Orally Retrieved Negative Autobiographical Events are Associated with Increased Heart Rate as Compared with Fabricated Ones

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Abstract

While it is well-established that authentic emotional autobiographical memories elicit physiological responses, research suggests that this elicitation can also occur for fabricated autobiographical memories. Yet challenges arise from awareness discrepancies when considering two research fields: Participants in memory studies may be unaware of producing false memories, while liars are aware of fabricating false events. Hence, in two experiments, we compared the psychophysiological pattern of true autobiographical memories with fabricated memory narratives. Using non-invasive biometric devices to measure Heart Rate (HR) and Skin Conductance Level (SCL), participants were tasked with recalling both true and fabricated negative and neutral autobiographical experiences in a written (Experiment 1) and oral (Experiment 2) way. While in Experiment 1, no statistically significant differences were detected in participants' physiological responses across different recall types, in Experiment 2, we found higher HR responses during the recollection of true negative memories as compared with true neutral and fabricated memory accounts. These latter findings confirm that negative autobiographical memories might be associated with increased HR responses when they are recalled verbally. Furthermore, they suggest that people's awareness of memory authenticity (i.e., recalling true versus fabricated events) may be linked to corresponding physiological reactions linked to specific recollections.

Keywords: Autobiographical memory; emotional memory; false and fabricated memories; physiological responses; awareness

Orally Retrieved Negative Autobiographical Events are Associated with Increased Heart Rate as Compared with Fabricated Ones

Autobiographical memories are personal recollections of past events, experiences, that occurred at specific times and places in people's lives, contributing to their sense of identity and self-awareness (Conway & Pleydell-Pearce, 2000; Conway & Rubin, 1993). In reflecting upon personal past events, memories may vary in how easily they come to mind and how detailed they are. Although not all autobiographical memories are equally emotionally arousing (i.e., intensity or level of activation associated with the emotional response caused by a memory; Talarico, 2004) recalling personal events frequently elicits emotional reactions (Philippot et al., 2003; Schaefer & Philippot, 2005; Schwartz et al., 1981). Whereas it is established that emotional events (positive or negative) are far better remembered than neutral events (Christianson, 1992; D'Argembeau et al., 2003; Schooler & Eich, 2000), some studies have also shown that recollection of emotional experiences is associated with physiological changes (Marci et al., 2007; Kreibig, 2010). That is, autobiographical memories, often tied to emotional contents, trigger neurochemical reactions, resulting in physiological responses (McGaugh, 2015) analogous to the reactions elicited when the original experience took place. Moreover, studies have demonstrated that involuntary memories are more frequently accompanied by physiological changes compared to voluntary ones (Barzykowski & Mazzoni, 2022), indicating that physiological reactions play a significant role in the retrieval of autobiographical memories (see Barzykowski & Staugaard, 2016; 2018).

Taken together, previous research has examined physiological responses during memory retrieval, revealing some variations in both cardiovascular and electrodermal activities by measuring heart rate (HR) and skin conductance level (SCL), respectively. For instance, Schaefer and Philippot (2005) assessed cardiovascular and electrodermal activity while participants retrieved neutral and emotionally charged autobiographical memories. Findings revealed noteworthy physiological alterations (increased HR and SCL) during emotional memory retrieval as compared

with neutral memories. Moreover, Marci and colleagues (2007) examined skin conductance and HR variability in participants recalling autobiographical memories depicting anger, happiness, and sadness. Anger was shown to be the only emotion demonstrating a significant increase in skin conductance and HR.

Having established that recalling personal experiences activates physiological components due to their inherently emotional nature (Foster & Webster, 2001; Kreibig, 2010), it is also important to consider that people may sometimes show emotional, as well as physiological, reactions in response to fabricated memory accounts. Two lines of research provide insight into potential differences in physiological reactions when comparing genuine (true) and fabricated (false) memory accounts. On the one hand, research has tried to distinguish between true and false memories, namely recollections of events that never occurred (Loftus, 2005), based on several aspects, including people's physiological responses (e.g., Faulker & Leaver, 2016). On the other hand, there is research suggesting differences in physiological responses when people engage either in telling the truth or fabricating memory reports (e.g., Lykken, 1959; Podlesny & Raskin, 1977), also considered as an act of lying (Battista & Otgaar, 2022; Vrij et al., 2008). Drawing upon these lines of research, the current work aimed to investigate, to what extent, true emotional autobiographical memories provoke physiological responses as compared with voluntarily fabricated memory accounts.

Physiological Responses to True and False Memories

Many investigations have attempted to evaluate the accuracy of individuals' memory reports through various methods and techniques, including detailed statement analyses (e.g., reality monitoring; Johnson & Raye, 1981; Otgaar et al., 2009; Porter et al. 1999; Schooler et al., 1986). Although these studies indicate distinctions between true and false memories, such as variances in perceptual, contextual, and affective details, a definitive profile of properties to unequivocally distinguish between true and false emotional memories remains elusive (see Wachendörfer &

Oeberst, 2023). Additionally, other studies have tried to differentiate true from false memories in terms of self-reported emotionality measures but failed to reveal any notable difference (see Kaplan et al., 2016; Laney & Loftus, 2008). For those reasons, some researchers argued that more objective measures, such as physiological measures, could assist in uncovering a more nuanced distinction in people's responses to these memories. For instance, Faulker and Leaver (2016) compared participants' physiological responses [i.e., HR, electrodermal activity (EDA), and electromyographic activity (EMG)] when they recalled true and false memories. These authors revealed a notable difference between true and false memories, particularly in terms of EDA and EMG responses, but not in terms of HR. That is, overall, participants exhibited significantly greater EDA and EMG activations when recalling false memories than true ones. However, this distinction was not observed for negative memories.

By contrast, McNally et al. (2004) focused on the emotional intensity of an improbable, if not impossible, event. Participants, who believed and remembered they had been abducted by aliens, exhibited heightened physiological arousal (i.e., HR, SCL, and EMG) and self-reported emotionality when guided through an imagery recount of the experience, as compared with control participants who did not share this belief but underwent the same imagery exercise. Interestingly, the abductees showed greater physiological arousal in response to the alien abduction imagery than to self-reported experiences. However, the difference in physiological responses between the abduction (presumed to be false) and other traumatic experiences (presumed to be true) was not statistically significant. To some extent, therefore, McNally and colleagues' (2004) results indicated that both true and false negative memories elicited similar physiological responses in terms of arousal. It is vital to note that, in those previous studies, people were unaware they reported a false account. However, under certain circumstances, people are cognizant that they are pretending to recall something true.

