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## Involuntary Autobiographical Memories and Future Projections in Social Anxiety

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## Abstract

Intrusive involuntary memories and images are a cardinal phenomenon in a range of psychological disorders, but not systematically examined in social anxiety. We examined potential biases upon generating involuntary versus voluntary memories and future projections in individuals with high and low levels of social anxiety. Participants recorded involuntary and voluntary autobiographical events, and their associated emotional response in a structured mental time travel diary. High social anxiety was associated with more intense anxiety and embarrassment and greater use of a range of emotion regulation strategies upon generating all types of autobiographical events. Involuntary (versus voluntary) memories and future events were associated with a heightened emotional response independent of social anxiety, and memories were associated with more embarrassment than imagined future events. The effects of high versus low social anxiety and involuntary versus voluntary generation process were independent from each other. The findings have implications for affective and cognitive models of involuntary memories and future projections in emotional disorders.

**Keywords:** social anxiety; autobiographical memory; future projections; emotion regulation; spontaneous cognition, involuntary retrieval

## **Involuntary Autobiographical Memories and Future Projections in Social Anxiety**

Intrusive involuntary memories and images are present across a range of clinical disorders (Brewin, Gregory, Lipton, & Burges, 2010). At the same time, outside psychopathology, involuntary memories and images of autobiographical events are frequent, mostly positive and typically not experienced as intrusive (e.g., Berntsen, 2009). What then renders such spontaneous thought processes problematic in clinical disorders? Here we pursue the overarching assumption that a key factor is the emotional response to the involuntary memories and images at the time they come to mind rather than the content of events and how they were processed at the time of encoding. We base this assumption on previous research showing that this emotional response generally is enhanced in internalizing disorders, irrespective of the emotional valence of the remembered events (del Palacio-Gonzalez et al., 2017), and that involuntary memories and images generally are associated with more emotional response than their voluntary counterparts in all individuals, irrespective of their clinical status (e.g., Berntsen & Hall, 2004; Berntsen & Jacobsen, 2008, del Palacio-Gonzalez et al., 2017; Rubin, Dennis, & Beckham, 2011). Following these findings, we suggest that individuals with elevated internalizing symptoms may experience involuntary memories and future events as especially bothersome and intrusive due to two independent, additive, effects. One is robust emotional biases, characteristic of internalizing disorders. The other is the involuntary formation of the mental images and the enhanced emotional response associated with such involuntary processes.

We here examine this assumption in relation to social anxiety by extending a structured diary method previously employed in dysphoria (del Palacio-Gonzalez et al., 2017). In this earlier study, the participants recorded involuntary and voluntary autobiographical memories in everyday life for which they answered a series of questions probing their emotional intensity and use of emotion regulation in response to each memory as it came to mind.

In del Palacio-Gonzalez et al.'s (2017) study, involuntary memories were experienced with more intense negative emotions (fear and anger), and were associated with greater efforts for emotion regulation for both dysphoric and non-dysphoric individuals in response to retrieving the memories. Furthermore, relative to non-dysphoric individuals, participants with dysphoria experienced more intense anger, sadness, and fear, and reported a greater use of various emotion regulation strategies upon retrieving everyday involuntary and voluntary autobiographical memories. Importantly, retrieval type and depression status did not interact with each other, thus suggesting that the heightened emotional response to autobiographical memories was explained by independent effects of involuntary retrieval and elevated depressive symptoms, respectively.

These results were consistent with previous studies involving participants diagnosed with depression (Watson et al., 2012) and PTSD (Rubin et al., 2011), as well as studies with non-clinical populations showing that involuntary memories are associated with a stronger emotional impact than intentionally retrieved memories (e.g., Berntsen & Hall, 2004; Cole, Staugaard, & Berntsen, 2016; Hyman et al., 2015). However, unlike del Palacio-Gonzalez et al. (2017), none of these studies systematically examined emotion regulation strategies in response to retrieving the memories. We here extend del Palacio-Gonzalez et al. (2017) in two ways: (1) we examine individuals who are high versus low in social anxiety, and (2) the participants report their involuntary (and voluntary) future thoughts, in addition to memories. We motivate these two strategies in the following.

First, examining involuntary cognitions in social anxiety is important since several forms of intrusions are proposed to be part of the cognitive biases in social anxiety (Clark & Wells, 1995; Hirsch and Holmes, 2007). Also, social anxiety is associated with prominent emotional deficits (Blalock, Kashdan, & Farmer, 2016; Farmer & Kashdan, 2012; D'Avanzato, Joormann, Siemer & Gotlib, 2013). While some studies have examined some aspects of the phenomenology of intrusive

images or memories in social anxiety, such as valence and intrusiveness (Hackman, Clark, & McManus, 2000; Moscovitch, et al., 2018; Tudor, Davis, Brewin, & Howell, 2013), these studies have not included a systematic comparison of the phenomenological characteristics of involuntary versus voluntary cognitions. Such comparison is crucial in order to make claims about the role of involuntary cognition processes in the context of psychopathology. Further, earlier studies have been conducted in experimental settings and/or have relied on retrospective methods, thus presenting potential limitations for the generalization to the everyday occurrence of involuntary cognitions.

A few studies have examined the emotional impact of voluntarily retrieved autobiographical memories in social anxiety (see Morgan, 2010, for a review) but findings are mixed. Rapee, McCallum, Melville, Ravenscroft, and Rodney (1994) failed to find differences between socially anxious individuals and controls regarding the intensity of anxiety experienced when retrieving word-cued autobiographical memories. In contrast, more recent findings suggest that socially anxious individuals report more intense anxiety, embarrassment, and shame upon retrieving negative memories than controls (D'Argembeau, van der Linden, d'Acremont, & Mayers, 2006; Moscovitch et al., 2012). Moreover, some of these findings suggest that a heightened negative emotional intensity in social anxiety may extend to other types of memories and cognitions. For instance, D'Argembeau et al. (2006) found that socially anxious individuals had higher anxiety ratings for both social and non-social memories, and for both positive and negative memories. Moscovitch et al. (2012) found that socially anxious individuals not only reported more embarrassment upon retrieving memories of personal social blunders, but also when imagining social blunders incurred by others. In another study, socially anxious individuals reported engaging in more cognitive suppression (i.e., a form of emotion regulation) than controls when processing negative autobiographical images and autobiographical memories (Moscovitch et al., 2013).

