely confidential, and that the instructor for the course is not affiliated with this study. Narratives will be identified with a confidential number ID, and only the principal and co-investigators will have access to them. So please be open and honest in your narratives.

The duration for this part of the experiment will be approximately 5 minutes

Footnotes

ⁱ Analyses for the AAQ-II and PANAS included nine and one fewer participants, respectively, than the total since responses on these two questionnaires were not reported by all participants.

ⁱⁱ Because of these specific a priori predictions (and lack thereof in some instances), two-way ANOVAs were deemed more informative for the specific effects of interest than a standard, three-way omnibus ANOVA, the application of which was further complicated by the uneven sample distribution across valence groups that came about from a replication of the predicted pleasantness bias in the initial valence ratings.