Physiological Responses to Telling the Truth and Lying

A plethora of research adopted behavioral, autonomic, and neural measures along with paradigms designed to study lie detection, wherein participants' physiological reactions to truthful answers were pitted against deceptive ones in high-stakes situations (see Meijer et al., 2016). Some evidence tends to indicate consistent variations in the sympathetic nervous system between truth-telling and lying, based on the assumption that the latter should be more emotionally arousing than the former, thereby showing heightened physiological responses (DePaulo et al., 1996; Ekman, & Friesen, 1974). Currently, however, it is widely accepted that lying does not exhibit a distinct physiological arousal pattern (Meijer & Verschuere, 2015). Rather, research has suggested that lying imposes greater cognitive demands as compared with truth-telling which may eventually hint towards the authenticity of one's memory statements (Battista, 2021a, 2021b; Curci et al., 2019; Vrij et al., 2008; Walczyk et al., 2005). Liars are tasked with concealing the truth, engaging in a deliberate and intentional process that demands cognitive effort (Walczyk et al., 2003, 2005). Accordingly, the literature provides some hints that experiencing cognitive load, for instance during the act of lying, may result in reduced levels of SCL (Leal et al., 2008), as well as decreased HR (Lacey, 1967; Suchotzki & Gamer, 2019). That is, while being interrogated about emotional events (e.g., mock crime), rather than exhibiting signs of nervousness, liars demonstrate delayed physiological responses, which may reflect cognitive processes associated with allocating attentional resources to stimuli requiring deceptive responses (Gamer, 2011; Verschuere & Ben-Shakhar, 2011).

The Current Experiments

In the present experiments, we delved into two distinct yet interconnected domains – one concerning false memories and the other referring to lie detection – to differentiate true autobiographical memories from intentionally generated fabricated memory accounts of comparable valence and arousal. Specifically, we posited that people's awareness regarding the authenticity of

their memories might play a pivotal role in distinguishing between true autobiographical recollections and fabricated narratives. It is conceivable that in the absence of such awareness, people's false negative memory accounts may evoke physiological responses akin to those elicited by genuine negative experiences, such as heightened HR and SCL. By contrast, when individuals are cognizant that they are recalling fabricated negative autobiographical reports, distinct patterns of physiological arousal may emerge as compared with when they engage in retrieving true events. To elucidate these nuanced physiological responses, our work focused on deliberate attempts to fabricate negative autobiographical accounts.

Specifically, in two experiments, we examined participants' physiological changes during the recall of true autobiographical memories as compared with fabricated ones. Participants were asked to recall four different events, two genuine autobiographical memories (negative and neutral) and two fabricated experiences (negative and neutral), in written (Experiment 1) and oral (Experiment 2) form. For each event, we took participants' measures of HR and SCL using a non-invasive biometrical device. Additionally, participants provided self-reported ratings of both valence and arousal. In line with prior research (e.g., Schaefer & Philippot, 2005), we expected that the recollection of true negative autobiographical events would elicit more pronounced physiological responses (i.e., increased HR and SCL) than true neutral memories. Moreover, given that genuine negative autobiographical memories elicit the reactivation of emotional components (Buchanan, 2007; McGaugh, 2015), we anticipated heightened physiological responses during their recollection as compared with accounts of fabricated negative events that were never experienced. We did not have any other specific expectations regarding participants' physiological responses for the other comparisons.

Experiment 1

Method

Participants and Design

We ran an a priori power analysis using G*Power (i.e., repeated ANOVA within factors, one group, four measurements; target effect: main; correlation among repeated measure = 0.5, nonsphericity correction ε = 1; Faul et al., 2007) with a power of 0.80 and an effect size of $f = .25$ ($\alpha = .05$). This analysis required 24 participants. We recruited 35 master students through ads on the university SONA system of KU Leuven, rewarding them with 1 credit course. We eliminated data from 7 participants because their physiological signals were not optimal. Eventually, we performed analyses on a total of 28 participants (range: 17-27, $M = 18.50$, $SD = 1.77$; 93% female).

We used a 2 (authenticity of the event: true vs. fabricated) x 2 (emotionality of event: negative vs. neutral) within-subjects design, with physiological responses (HR and SCL) and self-reported measures of valence and arousal as dependent variables. For both of our experiments, we obtained approval from the ethical committee at KU Leuven (G-2022-5412-R2). Both datasets and materials are accessible on Open Science Framework (OSF; osf.io/rkm9s).

Measures

Physiological Measures

To measure participants' HR and EDA, we used Empatica E4 Wristband[1], a wearable wireless tool designed to collect real-time physiological data, widely used in different research fields[2] (Girardi et al. 2021; Rasmussen et al., 2021). HR and EDA are sampled at a frequency of 1 and 4 Hz, respectively. From the EDA signal, it is possible to derive two components, phasic and tonic, calculated using the cvxEDA algorithm (Girardi et al. 2021; Greco et al., 2015). Whereas the EDA phasic component captures the swift, moment-to-moment fluctuations in skin conductance to

[1] https://www.empatica.com/en-gb/research/e4/
[2] https://www.empatica.com/research/publications/

identify sudden changes in arousal, known as Skin-Conductance Response, the EDA tonic component reflects the relatively gradual changes in skin conductance attributed to factors such as overall sweat gland activity, skin hydration, and arousal level. In line with previous research (Leal et al., 2008; Schaefer & Philippot, 2005), in the current experiment(s) we used only the EDA tonic component, also known as skin-conductance level (SCL), to capture the gradual alterations in skin conductance activity over time. Notably, variations in SCL are considered indicative of overall changes in autonomic arousal (Dawson et al., 2016; Rasmussen et al., 2021).

Because we were interested in capturing a more stable and generalized measure of physiological response throughout the entire period of event processing, we chose to average participants' HR and SCL measures. This approach, in line with previous work (e.g., Faulker & Leaver, 2016; McNally et al., 2004), was selected to ensure a comprehensive assessment of overall physiological response during both the recollection of true events and generation of fabricated narratives, rather than isolating specific peak responses. The initiation and conclusion of each participant's event recollection were marked using the event mark button on the wristbands, thus associating these events with their corresponding physiological signals. Importantly, participants were not permitted to remove the Empatica E4 tool from their wrists during the entire experiment. Later on, therefore, we used the E4 TimeStamper software[3] to extract E4 signals and automatically timestamp each participant's recollection in the physiological data (e.g., HR and EDA). The timestamps were aligned with the chosen time zone and format, delineated by the distinct event marks.

Self-report Measures

Positive and Negative Affective Scale (PANAS; Watson et al., 1988). These scales require participants to rate on twenty 5-point items [ranging from "not at all" (1) to "extremely" (5)] how they experience different affects along two dimensions, namely Positive Affect (PA) and Negative

[3] https://github.com/imranture/E4-TimeStamper

Affect (NA). The scale is also commonly used to measure people's trait (PANAS-T) and state (PANAS-S) mood. For both PANAS-T and -S item scores were summed up. More specifically, the PA-T scale (α = .87) indicates the individual positive level of emotions generally felt by people, while in contrast, the NA-T scale (α = .84) indicates the individual general dimension of aversive affect and distress. The PA-S (α = .85) and the NA-S (α = .82) scales reflect how individuals feel at that precise moment.