Second, we extend previous work by not just examining memories but also future thoughts. This strategy is consistent with a large body of research showing highly related processes involved with remembering past events and imagining future events (e.g., for reviews see D'Argembeau, 2012; Schacter, Benoit, & Szpunar, 2017). Including both memory and future thought conditions in the present context is especially important to rule out potential effects associated with how the events were experienced at the time of encoding (Berntsen & Jacobsen, 2008). If similar emotional responses are associated with the remembering (and imagining) of both past and future events, this would suggest that factors operating at the time of remembering (or imagining) are more central than factors operating at the time of the original experience (and encoding) of the event, since future events, by definition, have not yet been encountered (e.g., Berntsen & Bohn, 2010). In addition, examining future events in social anxiety is crucial for at least two reasons. First, biased anticipatory processes are proposed to be a maintaining factor of social anxiety (Clark & Wells, 1995). Second, in the same manner that self-views may be supported by the memories retrieved in social anxiety (Clark, 2001), future-oriented cognition may be both a product of, and a guide for, construing self-views in social anxiety (Krans, de Bree, & Bryant, 2014; Krans et al., 2017). To the best of the authors' knowledge, there is no empirical research on the phenomenology of future-oriented autobiographical events in social anxiety, beyond event valence (Krans et al., 2014).

### **The current study**

The primary aim of the study was to compare the emotional response to remembering and imagining past and future autobiographical events in social anxiety, both when the formation of the mental events happens involuntarily and as a result of a strategic, voluntary process. The emotional response was operationalized as the intensity of positive and negative emotions, as well as the use of emotion regulation strategies upon remembering and imagining the autobiographical events.

We assessed four emotions central to social anxiety— anxiety, embarrassment, safety, and happiness. The five emotion regulation strategies examined (brooding, reflection, cognitive suppression, emotional suppression, and cognitive reappraisal) were the same as assessed by del Palacio-Gonzalez et al. (2017), and are highly relevant for internalizing disorders (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Brooding and reflection are dimensions of rumination. The first refers to repetitive judgmental and negative self-evaluation, whereas reflection is a form of active cognitive processing seeking an understanding and/or a solution to one's problems (Whitmer & Gotlib, 2011). Thought suppression (Wegner & Zanakos, 1994) and expressive suppression refer to the inhibition of undesired thoughts and of the behavioral expression of emotions, respectively (Gross & John, 2003). Lastly, cognitive reappraisal refers to interpreting emotion-eliciting events in a manner that changes its emotional impact (Gross & John, 2003). Individuals may use any or all of these strategies consciously or unconsciously to influence their emotional experience.

A secondary aim of the study was to assess other characteristics of the events that were not directly related to emotion, including imagery, visual perspective (field vs. observer perspective), the events' temporal distance from the present, the centrality of the events for the person's life story and identity, and the degree to which the events referred to social interaction. Some of these variables have been previously examined for autobiographical memories in social anxiety, but with mixed findings (e.g., Chiupka, Moscovitch, & Bielak, 2012; D'Argembeau, et al., 2006; Moscovitch, Gavric, Merrifield, Bielak, & Moscovitch, 2011; Moscovitch et al., 2018). These mixed findings may partly reflect variations regarding the specific types of memories assessed. We therefore sought to establish general patterns of such cognitive characteristics, across both involuntary and voluntary of remembering (and imaging) as well as future versus past time orientation.

To this end, high and low socially anxious individuals completed a structured diary that required the immediate recording of four subtypes of (mental) autobiographical events: Involuntary memories, voluntary memories, involuntary future events, and voluntary future events. The primary hypotheses concerned the emotional response to autobiographical memories and future events in social anxiety. In agreement with recent findings of more intense negative emotions associated with autobiographical memories in social anxiety (e.g., Moscovitch et al., 2012; 2013), as well as the extensive literature on general emotional deficits (e.g., Dryman & Heimberg, 2018; Kashdan & Farmer, 2014), we expected socially anxious individuals to report less intense positive emotions and more intense negative emotions upon remembering and imagining autobiographical events, compared with non-anxious individuals.

Additionally, we expected socially anxious individuals to employ all emotion regulation strategies to a greater extent than non-anxious individuals. This hypothesis was formulated on the basis of earlier findings that dysphoric participants employed a range of emotion regulation to a greater extent upon memory retrieval than controls (del Palacio-Gonzalez, et al., 2017). Moreover, a recent review (Dryman & Heimberg, 2018) concluded that the deficits in emotion regulation in social anxiety both concern the extent to which emotion regulation strategies are used, as well as how the strategies are employed. Given this research, we had reasons to expect that socially anxious individuals would show more frequent and/or greater attempts to regulate emotions than low-social anxiety individuals, independent of the temporal orientation of the events or whether their occurrence was the result of a voluntary or involuntary process (see del Palacio-Gonzalez, et al., 2017).

We also expected to replicate key findings regarding characteristics of involuntary versus voluntary remembering (and imagining). Specifically, following del Palacio-Gonzalez et al. (2017), we expected a significant effect of involuntary versus voluntary formation on emotional intensity

(at least for negative emotions) and emotion regulation, for which involuntary processes would be associated with more intense emotions and more emotion regulation efforts. Further, consistent with previous work, we expected involuntary events to be more specific (e.g., Berntsen & Hall, 2004; Berntsen & Jacobsen, 2008; Berntsen, 2009). Regarding differences between memories and future events, we expected future events to be more positive, to be temporally closer to the present than memories (see Berntsen, 2019, for a recent review), and to have more observer perspective than memories (Finnbogadottir & Berntsen, 2014). Exploratory analyses were conducted for other characteristics without specified hypotheses.

## Method

### Participants

Power analyses were estimated for 2 (Involuntary versus Voluntary Process Type) x 2 (Time Orientation) x 2 (Social Anxiety Group) ANOVAs with emotional intensity and the emotion regulation strategies as dependent variables with G\*power 3.1.9.4 (Faul et al., 2007). The analyses were set at  $\alpha = .05$  and power = .80. We used del Palacio-Gonzalez et al.'s (2017) effect sizes ( $\eta^2_p$ ) obtained when analyzing emotion regulation and emotional intensity variables. According to the power analyses, 46 individuals were needed for detecting small between-within interactions ( $\eta^2_p = .03$ ,  $f = .17$ ), whereas  $N = 34$  were needed for detecting moderate group effects ( $\eta^2_p = .14$ ,  $f = .40$ ). Our analyzed sample consisted of 47 participants (24 high socially-anxious, seven men; and 23 low social-anxiety, four men). See Appendix A in the supplementary online materials for a summary of the analysis sample.

The gender distribution was not statistically different between groups,  $\chi^2(N = 47) = 0.908$ ,  $p = .272$ . The mean age of participants was 22.4 years ( $SD = 1.9$ , range 19-29),  $t(45) = 0.71$ ,  $p = .481$ . All participants were bachelor or master-level students when completing the diary. Eighty-nine

percent of the participants ( $n = 42$ ) identified themselves as Caucasian, 9% ( $n = 4$ ) as of "other" ethnic group, and 2% ( $n = 1$ ) as Middle Eastern.

## Materials

*Liebowitz Social Anxiety Scale – Self Report version* (LSAS-SR) (Rytwinski, et al., 2009). The LSAS-SR was employed as the primary measure of social anxiety. The LSAS-SR is a self-report version of the original LSAS to be administered by a clinician (Liebowitz, 1987). The self-report version contains 24 items identical to the original LSAS. The items assess anxiety during social interaction and public performance. Each item is rated for degree of fear experienced and avoidance of the situation presented. The fear ratings range from *none* (0) to *severe* (3), whereas avoidance is rated from *never* (0% = 0) to *usually* (67-100% = 3). A total score of 47 is the recommended cut-off score for diagnosing social anxiety while providing both high specificity and sensitivity (Rytwinski, et al., 2009). The LSAS was administered during the screening before commencing the diary study (T0) and upon completion of the MTT diary (T2). The internal Cronbach's  $\alpha$  was .96 at both T0 and T2.

*State Social Anxiety Scale* (SSAS) (Kashdan & Steger, 2016). We employed a seven-item self-report scale on state anxiety to assess daily social anxiety. The items are rated on a 1 (*very slightly*) to 5 (*extremely*) scale. The SSAS was completed in three occasions by each participant as a supplementary index of social anxiety: Before commencing the autobiographical events diary (T0), upon completing the first half of the diary (T1), and upon completing the entire diary (T2). The Cronbach's  $\alpha$  were  $> .89$  in all three occasions.

*Beck Depression Inventory-II* (BDI-II; Beck, et al., 1996). This self-report inventory assesses 21 depression symptoms with four response options that reflect increasing symptom frequency or severity. The BDI-II correlates strongly ( $r = .83$ ) with the number of depressive symptoms assessed by the Structured Clinical Interview for *DSM-IV* Axis I Disorders (SCID-I)

(Huprich & Roberts, 2012). The BDI-II was only administered prior to commencing the diary (T0), and its internal consistency as measured by Cronbach's  $\alpha$  was .93.

*Structured Diary for Autobiographical Memories and Future Events.* A well-established method to collect involuntary and voluntary everyday memories and future events was employed in the current study (Berntsen & Jacobsen, 2008; Finnbogadottir & Berntsen, 2011). The diary period was divided into two parts. One part focused on memories, and the other on future events. Participants were randomly assigned to start recording one of the time orientations, and then shifted to complete the second part. Participants recorded eight entries for each type of autobiographical event (i.e., involuntary memories, involuntary future projections, voluntary memories, and voluntary future projections).

Following previous studies (Berntsen & Hall, 2004; del Palacio-Gonzalez et al., 2017; Finnbogadottir & Berntsen, 2011), the diary consisted of three main steps for both the memories and future events. First, participants were to record a maximum of two involuntary cognitions per day (either memories or future events, depending on which time orientation participants had been assigned to work on first) in a notebook provided by the researchers. The rule was made to avoid taxing the participants by requesting them to report numerous entries per day, and to prevent participants from actively generating 'involuntary' memories and imaginations. Participants immediately recorded the emotional intensity, emotion regulation, key descriptors of the event, specificity, and imagery upon retrieval of the involuntary cognitions. The specific questions of the diary are listed in Table 1. The vast majority of these items has been employed in other diary studies (Del Palacio-Gonzalez, et al., 2017; Finnbogadottir & Berntsen, 2011).

The involuntary events had to be the first two that possibly occurred during a given day. Given individual differences regarding the frequency with which individuals experience involuntary mental time travel (Berntsen, Rubin, & Salgado, 2015), there was no requirement for involuntary

cognitions to be registered every day. This method also implies that the time to complete the diary varies from person to person, consistent with previous studies (e.g., Del Palacio-Gonzalez et al., 2017; Finnbogadottir & Berntsen, 2011).

The second step was to transfer the immediate ratings concerning involuntary cognitions to a structured diary questionnaire later in the day and to answer a more extensive questionnaire on the basis of the notebook recordings. At this point, participants answered additional questions for each entry, including how distant the event was from the present (event age), the centrality of the remembered or imagined event, and its valence. (See Table 1).

The last step was to uncover a cue word contained in the structured diary in order to retrieve a voluntary (i.e., word-cued) autobiographical event. The cue words were balanced with regard to their social versus non-social relevance. Of the eight cues provided, half related to social interaction (*friend, school, party, telephone*), while the other half related to non-social content (*rain, bicycle, view, book*). These cues were also a subset of cues employed in previous studies on everyday mental time travel (Berntsen & Hall, 2004; Finnbogadottir & Berntsen, 2011). The same cues were used for the memory and future-event diary parts, however, the order was varied in the two conditions. Once participants generated a voluntary entry, they answered the same series of questions they had completed for the involuntary cognitions (cf. above) but in relation to the voluntary cognitions. The diary period concluded when participants had 16 memories and 16 future events.

Participants were instructed individually by an experimenter. It was explained that the memories and future events could deal with all kinds of personal experiences, important or unimportant, pleasant or unpleasant, temporarily close or distant. Involuntary memories (and future events) were defined as past (future) events that come to mind without preceding conscious attempt to retrieve (imagine) them. The distinction between specific versus non-specific events was

explained and examples were provided by the researcher, so that participants could later rate whether the memory or future projection was specific or not specific, that is, whether they referred to a specific day in their (past or future) life. For ethical reasons, participants were allowed to exclude very personal or distressing entries that they did not want the experimenter to read. Important advantages of this diary method include reporting and rating cognitions immediately rather than retrospectively, not taxing participants by reporting numerous entries on the same day, and minimizing a selection bias by not allowing participants to select what entries to record—that is, including only the first two involuntary cognitions of the day (e.g., Berntsen, 2009).

### **Procedure**

Participants were recruited via social media and by visiting university classrooms. Interested participants completed an online screening including the LSAS-SR, the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991), the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), the White Bear Suppression inventory (WBSI; Wegner & Zanakos, 1994), and other inventories not relevant for the present study.

Two hundred and fifty-seven students completed the online screening, from which the highest (LSAS-SR  $\geq 43$ ) and lowest (LSAS-SR  $\leq 18$ ) 25th percentiles in social anxiety scores were invited to participate in the diary within a few days to form the initial high and low social anxiety groups. Seventy-six participants met with the researchers to start the diary. In a first meeting, participants were instructed orally, following standard instructions (Berntsen & Jacobsen, 2008), received the research materials, which included a notebook for immediate recording of involuntary entries, the structured diary booklet, and the written instructions on how to complete the diary (as a supplement to oral instructions). Upon finishing the first half of the diary, participants returned to the lab where they were instructed on how to complete the second half of the diary, consisting of either the past or future time orientation that was left to be completed for the participant. Once the

two time orientations were completed, participants visited the lab for the last time to return their records, being debriefed, and receive compensation (250 DKK  $\approx$  \$US 40). At this point, participants were asked if they had purposefully left out any entries because they were too personal or stressful. There were no group differences in the number of participants who left out memories,  $\chi^2(47) = 0.41$ ,  $p = .39$ , or future events,  $\chi^2(47) = 0.01$ ,  $p = .646$ . Throughout the course of the study, participants received a reminder email about the study every two weeks, unless they had finished the diary between reminders.