Valence and Arousal. For each of the recalled event, participants rated on a 7-point Likert scale both valence and arousal. Specifically, concerning the former, participants ranged their event on a scale from 1 "extremely negative" to 7 "extremely positive", whereas arousal was anchored from 1 "extremely low" to 7 "extremely high". Note that participants rated both valence and arousal for the described event itself as well as for the act of recollecting the event, irrespective this being true or fabricated. In this latter case, participants were asked to explicitly rate both valence and arousal as if the fabricated events were real.

Procedure

The experiment was conducted in a quiet test room, which we equipped with a laptop. Upon arrival, an experimenter provided participants with a brief explanation of the research, including a description of the non-invasive tools adopted to register physiological variations. Once participants signed the informed consent, the experimenter placed the Empatica E4 Wristband on their dominant hand. When securing the Bluetooth connection between the E4 Wristband and its software, through which the experiment could monitor that the physiological parameters were correctly registered, participants began the experiment. Participants first completed demographic information and completed the PANAS. Subsequently, participants had to recall and write down four different events. Two of these events were authentic, drawn from participants' personal experiences that occurred within the last 12 months. The remaining two events were fabricated by participants themselves. As anticipated above, we requested participants to provide, for both true and fabricated

accounts, one with a negative (or unpleasant) emotional valence, and another one with a neutral valence. We provided participants with examples of both negative (or unpleasant) events, such as things like arguing with a friend, being involved in a car accident, or the death of a close relative, and neutral events, such as things as buying a book, or babysitting. Additionally, we asked participants to retrieve and describe all the events as vividly as possible, without any time limit, designing some questions to help them in such a task (e.g., what sort of day was it? What happened? Where were you at the time? Who was involved? What did they say? What did you think? How did you feel?). It is important to note that we did not instruct participants to lie when generating fabricated accounts, nor did we provide any indications regarding the consequences of following or not following the given instructions. Additionally, we did not limit participants' recall to specific categories of memories because we were not interested in the exact content of the memories but rather in their arousal and valence. The specific instructions given to participants can be found on OSF (osf.io/rkm9s).

The order in which participants recalled the four events was randomized to minimize potential order effects. A computerized randomization procedure was used to assign each participant to one of the possible presentation orders. Furthermore, immediately after each event description, participants rated valence and arousal through self-report measures for both the described event and the act of recollecting the event. To ensure consistency in our manipulation of recollection and generation of events and narratives, we instructed participants to rate fabricated negative and neutral narratives alongside true events. This approach was designed to control for any potential differences in explicit emotional response due to the nature of the fabricated narratives. By having participants rate fabricated events as if they were real, we maintained a consistent framework for analysing arousal and valence across both true and fabricated events. On average, participants' written descriptions of true negative autobiographical events lasted 4.93 minutes (SD = 2.19) (word count$_{True\ negative}$, M = 119.14, SD = 39.68), whereas for the neutral one it lasted 3.92 minutes (SD =

2.33) (word count$_{True\ neutral}$, M = 74.61, SD = 40.98). Moreover, on average, participants took 5.47 minutes (SD = 5.29) to write down the negative fabricated event (word count$_{Fabricated\ negative}$, M = 105.79, SD = 68.64), whereas it took 4.25 minutes (SD = 1.97) for the fabricated neutral one[4] (word count$_{Fabricated\ neutral}$, M = 67.25, SD = 32.35).

Results and Discussion

Manipulation Check on Participants' Emotional Trait and State

To mitigate potential mood-related effects on participants' performance before the experiment, we conducted a descriptive examination of their positive and negative PANAS-T and -S scores. On average, participants reported PA-T and NA-T scores of 22.88 (SD = 5.54) and 11.34 (SD = 6.24), respectively. Consistently, their PA-S and NA-S scores averaged 20.80 (SD = 5.86) and 5.54 (SD = 4.62). These findings suggested that, both in terms of PANAS trait and state, participants reported a moderate to high level of positive emotions and a relatively low level of distress prior to beginning the experiment.

Manipulation Check on Participants' Instructions

To determine compliance with participants' instructions (i.e., whether participants actually retrieved memories and generated narratives of the target valence), two independent raters (first and second authors) examined the content of 25% of reports per experiment. Specifically, both raters independently scored each reported event in one content category (e.g., conflicts or arguments with family members, the death of their pet, visiting family etc.). These categories were established by the first author after reading the reported events and then used by the second author to categorize the events. Inter-rater agreement for true events was high (negative: α = .85; neutral: α = .75). Regarding negative events, 46.4% (n = 13/28) of participants reported conflicts or arguments with family members/friends/partners, followed by 21.4% (n = 6/28) reporting a general negative event

[4] We conducted a repeated-measures ANOVA to check potential statistically significant variations in the durations of different recall conditions. The analysis did not reveal such differences, $F(3,28) = 1.50$, $p = .22$, $\eta_p^2 = .05$.

(e.g., stressful or embarrassing episodes), 17.9% (*n* = 5/28) the death of a family member/friend, 10.7% (*n* = 3/28) the death of their pet, and 3.6% (*n* = 1/28) a psychological breakdown. With respect to neutral events, 39.13% (*n* = 11/28) of participants stated general neutral events, such as walking with a dog or a specific moment of a day (e.g., making dinner), followed by 17.9% (*n* = 5/28) mentioning university-related events, 14.3% (*n* = 4/28) shopping, 14.3% (*n* = 4/28) a meal with family/friends, 7.1% (*n* = 2/28) visiting family, and 7.1% (n = 2/28) work-related events. Next, inter-rater agreement for fabricated narratives was quite high (negative: α = .88; neutral: α = .98). With respect to fabricated negative accounts, 28.6% (*n* = 8/28) of participants reported physical accidents, followed by 21.4% (*n* = 6/28) reporting a general negative event (e.g., stressful or embarrassing episodes), 21.4% (*n* = 6/28) conflicts or arguments with family members/friends/partners, 17.9% (*n* = 5/28) the death of a family member/friend, 7.1% (*n* = 2/28) the death of their pet, and 3.6% (*n* = 1/28) a sexual harassment. Finally, regarding fabricated neutral narratives, 42.9% (*n* = 12/28) of participants mentioned shopping, 39.3% (*n* = 11/28) a general neutral episodes, such as walking with a dog or a specific moment of a day (e.g., having breakfast), 7.1% (*n* = 2/28) babysitting, 3.6% (*n* = 1/28) visiting family, 3.6% (*n* = 1/28) work-related episodes, and 3.6% (*n* = 1/28) a meal with family/friend.