We collected 53 valid diaries. Six participants with LSAS-SR  $< 47$  scores at T0 in the high-social anxiety (HSA) group were excluded in order to meet the cutoff point score suggested for reaching the symptom severity of clinical populations (Rytwinski, et al., 2009). Thus, the main analyses were conducted with 24 high-social anxiety (HAS) and 23 low-social anxiety (LSA) participants. See Appendix A online for the participant's flow throughout the study.

## Results

### Diary Completion Time

Participants took significantly longer to complete the future-projections diary ( $M = 23.1$  days,  $SD = 25.2$ ), than the memory diary ( $M = 13.0$  days,  $SD = 10.3$ ),  $F(1, 45) = 10.53$ ,  $p = .002$ . However, the Group main effect,  $F(1,45) = 3.45$ ,  $p = .07$ , and the Time X Group interaction,  $F(1,45) = 2.12$ ,  $p = .15$ , were non-significant, therefore both groups completed their diaries at a similar pace.

### Group Differences in Symptom and Trait-Like Measures

Table 2 shows that the HSA group reported significantly higher levels of trait social anxiety before and after completing the diary, as well as higher state social anxiety at the beginning (T0), middle-point (T1), and after completing the diary (T2) compared to the LSA group. The HSA group had significantly higher depressive symptoms at T0 (in the mild to moderate range; Beck et al.,

1996), than the LSA group (non-clinical range). The HSA group reported significantly greater trait-like brooding, reflection, and thought suppression, but there were no significant group differences in trait-like emotional suppression and reappraisal.

### **Data Analysis Strategy**

The main analyses consisted of a series of 2 (Process Type: Involuntary vs. Voluntary) by 2 (Time: Past vs. Future) by 2 (Group: LSA vs. HSA) mixed ANOVAs that examined differences in emotional intensity and emotion regulation upon generating past and future autobiographical events. In addition, event valence was used as covariate in follow-up analyses of the identified Group differences in emotional intensity and emotion regulation.

In other analyses, another set of ANOVAs was conducted for cognitive (non-emotional) characteristics of the events, including age of event, specificity, centrality to identity, and imagery variables. Tables 3 and 4 show the main analyses, whereas Tables 5 and 6 report other analyses.

### **Emotional Intensity and Emotion Regulation of Autobiographical Events**

**Emotional Intensity.** There was a significant Group effect related to negative emotions. Socially-anxious individuals reported more intense embarrassment and anxiety in relation to all event subtypes compared with the LSA individuals. Further, HSA individuals reported lower happiness than LSA individuals. There were no significant Group effects for safety. No Group interactions were significant. See Table 3 for *Ms* and *SDs* and Table 4 for effect parameters.

Involuntary versus voluntary generation (Process) and temporal direction (Time) were both related to the intensity of negative emotions. For anxiety, a significant effect of Time was qualified by a significant Time x Process interaction. Follow-up tests indicated that both involuntary memories,  $t(52) = 4.23, p < .001$ , and involuntary future events,  $t(52) = 6.27, p < .001$ , were more anxiety provoking than their voluntary counterparts. However, the involuntary vs. voluntary process difference was larger for future events,  $M_{\text{diff}} = .59, p < .001$ , than for memories,  $M_{\text{diff}} = .27, p <$

.001. Thus, of all event subtypes, involuntary future events were the most anxiety intense upon imagining. For embarrassment, an effect of Process reflected that events generated involuntarily was more intense, and a Time effect indicated that memories were related to more embarrassment than future events.

Contrary to expected, voluntarily generated autobiographical events were rated as both safer and happier than involuntary events. However, this was qualified by an interaction with Time, indicating that voluntary future events felt safest compared to memories and involuntary future events. There were no significant interactions predicting happiness.

**Emotion Regulation.** There were significant Group effects for all five emotion regulation strategies assessed, thus our hypotheses were supported. Socially anxious individuals engaged in greater brooding, cognitive suppression, emotional suppression, reflection, and reappraisal than non-anxious individuals upon experiencing autobiographical mental events. All the Group interactions were non-significant. See Tables 3 and 4.

Also as expected, all five emotion regulation strategies assessed were rated higher for involuntary versus voluntary process. However, significant Time X Process interactions qualified these effects. In general, involuntary future events were rated numerically higher across the five emotion regulations strategies compared to voluntary events. In addition, the pattern for brooding, emotional suppression, and reappraisal, specifically, indicated that the difference between involuntary and voluntary future events was greater than the difference between involuntary and voluntary memories.

There was only one effect of Time on emotion regulation, indicating that the use of reappraisal was higher upon imagining future events than remembering past events.

### **Other Autobiographical Event Characteristics**

**Event Valence.** As expected, socially anxious individuals rated their events significantly less positive than non-anxious individuals. Further, involuntary future events and memories were less positive than their voluntary counterparts. In supplementary analyses, we found that although event valence was significantly associated with the intensity of negative emotions, happiness, and the use of emotion regulation, the majority of group effects in emotional intensity and emotion regulation did not simply reflect that socially anxious individuals recorded less positive events (see online supplementary Appendix B for details).

**Social Content.** There were no Group effects for the degree of social interaction ( $ps > .12$ ), or for the distribution of entries with different number of people involved in each type of event (none, one, two or more)  $\chi^2(100) < 1.84, ps > .40$ .

For degree of social interaction, there was a significant main effect of Process, in which the involuntarily generated events more frequently were about social interaction (See Tables 5 and 6). The Time main effect and the interactions were not significant ( $ps > .09$ ).

**Centrality.** There were significant main effects of Group, Time, and Process on event centrality. The Group effect showed that HSA individuals appraised their events as more central to identity than LSA individuals. A Time X Process interaction qualified the Time and Process main effects and indicated that future events were overall more central than memories, and that the difference between involuntary future events and involuntary memories was greater than the difference between their voluntary counterparts ( $p = .001$ ) (see Tables 5 and 6).

**Other characteristics.** There were no significant Group main effects or Group interactions for specificity, event age, imagery (i.e., events experienced as pictures), and vantage point or perspective (See Table 5).

We replicated earlier work showing higher levels of specificity for involuntary memories and future events than for their voluntary counterparts (e.g., Berntsen & Jacobsen, 2008). However,

this effect was qualified by an interaction with Time, reflecting that this difference was greater for future than for past events ( $p = .038$ ). Similarly, we replicated earlier work showing reduced specificity for future compared with past events ( $p = .039$ ). Event age was operationalized as the temporal distance from the present (in months) at which the events had taken place (memories) or when the events were projected to happen (future). The interaction indicated that future events were significantly closer to the present than the memories ( $p < .001$ ). At the same time, voluntary memories were temporally farther from the present, compared to all other events, including involuntary memories ( $p = .006$ ) (see Tables 5 and 6).

There were significant Time orientation effects for vantage perspective. Memories were experienced more from an “own eyes” perspective than future events. Conversely, future events were experienced more from an “observer” perspective than memories, consistent with earlier findings (Finnbogadottir & Berntsen, 2014).

## Discussion

In order to remedy a lack of research on involuntary self-related cognitions in social anxiety, we extended a structured diary method previously used in research on depression, dysphoria, and PTSD to compare involuntary versus voluntary memories and future events in social anxiety. Our primary focus was on the emotional response upon remembering and imagining autobiographical events. Other non-emotional characteristics of the events were also examined.

As expected, we found that social anxiety was associated with a heightened emotional response upon generating all types of autobiographical events in that socially anxious individuals reported more intense negative emotions and greater emotion regulation upon remembering and imagining the events than non-anxious individuals. The group effects on emotion variables did not interact with the type of process (involuntary vs. voluntary) or time orientation of the events (past vs. future).

In line with emotional biases that characterize social anxiety, we found that, as expected, socially anxious individuals experienced more intense anxiety and embarrassment when remembering and imagining future autobiographical events than did non-anxious individuals. Consistent with our hypotheses, socially anxious individuals employed all the emotional regulation strategies assessed to a greater extent than non-anxious individuals, including greater brooding, reflection, reappraisal, cognitive suppression, and emotional suppression upon generating autobiographical events. Also consistent with previous findings employing other research paradigms (e.g., Krans et al., 2014; Moscovitch et al., 2011), socially anxious individuals reported fewer positive events, thus suggesting a diminished positivity bias in their everyday mental time travel. Supplementary statistical analyses showed that the lower positive event valence in social anxiety explained some emotion regulation effects, but did not fully account for the more intense negative emotions experienced by socially anxious individuals.

Socially anxious individuals did not report events that had more social content, but socially anxious individuals appraised the reported events as more central to their identity than control participants. The difference, albeit small, could play a role in the emotional response to remembering and/or projecting future events. This finding warrants further examination, however, it is compatible with other studies in which memories highly central to identity are related to a heightened emotional response (del Palacio-Gonzalez & Berntsen, 2018). Social anxiety was not systematically related to other non-emotional, cognitive characteristics of the events.

The emotional biases found in social anxiety replicate and extend the findings by Del Palacio-Gonzalez et al. (2017) with dysphoric individuals in two ways. First, similar to dysphoria, the elevation of a different type of internalizing symptoms, namely social anxiety, was associated with more intense negative emotions and greater emotion regulation across voluntarily and involuntarily retrieved memories.

Second, the present findings showed that such emotional bias extend to future projections in the context of social anxiety, and suggest that a heightened emotional response in social anxiety may apply to different types of cognitions. Previous studies found that socially anxious individuals reported more intense negative emotions when retrieving both social and non-social memories of both positive and negative valence (D'Argembeau et al. 2006), and when imagining blunders committed by others (Moscovitch et al., 2012). Another study found that socially anxious participants employed more cognitive suppression, a type of emotion regulation strategy, when retrieving negative self-images (Moscovitch et al., 2011). Therefore, our findings that socially anxious individuals overall experience more intense negative emotions and employ various emotion regulation to a greater extent than low anxiety individuals are consistent with findings focusing on specific types of cognitions.

Our findings have theoretical implications for understanding both emotion regulation processes and involuntary cognition in social anxiety, and potentially other internalizing disorders. First, previous findings with dysphoria (del Palacio-Gonzalez et al., 2017) and the present findings with social anxiety are consistent with shared emotional difficulties in social anxiety and depression (Aldao, et al., 2010; Dryman & Heimger, 2018), as well as more intense negative emotions in daily life (Blalock et al., 2016; Kashdan & Steger, 2014). In an important extension of these previous studies, we here found that this response appears not only in relation to demands of the external environment, but also in response to memories and future projections generated by the self.

Relatedly, our findings support the notion that the uncontrolled nature of involuntary memories and/or future events have an important emotional impact on all individuals. Berntsen (2009) has proposed that this effect is at least partly due to the lack of opportunity to prepare for an unexpected stimulus (e.g., an involuntary memory) by regulating emotions. Such basic processes may explain an individual's emotional experience not only upon retrieving involuntary memories in

daily life, but also upon experiencing other forms of involuntary or cognitions, such as automatic thoughts and intrusive imagery in the context of psychopathology in general (Brewin et al., 2010), and social anxiety in particular.

In addition to the emotional biases in social anxiety, several hypotheses concerning involuntary versus voluntary remembering and imagining were supported. We replicated the independent effects of involuntary retrieval on (negative) emotional intensity and emotion regulation reported by del Palacio-Gonzalez et al. (2017). By extending the examination to future events, we supported the notion that the more intense negative emotions and the greater efforts to regulate the emotions associated with involuntary memories are not easily attributable to factors taking place during the encoding of the events, but more likely reflect the involuntary process itself.

We also replicated previous work that involuntary memories and future events are more specific than their voluntary parallels (e.g., Berntsen & Jacobsen, 2008), and that future events are more central to life story and identity, less specific (Berntsen & Bohn, 2010) and temporally closer to the present than are memories (Berntsen & Jacobsen, 2008; Cole et al., 2016; Spreng & Levine, 2006). Lastly, there was a novel finding indicating an interaction between involuntary processes and future projections on the intensity of anxiety. Specifically, involuntary future projections were associated with the highest anxiety intensity compared to the other three types of events. Further, involuntary future events were also associated to higher use of brooding, emotional suppression, and reappraisal. These patterns were not different for socially anxious individuals and non-anxious individuals.