Physiological Measures

We performed two 2 (authenticity: true vs. fabricated) x 2 (emotionality: negative vs. neutral) repeated measures ANOVAs on participants' HR and SCL responses, respectively. This allowed us to examine physiological variations across different recall conditions. We observed neither any main nor interaction effects of recollection on both HR levels, $F_s(1,27) < 2.37$, $p > .135$, $\eta p^2 < .08$, BF_{10}[5] < .081, and SCL responses, $F_s(1,27) < 1.28$, $p > .268$, $\eta p^2 < .04$, $BF_{10} < .599$, respectively.

[5] All BF_s were calculated using JASP (Marsman & Wagenmakers, 2017) with a standard prior and $r_{scale} = 1$. BF_{10} are used to interpreting positive numbers as evidence for the alternative hypothesis. BFs of 1–3 indicate ambiguous evidence for the alternative hypothesis; 3–10 substantial evidence; 10–100 strong evidence; > 100 decisive evidence (Kass & Raftery, 1995).

Overall, this means that we did not find any statistically significant differences among participants' physiological measures when they were engaged in describing true negative, true neutral, fabricated negative and fabricated neutral events (all $p_s > .05$). Table 1 shows participants' mean and standard deviations for both participants' HR and SCL responses.

Self-report Measures

Valence and Arousal for the Described Events

Two 2 (authenticity: true vs. fabricated) x 2 (emotionality: negative vs. neutral) repeated-measures ANOVAs were performed on participants' ratings of valence and arousal for the described events. Only the main effect of emotionality was found statistically significant on how participants rated the nature of the recalled events, $F(1,27) = 293.66$, $p < .001$, $\eta p^2 = .92$, $BF_{10} = 1.00$. Post-hoc with Bonferroni correction indicated that, irrespective of the authenticity of their recollections, participants rated negative experiences ($M = 1.55$; $SD = .85$) as more adverse than neutral ones ($M = 4.69$; $SD = 1.61$), $t = -20.36$, $p < .001$, 95% CI for mean difference [-3.53 -2.89], $d = 4.05$, $BF_{10} = 2.05$.

Furthermore, we did not observe any statistically significant main or interaction effects on participants' arousal ratings for the events, $F_s(1,27) < 1.60$, $p > .216$, $\eta p^2 < .05$, $BF_{10} < .631$. This implies that participants perceived the described events as nearly equally arousing, regardless of whether they were true negative and neutral, and fabricated negative and neutral events (all $p_s > .05$). Table 1 displays participants' mean and standard deviations for both valance and arousal for the described events.

Valence and Arousal for the Act of Recollecting the Events

Finally, we ran two 2 (authenticity: true vs. fabricated) x 2 (emotionality: negative vs. neutral) repeated-measures ANOVAs on participants' valence and arousal rates for the act of recollecting the events. As before, the main effect of emotionality was the only statistically significant factor influencing participants' ratings for the act of recollecting the events, $F(1,27) = 225.00$, $p < .001$,

ηp^2 = .89, BF_{10} = 1.00. Post-hoc with Bonferroni correction showed that, regardless being true or fabricated, the emotionality given to negative events (*M* = 2.08; *SD* = 1.15) was rated as significantly more negative than that of neutral events (*M* = 4.67; *SD* = 1.30), *t* = -15.05, *p* < .001, 95% CI for mean difference [-2.94 -2.23], *d* = 3.01, BF_{10} = 1.02.

Concerning participants' arousal rates for the act of recollecting the events, only the main effect of authenticity was statistically significant, *F*(1,27) = 7.25, *p* = .012, ηp^2 = .21, BF_{10} = 1.00. Participants' recollection for fabricated events (*M* = 4.14; *SD* = .88) was assessed as being more arousing than true autobiographical experiences (*M* = 3.69; *SD* = .88), *t* = -2.69, *p* = .012, 95% CI for mean difference [-.81 -.11], *d* = .40, BF_{10} = 11.59. Table 1 shows participants' mean and standard deviations for both valance and arousal for act of recollecting the events.

--- Insert Table 1 about here ---

In Experiment 1, we did not find increased HR and SCL rates when participants described true negative autobiographical events as pitted against the other narratives. The lack of significant differences in this experiment suggests that, from a psychophysiological perspective, participants exhibited similar physiological reactions regardless of the authenticity or the emotionality of the events they were recalling. This is particularly interesting especially when considering the recollection of true negative autobiographical events. At first glance, this finding contradicts research demonstrating a robust connection between physiological arousal and memory for emotionally intense autobiographical experiences (Golland et al., 2014; Holland & Kensinger, 2010). However, some simple explanations may be put forward for such uniformity in physiological responses across these various recall conditions. First, despite participants self-acknowledging their emotionality both for the event and its recollection, we observed no distinction between true negative autobiographical events and the other narratives because the former were likely not arousing enough. Indeed, participants self-rated fabricated events as even more arousing than true ones upon retrieval. This suggests that participants may have recalled autobiographical events

lacking genuine emotional components, consequently failing to evoke corresponding physiological responses (Frijda, 1993; Gross, 1998; Van Reekum & Scherer, 1997).

Second, writing about emotional experiences could be a complex task. Engaging in the act of writing could have led participants to activate cognitive control processes that may have inhibited emotional activation (Ochsner & Gross, 2005; Pessoa, 2008), resulting in no physiological differences between true autobiographical memories and fabricated accounts during recollection. Relatedly, writing encourages a more deliberate and reflective approach to narration, allowing participants to edit and refine their responses. Therefore, it may be that the act of writing in our experiment facilitated emotional processing (Frattaroli, 2006; Pennebaker & Chung, 2007), thereby possibly reducing the physiological responses typically associated with spontaneous emotional recall.

Finally, using Empatica E4 wristband while engaging in such a task that involves a wrist movement (e.g., writing on a keyboard) could have interfered with the results, thereby not allowing us to fully capture variations of physiological signals (i.e., HR and SCL). However, the guidelines provided by Empatica[6] do not preclude the use of the E4 wristband even in tasks involving significant movements (see also Girardi et al. 2021). Nevertheless, we could not fully determine the intensity of participants' wrist movements while they were typing the events. Therefore, to eliminate this potential confounding factor and delve deeper into the physiological signals of between true and fabricated autobiographical experiences, we conducted a second experiment mirroring the current one, wherein participants verbally reported the four events.