The study has limitations. First and foremost, the sample consisted primarily of women. Given gender differences in emotion regulation (Zimmerman & Iwanski, 2014), our findings may not generalize to men. Second, we purposefully selected a sample of young adults, because both autobiographical memory and emotion regulation change with age (Levine, Svoboda, Hay,

Winocur, Moscovitch, 2002; Zimmerman & Iwanski, 2014). Thus, future research could examine whether our results generalize to other age groups. Third, all the ratings were based on self-report. This method makes it difficult to separate true emotional biases from biased interpretations. Future research employing naturalistic designs could combine self-reports with objective measures of emotional response, such as galvanic skin response and heart rate. Relatedly, many of the constructs were assessed via single items. Single items assessing emotion regulation in naturalistic studies have been found to be reliable and valid (Ong, Bergeman, Bisconti, & Wallace, 2006), however, they may still pose conceptual limitations compared to other more thorough assessments. Fourth, our findings identified broad emotional biases in social anxiety related to remembering and imagining future events irrespective involuntary versus voluntary activation process. However, they do not rule out the possibility that memories or future events with a specific constellation of characteristics (e.g., highly important autobiographical events) may be associated with different emotional responses. In this regard, future research may include analyses in which different categories of the remembered and imagined events are analyzed. Lastly, although the sample size was adequately powered for analyses on emotional intensity and emotion regulation, we did not conduct power analyses for analyzing other variables, such as imagery and centrality. For this reason, the non-hypothesis driven, novel findings should be taken with caution (e.g., that involuntary future events were associated with more intense anxiety). Overall, replications of our main findings with other methodologies would further strengthen our interpretations.

In conclusion, the present findings point to a general emotional bias present upon remembering and imagining autobiographical events in social anxiety. We did not find support for a special role for involuntary self-related cognitions in social anxiety in relation to any of the characteristics assessed for memories and future events, consistent with previous work involving both clinical and non-clinical populations (del Palacio-Gonzalez et al., 2017; Rubin, et al., 2011;

Watson et al., 2012). Therefore, we suggest that individuals with elevated internalizing symptoms, including social anxiety (present study), depression (Watson et al., 2012), and PTSD (Rubin, et al., 2011) may experience involuntary memories and future events as intrusive due to two independent effects on the emotional response upon retrieval of autobiographical events. One effect is driven by involuntary retrieval, and another by robust emotional biases characteristic of internalizing disorders.

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**Data availability statement.** Data are available from the first author upon request.

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Table 1

*Structured diary. Questions completed for both involuntary and voluntary autobiographical events. The wording for the future events reflected such temporal orientation.*

- 
1. *\*(Pre-Retrieval Mood)* What was your overall mood before the memory came to mind?<sup>1</sup>
  2. *\*(Imagery)* When the memory came to mind, I could see it in my mind (e.g. it was a visual image)
  3. *\*(Perspective)* When the memory came to mind, it was as if I predominantly saw what happened from the perspective of...
    - a. My own eyes
    - b. An observer's eyes
  4. *\*(Words)* The memory came to mind in the form of words
  5. *\*Describe the memory*
  6. *(Number of people)* Were there other people in this memory?<sup>2</sup>
  7. *(Social interaction)* Did the situation require you to interact with others?
  8. *\*(Emotional Intensity)* How intense were your emotions immediately after the memory came to mind?:
    - a. Anxiety
    - b. Happiness
    - c. Safety
    - d. Embarrassment
    - e. Other
  9. *\*(Emotion regulation)* Right after you had this memory, how much did you do any of the following?
    - a. *(Brooding)* I thought: Why do I always react this way?
    - b. *(Thought suppression)* I tried not to keep thinking about this memory
    - c. *(Reflection)* I analyzed the event to try to understand my feelings
    - d. *(Emotional suppression)* I controlled my emotion by not expressing it
    - e. *(Reappraisal)* I changed the way I was thinking about the situation
  10. *(Specificity)* Was the memory about an event in a specific day in your past?<sup>3</sup>
  11. *(Event age)* How long ago did the event(s) related to the memory happen? / When do you think the events related to the projection will happen?<sup>4</sup>
  12. *(Valence)* How positive or negative was the event when it took place? / How positive or negative would the event be if it were to take place?<sup>1</sup>
  13. *(Centrality)* The event(s) associated with this memory<sup>5</sup>
    - a. Is an important part of my identity
    - b. Has become a central part of my life story
- 

*Note.* The majority of the items were rated from 1 = *Not at all* to 5 = *A great deal*, with the following exceptions:

<sup>1</sup>Ratings from 2 = *Very Negative* to +2 = *Very positive*

<sup>2</sup>Circle one option: I was alone; There was one more person; There were more than one other person

<sup>3</sup>Participant rated: Yes = *Specific* or No = *Non-specific*

<sup>4</sup>Distance from the present. Participants were asked to give their best estimates for how long ago the events took place (memories) or when they estimated the retrieved event would take place (future projections). All answers were converted into months.

<sup>5</sup> Ratings from 1 = *Strongly disagree* to 5 = *Strongly agree*

\* These questions were answered immediately upon retrieval of the autobiographical event.

Table 2

*Symptom Level and Measures of Emotion Regulation and Thought Suppression among Low and High Social Anxiety Groups*

	LSA ( <i>n</i> = 23)		HSA ( <i>n</i> = 24)		<i>t</i> (45)	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
LSAS T0	12.87	4.43	61.20	12.09	18.03	<.001
LSAS T2	17.26	9.27	59.95	15.99	11.13	<.001
SSAS T0	1.14	0.28	1.80	0.74	3.94	<.001
SSAS T1	1.27	0.40	2.13	0.79	4.62	<.001
SSAS T2	1.14	0.22	2.17	0.98	4.67	<.001
BDI T0	4.48	3.80	17.62	10.66	4.91	<.001
RRS Brooding T0	7.48	2.35	12.83	3.63	5.58	<.001
RRS Reflection T0	8.26	3.00	12.08	3.17	4.40	<.001
ERQ Emo. Sup. T0	11.63	4.34	14.17	6.06	1.64	.107
ERQ Reappraisal T0	29.67	4.77	27.42	6.98	-1.29	.204
WBSI Thou.Sup. T0	39.26	10.31	59.75	6.04	8.35	<.001

*Note.* BDI = Beck Depression Inventory – II; ERQ = Emotion Regulation Questionnaire; LSAS = Liebowitz Social Anxiety Scale – Self report; RRS = Ruminative Responses Scales; SSAS = State Social Anxiety Scale; T0 = Before completing the diary; T1 = Mid-point diary assessment; T2 = Re-assessment after completing the memory diary; WBSI = White Bear Suppression Inventory.

Table 3

*Means and SDs of the emotional responses upon retrieval of everyday mental time travel in low and high socially anxious individuals.*

	Low Social Anxiety ( <i>n</i> = 23)				High Social Anxiety ( <i>n</i> = 24)			
	Memories		Future Events		Memories		Future Events	
	Involuntary <i>M</i> ( <i>SD</i> )	Word-cued <i>M</i> ( <i>SD</i> )	Involuntary <i>M</i> ( <i>SD</i> )	Word-cued <i>M</i> ( <i>SD</i> )	Involuntary <i>M</i> ( <i>SD</i> )	Word-cued <i>M</i> ( <i>SD</i> )	Involuntary <i>M</i> ( <i>SD</i> )	Word-cued <i>M</i> ( <i>SD</i> )
<i>Emotional Intensity</i>								
Happiness	3.21 (0.70)	3.42 (0.76)	3.38 (0.61)	3.47 (0.75)	2.78 (0.69)	2.82 (0.63)	2.95 (0.80)	3.25 (0.81)
Safety	2.73 (0.85)	2.91 (0.70)	2.70 (0.69)	3.19 (0.73)	2.54 (0.63)	2.69 (0.60)	2.47 (0.91)	2.85 (0.83)
Anxiety	1.49 (0.53)	1.27 (0.32)	1.72 (0.51)	1.27 (0.23)	2.04 (0.54)	1.72 (0.54)	2.51 (0.76)	1.72 (0.57)
Embarrassment	1.62 (0.54)	1.36 (0.32)	1.46 (0.50)	1.21 (0.24)	2.18 (0.40)	2.03 (0.61)	1.99 (0.57)	1.57 (0.49)
<i>Emotion Regulation</i>								
Brooding	1.35 (0.55)	1.28 (0.54)	1.54 (0.74)	1.24 (0.39)	1.92 (0.61)	1.76 (0.59)	2.18 (0.79)	1.71 (0.63)
Thought Sup.	1.42 (0.36)	1.19 (0.26)	1.56 (0.47)	1.17 (0.17)	2.16 (0.66)	1.95 (0.71)	2.18 (0.66)	1.61 (0.64)
Emotional Sup.	1.71 (0.83)	1.54 (0.87)	1.74 (0.81)	1.340 (0.47)	1.98 (0.73)	1.76 (0.58)	1.97 (0.66)	1.53 (0.71)
Reflection	1.42 (0.48)	1.26 (0.58)	1.51 (0.70)	1.17 (0.40)	2.23 (0.78)	2.14 (0.78)	2.42 (0.88)	2.03 (0.92)
Reappraisal	1.40 (0.50)	1.15 (0.30)	1.49 (0.49)	1.24 (0.32)	1.80 (0.53)	1.63 (0.53)	2.18 (0.82)	1.64 (0.65)
<i>Other</i>								
Pre-retrieval Mood <sup>a</sup>	0.99 (0.46)	1.00 (0.55)	0.96 (0.40)	1.04 (0.53)	0.47 (0.47)	0.54 (0.35)	0.44 (0.45)	0.46 (0.47)
Event Valence <sup>a</sup>	0.78 (0.54)	1.00 (0.45)	0.97 (0.42)	1.05 (0.45)	0.28 (0.49)	0.43 (0.62)	0.55 (0.57)	0.88 (0.57)

*Note.* The emotional intensity and emotion regulation items were rated in a scale from 1 = *Not at all* to 5 = *A great deal*.

<sup>a</sup> Items were rated from -2 (*very negative*) to +2 (*very positive*).

Table 4

*Main and interaction effects for emotion-related variables of autobiographical events, including 95% confidence intervals.*

	Group	Process Type	Time	Group*Proc.	Group * Time	Proc. * Time
<i>Emotional Intensity upon Retrieval</i>						
Happiness	$F = 6.55^*$ , $\eta^2_p = .13$ , [.01, .31]	$F = 4.93^*$ , $\eta^2_p = .10$ , [.00, .27]	$F = 4.52^*$ , $\eta^2_p = .09$ , [.00, .26]	$F = 0.03$ , $\eta^2_p < .01$ , [.00, .07]	$F = 0.93$ , $\eta^2_p = .02$ , [.00, .15]	$F = 0.36$ , $\eta^2_p < .01$ , [.00, .12]
Safety	$F = 2.13$ , $\eta^2_p = .04$ , [.00, .20]	$F = 17.15^{***}$ , $\eta^2_p = .28$ , [.08, .45]	$F = 0.68$ , $\eta^2_p = .01$ , [.00, .14]	$F = 0.25$ , $\eta^2_p < .01$ , [.00, .11]	$F = 0.14$ , $\eta^2_p < .01$ , [.00, .10]	$F = 5.13^*$ , $\eta^2_p = .10$ , [.00, .28]
Anxiety	$F = 27.40^{***}$ , $\eta^2_p = .38$ , [.16, .54]	$F = 56.48^{***}$ , $\eta^2_p = .56$ , [.35, .68]	$F = 5.23^*$ , $\eta^2_p = .10$ , [.00, .28]	$F = 3.55$ , $\eta^2_p = .07$ , [.00, .24]	$F = 0.56$ , $\eta^2_p = .01$ , [.00, .13]	$F = 11.09^{***}$ , $\eta^2_p = .38$ , [.03, .38]
Embarrassment	$F = 31.16^{***}$ , $\eta^2_p = .41$ , [.19, .57]	$F = 20.12^{***}$ , $\eta^2_p = .31$ , [.10, .48]	$F = 14.26^{***}$ , $\eta^2_p = .24$ , [.05, .42]	$F = 0.05$ , $\eta^2_p < .01$ , [.00, .08]	$F = 1.62$ , $\eta^2_p = .01$ , [.00, .18]	$F = 1.60$ , $\eta^2_p = .01$ , [.00, .18]
<i>Emotion Regulation upon Processing</i>						
Brooding	$F = 16.41^{***}$ , $\eta^2_p = .27$ , [.07, .45]	$F = 12.79^{***}$ , $\eta^2_p = .22$ , [.04, .40]	$F = 1.58$ , $\eta^2_p = .03$ , [.00, .18]	$F = 0.84$ , $\eta^2_p = .02$ , [.00, .15]	$F = 0.04$ , $\eta^2_p < .01$ , [.00, .07]	$F = 7.48^*$ , $\eta^2_p = .14$ , [.01, .32]
Thought Sup.	$F = 36.84^{***}$ , $\eta^2_p = .45$ , [.22, .60]	$F = 29.76^{***}$ , $\eta^2_p = .40$ , [.18, .56]	$F = 0.42$ , $\eta^2_p < .01$ , [.00, .12]	$F = 0.43$ , $\eta^2_p < .01$ , [.00, .13]	$F = 1.97$ , $\eta^2_p = .04$ , [.00, .20]	$F = 4.94^*$ , $\eta^2_p = .10$ , [.00, .27]
Emotional Sup.	$F = 9.51^{***}$ , $\eta^2_p = .17$ , [.02, .36]	$F = 28.03^{***}$ , $\eta^2_p = .38$ , [.16, .54]	$F = 0.96$ , $\eta^2_p = .02$ , [.00, .15]	$F = 0.60$ , $\eta^2_p < .01$ , [.00, .14]	$F = 1.09$ , $\eta^2_p = .02$ , [.00, .16]	$F = 4.56^*$ , $\eta^2_p = .09$ , [.00, .27]
Reflection	$F = 9.28^{***}$ , $\eta^2_p = .17$ , [.02, .35]	$F = 14.10^{***}$ , $\eta^2_p = .24$ , [.05, .42]	$F = 0.01$ , $\eta^2_p < .01$ , [.00, .05]	$F = 0.01$ , $\eta^2_p < .01$ , [.01, .05]	$F = 0.28$ , $\eta^2_p < .01$ , [.00, .11]	$F = 4.23^*$ , $\eta^2_p = .09$ , [.00, .26]
Reappraisal	$F = 15.56^{***}$ , $\eta^2_p = .26$ , [.06, .44]	$F = 19.20^{***}$ , $\eta^2_p = .30$ , [.09, .48]	$F = 5.40^*$ , $\eta^2_p = .11$ , [.01, .28]	$F = 0.54$ , $\eta^2_p < .01$ , [.00, .13]	$F = 0.77$ , $\eta^2_p = .02$ , [.00, .15]	$F = 4.23^*$ , $\eta^2_p = .09$ , [.00, .26]
<i>Mood and valence</i>						
Pre-retrieval	$F = 20.65^{***}$ , $\eta^2_p = .31$ , [.10, .49]	$F = 1.68$ , $\eta^2_p = .01$ , [.00, .18]	$F = 0.22$ , $\eta^2_p < .01$ , [.00, .11]	$F = 0.01$ , $\eta^2_p < .01$ , [.00, .05]	$F = 0.26$ , $\eta^2_p < .01$ , [.00, .11]	$F = 0.01$ , $\eta^2_p < .01$ , [.00, .05]
Mood						
Event Valence	$F = 26.45^{***}$ , $\eta^2_p = .37$ , [.15, .53]	$F = 6.83^*$ , $\eta^2_p = .13$ , [.01, .31]	$F = 8.37^*$ , $\eta^2_p = .16$ , [.01, .34]	$F = 0.37$ , $\eta^2_p < .01$ , [.00, .12]	$F = 2.08$ , $\eta^2_p = .04$ , [.00, .20]	$F = 0.03$ , $\eta^2_p < .01$ , [.00, .07]