[6] https://support.empatica.com/hc/en-us/articles/360030058011-E4-data-IBIexpected-signal

Experiment 2

Method

Participants and Design

A second experiment was conducted almost in parallel with Experiment 1. As for this latter, we conducted an a priori power analysis using G*Power (i.e., repeated ANOVA within factors, one group, four measurements; target effect: main; correlation among repeated measure = 0.5, nonsphericity correction ε = 1; Faul et al., 2007), which indicated 24 participants. We recruited 34 master's students through advertisements on the university SONA system of KU Leuven, incentivizing their involvement in the experiment with 1 credit course. However, data from 3 participants were excluded due to suboptimal physiological signals. Subsequently, analyses were performed on a final sample of 31 participants (range: 17-43, M = 19.06, SD = 4.27; 88% female). Furthermore, we used the same 2 (authenticity of the event: true vs. fabricated) x 2 (emotionality of the event: negative vs. neutral) within-subjects design, with physiological responses (HR and SCL) and self-reported measures of valence and arousal as dependent variables.

Materials, Measures, and Procedure

The present experiment maintained methodological consistency with Experiment 1. Specifically, we used the same physiological signals (HR and SCL) captured through the Empatica E4 Wristband, placed on participants' dominant hand, along with identical self-report measures administered in a written form (i.e., PANAS-T and S and 7-point Likert scales to assess participants' valence and arousal rates related to the described events and its recollection). PA-T (α = .72) and NA-T (α = .83) scales gauged the overall positive and negative emotional states typically experienced by individuals, whereas the PA-S (α = .76) and NA-S (α = .85) scales captured the specific emotional states individuals were experiencing in that particular moment.

The procedure precisely mirrored every phase of Experiment 1, with the sole difference consisting of participants verbally recalling the four events, instead of writing them down. Thus,

participants followed the instructions provided by the experimenter and verbally described the four events. Also in this experiment, we randomized the order in which participants recalled the four events. Participants, on average, spent 2.94 minutes (*SD* = 1.30) recalling true negative autobiographical events, compared with 1.64 minutes (*SD* = 1.05) for neutral events. Furthermore, the average time taken to articulate the negative fabricated event was 1.74 minutes (*SD* = 0.64), whereas the fabricated neutral event required an average of 1.29 minutes (*SD* = 0.54)[7].

Results and Discussion

Manipulation Check on Participants' Emotional Trait and State

To address potential mood-related influences on participants' performance before the experiment, we conducted a descriptive analysis of their positive and negative scores on the PANAS-T and PANAS-S scales. On average, participants reported PANAS-T scores of 26.67 (*SD* = 4.22) for positive affect (PA) and 11.67 (*SD* = 6.06) for negative affect (NA). Similarly, their PANAS-S scores averaged 24.32 (*SD* = 4.70) for positive affect and 5.02 (*SD* = 4.52) for negative affect. These results indicated that participants demonstrated a moderate to high level of positive emotions and a relatively low level of distress both in terms of PANAS trait and state before starting the experiment.

Manipulation Check on Participants' Instructions

To assess whether participants complied with the instructions (i.e., whether they retrieved memories and generated narratives with the specified valence), two independent raters (the first and second authors) thoroughly examined the content of their reports. The inter-rater agreement for true events was very high (negative: α = 98; neutral: α = .92). Regarding negative true events, 25.8% (*n* = 8/31) of participants mentioned a physical incident, followed by 25.8% (*n* = 8/31) reporting

[7] Through a repeated-measures ANOVA we found statistically significant variations in the durations of different recall conditions, $F(3,30) = 24.44$, $p < .001$, $\eta_p^2 = .50$, likely driven by the amount of time participants spent in describing true negative events. However, we did not find any influence of time recollection on both participants' physiological and self-report measures when inserting time as a covariate in our main analyses (all $p_s > .05$).

conflicts or arguments with family members, friends, or partners, 19.4% (n = 6/31) a general negative event (e.g., stressful or embarrassing episodes), 16.1% (n = 5/31) a psychological breakdown/issue, 6.5% (n = 2/31) the death of a family member or friend, 3.2% (n = 1/31) a sexual harassment, 3.2% (n = 1/31) the death of a pet. For neutral true events, 29% (n = 9/31) of participants described general neutral events such as walking with a dog or a specific moment of the day (e.g., making dinner). This was followed by 16.1% (n = 5/31) reporting shopping, 16.1% (n = 5/31) university-related events, 12.9% (n = 4/31) meals with family or friends, 9.7% (n = 3/31) visiting family, 9.7% (n = 3/31) work-related events, 3.2% (n = 1/31) a family reunion, and 3.2% (n = 1/31) babysitting.

Moreover, also the inter-rater agreement for fabricated narratives was very high (negative α = .96; neutral α = .99). For negative fabricated reports, 35.5% (n = 11/31) of participants reported physical accidents, followed by 32.3% (n = 10/31) reporting a general negative event (e.g., stressful or embarrassing episodes). Additionally, 16.1% (n = 5/31) mentioned conflicts or arguments with family members, friends, or partners, 6.5% (n = 2/31) the death of a pet, 3.2% (n = 1/31) sexual harassment, 3.2% (n = 1/31) an attempted robbery, and 3.2% (n = 1/31) the death of a family member or friend. Finally, for neutral fabricated accounts, 32.3% (n = 10/31) of participants described general neutral episodes such as walking with a dog or a specific moment of the day (e.g., skincare routine). This was followed by 16.1% (n = 5/31) mentioning university-related events, 12.9% (n = 4/31) shopping, 12.9% (n = 4/31) babysitting, 9.7% (n = 3/31) work-related episodes, 9.7% (n = 3/31) a meal with family/friends, and 6.5% (n = 2/31) visiting family.**Physiological Measures**

In line with Experiment 1, we conducted two 2 (authenticity: true vs. fabricated) x 2 (emotionality: negative vs. neutral) repeated-measures ANOVAs on participants' HR and SCL responses to determine physiological variations across different recollections. Statistically significant main effects of authenticity, $F(1,30) = 21.91$, $p < .001$, $\eta p^2 = .42$, $BF_{10} > 100$, and

emotionality, $F(1,30) = 8.52$, $p = .007$, $\eta p^2 = .22$, $BF_{10} = 7.58$, were found on participants' HR rates. Moreover, the interaction between authenticity and emotionality yielded statistical significance, $F(1,30) = 8.95$, $p = .005$, $\eta p^2 = .23$, $BF_{10} > 100$. Post-hoc with Bonferroni adjustment showed that, for true events, there was a statistically significant difference between negative and neutral recollections, $t = 3.97$, $p = .002$, 95%CI [2.16 12.01], $d = .48$, $BF_{10} = 30.74$. However, this difference was not significant when considering fabricated narratives, $t = 1.20$, $p = 1.00$, 95%CI [-5.27 5.03], $d = .008$, $BF_{10} = .43$. Furthermore, and of importance, we observed a statistically significant difference between true negative events and fabricated negative narratives, $t = 5.51$, $p < .001$, 95%CI [3.64 10.78], $d = .49$, $BF_{10} > 100$. Finally, while we also found that true negative episodes statistically differed from fabricated neutral narratives, $t = 4.98$, $p < .001$, 95%CI [4.20 14.50], $d = .64$, $BF_{10} > 100$, no other statistically significant differences emerged (all $p_s > .05$).

However, neither the main nor interaction effects of authenticity and emotionality were found on participants' SCL, $F_s(1,30) < 3.45$, $p > .073$, $\eta p^2 < .10$, $BF_{10} < .285$. This means that there were no statistically significant differences in participants' SCL when they recalled true negative, true neutral, fabricated negative, and fabricated neutral events (all $p_s > .05$). Table 2 displays participants' mean and standard deviations for both participants' HR and SCL responses.

Self-report Measures

Valence and Arousal for the Events

We ran two 2 (authenticity: true vs. fabricated) x 2 (emotionality: negative vs. neutral) repeated-measures ANOVAs on participants' rates of valence and arousal for the verbally recalled events. Concerning valence rates, only the main effect of emotionality reached significance, $F(1,30) = 594.34$, $p < .001$, $\eta p^2 = .95$, $BF_{10} > 100$. Post-hoc with Bonferroni correction showed that, regardless of being true or fabricated, negative experiences ($M = 1.46$; $SD = .75$) were rated as more negative than neutral ones ($M = 4.78$; $SD = 1.21$), $t = -24.37$, $p < .001$, 95% CI for mean difference [-3.23 -3.60], $d = 4.64$, $BF_{10} > 100$.

Additionally, the main effects of both authenticity, $F(1,30) = 14.58$, $p < .001$, $\eta p^2 = .32$, $BF_{10} = 7.93$, and emotionality, $F(1,30) = 90.04$, $p < .001$, $\eta p^2 = .75$, $BF_{10} > 100$, but not their interaction effect, $F(1,30) = .005$, $p = .944$, $\eta p^2 = .00$, $BF_{10} > 100$, were found statistically significant on participants' arousal ratings for the events. That is, in line with their instructions, participants rated fabricated events ($M = 5.30$; $SD = 1.25$) as being more arousing than genuine ones ($M = 4.70$; $SD = 2.16$), $t = -3.81$, $p < .001$, 95% CI for mean difference [-.91 -.27], $d = 1.88$, $BF_{10} = 12.99$. Moreover, negative events ($M = 6.14$; $SD = 1.14$) were rated as being more arousing than neutral ones ($M = 3.87$; $SD = 1.34$), $t = 9.48$, $p < .001$, 95% CI for mean difference [1.78 2.76], $d = 1.90$, $BF_{10} > 100$. Table 2 presents participants' mean and standard deviations for both valance and arousal for the events.

Valence and Arousal for the Act of Recollecting the Events

We conducted two 2 (authenticity: true vs. fabricated) x 2 (emotionality: negative vs. neutral) repeated-measures ANOVAs on participants' valence and arousal rates for the act of recollecting the events. These analyses reflected an identical pattern as that observed while analyzing participants' valence and arousal rates for the events. Indeed, concerning participants' valence rates, we found the main effects of both authenticity, $F(1,30) = 8.53$, $p = .007$, $\eta p^2 = .22$, $BF_{10} = 1.99$, and emotionality, $F(1,30) = 187.05$, $p < .001$, $\eta p^2 = .86$, $BF_{10} > 100$, but not their interaction effect, $F(1,30) = 1.74$, $p = .196$, $\eta p^2 = .05$, $BF_{10} > 100$. This means that participants rated true events ($M = 3.59$; $SD = .85$) as being more emotional than fabricated experiences ($M = 3.19$; $SD = .83$), $t = 2.92$, $p < .007$, 95% CI for mean difference [.12 .68], $d = .47$, $BF_{10} = 2.55$. Moreover, negative events ($M = 2.22$; $SD = .88$) were rated as being more adverse than neutral ones ($M = 4.56$; $SD = .80$), $t = -13.67$, $p < .001$, 95% CI for mean difference [-2.68 -1.98], $d = 2.76$, $BF_{10} > 100$.

Finally, concerning participants' rates of arousal for the act of recollecting the events, the main effects of both authenticity, $F(1,30) = 4.65$, $p = .039$, $\eta p^2 = .13$, $BF_{10} > 100$, and emotionality, $F(1,30) = 46.76$, $p < .001$, $\eta p^2 = .60$, $BF_{10} > 100$, but not their interaction effect, $F(1,30) = 1.34$, $p =$

.255, ηp^2 = .04, BF_{10} > 100, emerged statistically significant. Participants regarded true experiences (*M* = 4.54; *SD* = 1.21) as being less arousing than fabricated ones (*M* = 4.87; *SD* = .98), *t* = -2.15, *p* = .039, 95% CI for mean difference [-.62 -.02], *d* = .29, BF_{10} = .680. Moreover, negative events (*M* = 5.48; *SD* = 1.01) were rated as being more arousing than neutral ones (*M* = 3.93; *SD* = 1.19), *t* = 6.83, *p* < .001, 95% CI for mean difference [1.08 2.01], *d* = 1.40, BF_{10} > 100. Table 2 shows participants' mean and standard deviations for both valance and arousal for the act of recollecting the events.

--- Insert Table 2 about here ---

Partially in line with our expectations, true negative autobiographical experiences were associated with an increased HR response, but not with SCL, as compared with the other narratives. On the one hand, findings from Experiment 2 support evidence showing that emotional memories prompt physiological responses as compared with neutral memories (e.g., Schaefer & Philippot, 2005), additionally clarifying precise patterns of physiological arousal (i.e., HR) linked to genuine negative autobiographical recollections. On the other hand, this finding is particularly interesting when considering both true and fabricated negative autobiographical events. Despite participants' self-reports indicating even higher arousal rates (due to the instruction received) for fabricated experiences as compared with genuine events, the former did not elicit any corresponding physiological responses, which usually are associated with true events. This discrepancy, thus, may serve as a distinguishing feature of genuine negative autobiographical memories (Russell, 1980; Posner et al., 2005).

Germane to this, however, we revealed an absence of a corresponding increase in SCL. To some extent, this underscores the view that each of these measures (i.e., HR and SCL) may independently reflect sympathetic, parasympathetic, or both activities (Fernandez et al., 2012; Marci et al., 2007). Previous studies suggested that, while HR reflects a combination of both sympathetic and parasympathetic activity, SCL primarily mirrors sympathetic activity (Mauss &

Robinson, 2009). Particularly, SCL is also intended to mirror emotions that prompt action tendencies (Brehm, 1999; Frijda, 1986). In other words, a low level of electrodermal activity may indicate an absence of motor preparation associated with past emotions. For instance, when recalling a negative autobiographical event like the loss of a family member or friend, feelings of sadness may arise, which are characterized not by a desire for action but by a sense of helplessness or passivity due to the inability to change the situation. Consequently, a lack of an increased SCL response may be observed. However, it is important to interpret this cautiously, because we did not specifically label each negative autobiographical memory retrieved by participants with a distinct emotion.