Note. All  $F$ s (1,45). The Group X Time X Process interactions were all not significant,  $ps > .13$ .

Proc. = Process Type. Sup = Suppression.

\*\*\*  $p < .005$ . \* $p < .05$

Table 5  
Means and SDs of other phenomenological characteristics of everyday mental time travel in low and high socially anxious individuals

	Low Social Anxiety ( <i>n</i> = 23)				High Social Anxiety ( <i>n</i> = 24)			
	Memories		Future Events		Memories		Future Events	
	Involuntary	Word-cued	Involuntary	Word-cued	Involuntary	Word-cued	Involuntary	Word-cued
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )
<i>Social</i>								
Interaction	3.51 (0.64)	3.00 (0.86)	3.57 (0.53)	2.79 (0.66)	3.53 (0.73)	3.15 (0.69)	3.53 (0.68)	2.92 (0.60)
Specificity <sup>a</sup>	0.84 (0.15)	0.71 (0.18)	0.64 (0.28)	0.48 (0.26)	0.82 (0.13)	0.73 (0.17)	0.73 (0.16)	0.46 (0.25)
Centrality <sup>b</sup>	1.93 (0.51)	1.80 (0.46)	2.37 (0.76)	1.99 (0.52)	2.21 (0.60)	2.23 (0.63)	2.63 (0.72)	2.30 (0.73)
Event Age (months)	38.82 (33.97)	60.42 (34.77)	26.58 (47.05)	14.48 (14.74)	48.44 (33.11)	56.33 (27.51)	15.84 (24.32)	16.83 (21.23)
<i>Imagery</i>								
In Pictures	4.00 (0.87)	3.99 (0.80)	3.91 (0.92)	3.96 (0.86)	3.86 (0.57)	3.84 (0.52)	3.60 (0.70)	3.86 (0.71)
Own-Eyes P.	3.58 (0.88)	3.52 (1.00)	3.42 (0.85)	3.25 (1.03)	3.57 (0.78)	3.33 (0.76)	3.25 (0.96)	3.14 (0.77)
Observer P.	2.34 (0.84)	2.37 (0.96)	2.60 (0.89)	2.68 (0.95)	2.52 (0.86)	2.86 (0.90)	2.84 (0.93)	2.93 (0.84)
In Words	1.92 (0.74)	1.62 (0.54)	2.00 (0.82)	1.66 (0.64)	1.96 (0.78)	1.68 (0.59)	2.27 (0.99)	1.84 (0.72)

Note. P = perspective. Unless otherwise noted, items were rated in a scale from 1 = *Not at all* to 5 = *A great deal*

<sup>a</sup> Proportion out of 100%.

<sup>b</sup> Average of two items (identity and life story) each rated 1 to 5.

Table 6

*Main and interaction effects for other phenomenological characteristics of autobiographical events.*

	Main Effects						Two-Way Interactions					
	Group		Process Type		Time		Group x Proc.		Group x Time		Proc. x Time	
	<i>F</i> (1,45)	$\eta^2_p$	<i>F</i> (1,45)	$\eta^2_p$	<i>F</i> (1,45)	$\eta^2_p$	<i>F</i> (1,45)	$\eta^2_p$	<i>F</i> (1,45)	$\eta^2_p$	<i>F</i> (1,45)	$\eta^2_p$
Social Interaction Specificity <sup>a</sup>	0.21	<.01	38.72***	.46	1.28	.03	0.65	.01	0.06	<.01	0.76	.06
Centrality <sup>b</sup>	5.02*	.10	8.35***	.16	12.92***	.22	0.50	.01	0.16	<.01	8.40***	.16
Event Age (months)	0.01	<.01	1.50	.03	54.65***	.55	0.01	<.01	0.62	.01	9.32***	.17
<i>Imagery</i>												
In Pictures	0.77	.02	1.49	.03	2.15	.05	0.81	.02	0.22	<.01	2.49	.05
Own-Eyes P.	0.28	<.01	3.93	.08	4.99*	.10	0.14	.71	0.03	<.01	<.01	<.01
Observer P.	1.72	.04	3.07	.02	6.08*	.12	0.97	.02	0.17	<.01	0.78	.02
In Words	0.73	.02	15.32*	.25	2.20	.05	0.02	<.01	0.82	.02	0.67	.01

Notes. *N* = 47. P = Perspective; Proc. = Process Type

The Group X Time X Process interactions were all not significant, *ps* > .13, except for Event Age, for which there was a trend (*p* = .05).

<sup>a</sup> Proportion out of 100%.

<sup>b</sup> Average of two items (identity and life story) each rated 1 to 5.

\*\*\* *p* < .006. \**p* < .05