General Discussion

In two experiments, by using non-invasive biometrical devices, we investigated participants' physiological reactions during the recollection of true negative autobiographical memories. We anticipated that true negative autobiographical memories would evoke higher levels of physiological arousal (HR and SCL) especially when pitted against fabricated memory accounts, indicating the importance of the memory authenticity in eliciting corresponding physiological responses. Our expectations were partially met in Experiment 2, wherein we asked participants to recall the experiences orally. We observed an increase in participants' HR, without corresponding variations in SCL, originating from true emotionally charged recollections (i.e., true negative autobiographical experiences). Below, we further discuss findings from Experiment 2 focusing on the insights provided by the difference in participants' physiological responses when recalling true and fabricated autobiographical narratives.

Genuine negative autobiographical memories are often accompanied by physiological arousal, reflecting the emotional intensity and authenticity of the experience (Russell, 1980; Posner et al., 2005). This physiological response is believed to be driven by the activation of the autonomic nervous system (ANS) in response to emotionally charged stimuli (Schaefer & Philippot, 2005). In

contrast, fabricated negative autobiographical memories, despite potentially showing similar subjective feelings by participants, failed to elicit corresponding physiological responses. This discrepancy suggests that arousal associated with genuine negative autobiographical memories during their recollection may reflect the spontaneous activation of ANS linked to genuine emotional experiences (Buchanan, 2007; Kreibig, 2012). Arguably, fabricated narratives, lacking in genuine emotional content, may not follow the same neural pathways or elicit the same autonomic responses, resulting in the absence of physiological arousal.

Albeit counterintuitive at first, our findings from Experiment 2 relate to a few experimental studies showing no statistical difference in physiological variations between true and false memories (McNally et al., 2004; but see Faulker & Leaver, 2016). That is, in Faulker and Leaver's study (2016), participants formed false memories for emotional events, and they did not know they were recalling false events, nor they were informed about the authenticity of their false memories during the recollection. In McNally et al.'s work (2004), participants genuinely thought and remembered they were abducted (and sexually probed on a spaceship) by aliens, so the recall of such improbable emotional memories was as physiologically arousing as that of verifiable traumatic memories (e.g., a firefight in Vietnam). By contrast, our experiment yielded contrasting results, with higher HR responses observed for true negative autobiographical memories as compared with fabricated negative memory accounts. A key distinction between our research and that of McNally and colleagues (2004; but see also Faulker & Leaver, 2016) lies in participants' awareness regarding the authenticity of their memories. This is an noteworthy difference because such awareness may likely reflect genuine participants' physiological responses, leading to the observed differences in HR activation between true negative autobiographical memories and fabricated experiences. When individuals are unaware that their memories are false, they may exhibit physiological reactions comparable to those elicited by genuine memories. Still, when participants are cognizant of the fabricated nature of their narratives, as in our experiment, this awareness may

result in different patterns of physiological arousal (i.e., lower HR levels). Nonetheless, another important aspect to consider is the timing of physiological responses during the different phases of memory tasks. Differences in physiological responses between true autobiographical experiences and fabricated narratives might manifest at different stages, such as during the initial recollection or generation of the memory/event, or during the reporting phase. The latency (i.e., the time it takes for the physiological response to begin) and the temporal dynamics (i.e., the duration and pattern of the response over time) could vary between recalling true events and generating fabricated narratives. For instance, true events might elicit quicker and more sustained physiological responses due to their genuine emotional content, whereas fabricated narratives might show delayed or less pronounced responses due to the lack of authentic emotional engagement (Kreibig, 2010). To explore this further, future research could investigate the onset and duration of physiological responses during both the recollection/generation phase and the reporting phase to better elucidate how these features influence physiological responses over time.

Moreover, the outcomes of Experiment 2 draw parallels with research on the physiological correlates of lying. Despite not explicitly instructing our participants to lie, it is intriguing to note the resemblance in their physiological responses (low HR and SCL magnitude) akin to those revealed when people are instructed to lie in high-stakes situations (Lacey, 1967; Leal et al., 2008; Suchotzki & Gamer, 2019). Although speculative, to a certain degree, our data suggest that the act of reporting a false event (i.e., fabrication) in itself, irrespective of the intention to lie, appears to necessitate cognitive effort that impacts physiological reactions eventually. As such, and particularly in the context of fabricating negative autobiographical narratives, awareness still seems to play a multifaceted role in such a cognitive process. Once people know that they are fabricating experiences, this awareness may involve controlled cognitive mechanisms associated with monitoring, thereby regulating one's responses. Fabricating events likely involves top-down processes governed by cognitive control, whereas genuine memory retrieval typically starts with

bottom-up processes (Baddeley & Hitch, 1974; Schacter et al., 1998). When initial retrieval attempts are unsuccessful, top-down elaboration may be used to retrieve something from memory (Gilbert & Wilson, 2007; Johnson et al., 1993). This distinction could impact the physiological experiences associated with these tasks. For instance, in the absence of genuine emotional engagement, individuals may need to exert additional cognitive effort to generate plausible fabricated experiences, leading to increased cognitive load and decreased corresponding autonomic activity (Leal et al., 2008). Thus, while fabricating memories may sometimes seem easier than retrieving genuine ones, the cognitive processes and efforts involved differ significantly. Furthermore, retrieval effort itself could vary between conditions. Retrieving a genuine memory might involve more automatic processes (Tulving, 1985), whereas fabricating a memory requires constructing a narrative, which could be cognitively demanding (Conway & Pleydell-Pearce, 2000). These differences in retrieval and construction processes could contribute to the variations in physiological responses observed in our experiment. In light of this, future research exploring the interplay between awareness and physiological arousal during memory recall could provide new directions into the relationship between autobiographical memory and its physiological responses. Yet, it should be noted that we considered physiological responses that occurred solely during recollection, overlooking the moment in which participants were thinking about the experiences to be recalled. Arguably, that moment may have elicited ANS activation, thereby providing further information about physiological patterns involved in the recollection of true and fabricated autobiographical memories that we did not catch. Autonomic activity related to behavior preparation refers to physiological activation that occurs before the initiation of any behavior, prompting the ANS to respond to behavioral demands (Kreibig, 2010). This preparatory autonomic activity has been observed even in experimentally paralyzed animals (Bandler et al., 2000), highlighting that it is not solely the explicit behavior itself that triggers this physiological response. Therefore, it would be worthwhile to compare the physiological reactions at these two distinct time

points, namely during thinking of and evoking memories, to gain a comprehensive understanding of the underlying physiological processes involved in retrieving true and fabricated autobiographical memories.

We need to address several limitations regarding the current experiments. To begin with, there was a lack of objective measurement to verify whether participants had genuinely experienced the events they recalled. Consequently, whereas we took for granted that our participants were cognizant that they were recalling true and fabricated experiences, based on participants' self-reported descriptions, we were unable to independently confirm the authenticity of these accounts. Moreover, while our study used a fixed number of autobiographical events to maintain consistency and control within our experimental conditions, there is an interesting avenue for future research to explore the impact of retrieving a larger number of memories. Second, we did not include additional objective measures of emotional responses (e.g., neuroimaging techniques), relying solely on biometric sensors (HR and SCL) and participants' self-report emotional intensity and valence. Whereas our experiments did not aim to explore different emotions associated with various recalls, future research could investigate how specific negative autobiographical memories are associated with distinct emotions (e.g., sadness, anger, fear), potentially revealing different physiological patterns. Additionally, incorporating positive and negative cues, as commonly employed in autobiographical memory studies (D'Argembeau et al., 2003; Schaefer & Philippot, 2005), could enrich the emotional diversity of recollections and provide a broader spectrum of physiological responses. Third, and relatedly, the specificity of the autobiographical memories recalled by participants may have varied, potentially influencing the magnitude of physiological responses. However, it may be challenging to generalize a particular negative autobiographical memory to a specific emotion. For instance, similar events (e.g., the loss of a family member or a friend) may elicit different emotions in different individuals, leading to varied physiological responses. That is also the reason why, in our experiments, we did not further categorize, and analyse, negative

autobiographical events into supplementary subcategories (e.g., physical accidents, loss of someone close, sexual harassment). Fourth, the specific instructions given to participants for self-rating fabricated narratives - to rate the valence and arousal of both the events and the act of recollection as if they were real - may have influenced their self-reports. This methodological choice likely contributed to the absence of interaction effects of authenticity (true vs. fabricated) and emotionality (negative vs. neutral) on these ratings in both experiments. Consequently, while our work could provide valuable insights into HR and SCL responses during the recollection of true and fabricated events, it restricts us to draw solid conclusions regarding the relationship between self-reported arousal and valence and these physiological measures. Finally, we acknowledge that the modality in which participants recalled events in Experiment 2 might have introduced variability due to social desirability effects or anxiety associated with speaking aloud. Research has shown that the presence of an experimenter can influence participants' responses, potentially leading to increased anxiety and altered physiological responses (Schwartz et al., 2013; Thorson et al., 2020). Additionally, speaking aloud about personal experiences can itself be a source of stress, further affecting physiological measures (Behnke & Sawyer, 2001). To address these concerns, future studies should consider controlling for experimenter presence or employing methods to minimize its impact. One approach could be to allow participants to recall events in a more private setting without direct experimenter oversight, thereby accurately isolating the impact of recall modality on physiological responses.

In closing, data from our experiments have some practical relevance. In clinical settings, the method of recalling emotional experiences, whether orally or through written (e.g., diary), may warrant careful consideration due to potential implications for therapeutic interventions. Likely, oral recollection could lead to increased emotional activation, which may, in turn, offer opportunities for deeper exploration and processing of emotional content (Greenberg & Watson, 2006; Bohart & Tallman, 1999). This increased emotional engagement during oral recollection may foster a more

immersive re-experiencing of emotions, potentially assisting patients in their therapeutic journey by facilitating greater engagement with their emotional experiences (Neff, 2016). Moreover, our findings have implications for the field of legal psychology, particularly regarding witnesses' testimony and the reliability of autobiographical memory in legal proceedings. In a certain measure, our results suggest that fabricated accounts do not likely evoke similar physiological responses as genuine ones. This may temptingly imply that increased HR responses during the recall of true negative autobiographical memories could potentially inform about witnesses' accounts' authenticity. However, it is crucial to stress that our results should not be generalized to situations where individuals are unaware they are reporting false negative experiences. In legal contexts, witnesses' credibility is not solely determined by emotional expressions. Whereas witnesses may convey confidence and genuine emotions, their accuracy in recalling events cannot be assumed to be authentic (Laney & Loftus, 2008; Loftus, 2005). Likewise, physiological markers of emotion accompanying memory recollection cannot confirm the authenticity of the memory itself (McNally et al. 2004). Moving forward, though, our experiments contribute to the ongoing investigation into emotional autobiographical memories, offering new insights into true and fabricated autobiographical recollections and their corresponding psychophysiological responses.

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Tables

Table 1. Participants' (n = 28) means of physiological and self-report measures across the four different events (Experiment 1).

	Events			
	True Negative	True Neutral	Fabricated Negative	Fabricated Neutral
Heart Rate (HR)	84.06 (10.93)	85.51 (14.38)	84.74 (16.87)	79.94 (9.80)
Skin-Conductance Level (SCL)	2.22 (2.41)	2.44 (2.68)	2.55 (3.43)	2.83 (3.19)
Valence for event	1.53 (.57)	4.50 (.96)	1.57 (.63)	4.89 (1.03)
Arousal for event	4.10 (1.72)	3.96 (1.20)	4.25 (1.99)	4.46 (1.31)
Valence for recollection	2.28 (.76)	4.67 (.81)	1.89 (.87)	4.67 (1.02)
Arousal for recollection	3.56 (1.40)	3.82 (.86)	4.14 (1.62)	4.14 (.70)

Note: Standard deviations are shown between parentheses. Valence rates ranged from 1 "extremely negative" to 7 "extremely positive"; arousal scores ranged from 1 "extremely low" to 7 "extremely high".

Table 2. Participants' (n = 31) means of physiological and self-report measures across the four different events (Experiment 2).

	Events			
	True Negative	True Neutral	Fabricated Negative	Fabricated Neutral
Heart Rate (HR)	94.01[a] (16.47)	86.92[a] (14.24)	86.80[a] (14.26)	84.66[a] (13.32)
Skin-Conductance Level (SCL)	3.63 (4.07)	3.41 (3.81)	3.05 (2.73)	3.17 (3.64)
Valence for event	1.51 (.57)	4.82 (.82)	1.41 (.50)	4.74 (.89)
Arousal for event	5.83 (1.50)	3.58 (1.56)	6.45 (.62)	4.16 (1.09)
Valence for recollection	2.51 (.92)	4.67 (.79)	1.93 (.85)	4.45 (.81)
Arousal for recollection	5.22 (.99)	3.87 (1.40)	5.74 (1.03)	4.00 (.93)

Note: Standard deviations are shown between parentheses. Valence rates ranged from 1 "extremely negative" to 7 "extremely positive"; arousal scores ranged from 1 "extremely low" to 7 "extremely high". Same letters within the same row display significant differences within conditions at $p < .05$.