Emotion
2017, Vol. 17, No. 5, 867–873

1528-3542/17/$12.00 http://dx.doi.org/10.1037/emo0000294

The Devil is in the Details: Comparisons of Episodic Simulations of Positive and Negative Future Events

Vannia A. Puig and Karl K. Szpunar
University of Illinois at Chicago

Over the past decade, psychologists have devoted considerable attention to episodic simulation—the ability to imagine specific hypothetical events. Perhaps one of the most consistent patterns of data to emerge from this literature is that positive simulations of the future are rated as more detailed than negative simulations of the future, a pattern of results that is commonly interpreted as evidence for a positivity bias in future thinking. In the present article, we demonstrate across two experiments that negative future events are consistently simulated in more detail than positive future events when frequency of prior thinking is taken into account as a possible confounding variable and when level of detail associated with simulated events is assessed using an objective scoring criterion. Our findings are interpreted in the context of the mobilization-minimization hypothesis of event cognition that suggests people are especially likely to devote cognitive resources to processing negative scenarios.

Keywords: episodic simulation, emotion, detail

The ability to imagine outcomes of hypothetical events—namely, episodic simulation (for recent reviews, see Schacter et al., 2012; Szpunar, Spreng, & Schacter, 2014)—is commonly characterized as a mental function that can help people to prepare for the future. This may be particularly true in relation to possible negative future events (cf. Schacter, 2012; Szpunar, 2010). For instance, consider the situation of a teenager who is faced with the task of explaining to a romantic partner that he or she is no longer interested in dating. While the thought of this event may be negative, simulating possible ways of breaking the news, where to break the news, and so on can be useful in that insights gained from those simulations could help to minimize any negative consequences that might accompany this future action. Indeed, Taylor (1991) showed that in the interest of mentally preparing for the future, people tend to devote more resources to processing negative as compared to neutral or positive events (see also Aspinwall & Taylor, 1997).

Accordingly, one might predict that negative simulations of the future should be more detailed than positive simulations of the future. Yet, recent work on episodic simulation does not support this prediction. In fact, much of the extant work comparing positive and negative future event simulation reports the opposite pattern—that is, greater detail for positive as compared to negative future events (Barsics, Van der Linden, & D'Argembeau, 2016; D'Argembeau, Renaud, & Van der Linden, 2011; D'Argembeau & Van der Linden, 2004; de Vito, Neroni, Gamboz, Della Sala, & Brandimonte, 2015; King et al., 2011; Painter & Kring, 2015; Rasmussen & Berntsen, 2013; Williams et al., 1996; for cases in which no differences are reported, see D'Argembeau, Xue, Lu, Van der Linden, & Bechara, 2008; Mason et al., 2007). Why might this be the case? The explanation that is commonly put forward relates the pattern of greater details for positive than negative simulations to a more general positivity bias that people hold about their future. That is, people tend to think that their future is especially likely to be positive relative to the future of other people (e.g., Weinstein, 1980) and even in relation to their own past (e.g., Newby-Clark & Ross, 2003; for a recent review, see Shepperd, Klein, Waters, & Weinstein, 2013); hence, accessing positive self-views may be easier (D'Argembeau & Van der Linden, 2004; Rasmussen & Berntsen, 2013) and possibly important for supporting goal pursuit (D'Argembeau et al., 2010).

In the present article, we put forth and test an alternative possibility. Specifically, we suggest that the typical finding of greater detail for positive than negative future events arises because of a methodological confound in the literature. In particular, most studies that have assessed differences in detail between positive and negative events have used open-ended event cues (e.g., imagine a positive/negative event; imagine a positive/negative event in response to a specific cue word or phrase) that do not take into account frequency of past thinking about those events. Indeed, studies that do assess estimates of past thinking typically report that people have thought more about the positive future events than the negative future events that they report in experimental settings (de Vito et al., 2015; Rasmussen & Berntsen, 2013; but see Barsics et al., 2016). Given that increases in frequency of thinking about specific future events lead to increases in subjective reports of detail (Szpunar & Schacter, 2013), it is possible that past exposure might account for the positivity bias in detail typically reported in the literature. In the two studies outlined below, we control for the frequency of prior thinking and hypothesize that, in line with prior theorizing about the value of thinking about negative events

This article was published Online First February 16, 2017.

Vannia A. Puig and Karl K. Szpunar, Department of Psychology, University of Illinois at Chicago.

We thank Tony Cossidente, Jennifer Kargol, and Nicholas Pfahler for assistance with event transcription and Sushmita Shrikanth for assistance with event coding.

Correspondence concerning this article should be addressed to Karl K. Szpunar, Department of Psychology, University of Illinois at Chicago, 1007 West Harrison Street, MC 285, Chicago, IL 60067. E-mail: szpunar@uic.edu

(Aspinwall & Taylor, 1997; Taylor, 1991), people should simulate negative events in greater detail than positive events.

To ensure that participants had not thought about the specific positive and negative events they simulated in our studies, we made use of the experimental recombination procedure (Addis, Sacchetti, Ally, Budson, & Schacter, 2009; Addis, Wong, & Schacter, 2008; Szpunar, Addis, & Schacter, 2012). In this procedure, participants are asked to provide names of familiar people, places, and objects via reporting of specific memories (Addis et al., 2008, 2009) or independent lists (Szpunar et al., 2012). Once this information has been garnered, the researcher randomly reorganizes these lists to create a set of person-location-object triads that evoke novel simulations of the future.

Recently, we made use of the experimental recombination paradigm in the context of simulating emotional future events (Szpunar et al., 2012; Szpunar, Jing, Benoit, & Schacter, 2015; Szpunar & Schacter, 2013; Wu, Szpunar, Godovich, Schacter, & Hofmann, 2015). Interestingly, across these studies, we found a slight, albeit sometimes nonsignificant, tendency for positive events to be rated in greater detail than negative events. However, interpretations of these results are clouded for two reasons, both related to the fact that these studies assessed levels of detail via subjective ratings. First, researchers interested in episodic simulation often distinguish between specific/internal details of simulated events (e.g., who, what, where, etc.) and nonspecific/external details of simulated events (e.g., semantic or background details not necessarily relevant to the central event; Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002). It is not clear whether ratings based on phenomenological introspection map onto internal details, external details, or some combination of the two. Second, and more important, recent work has shown that manipulations intended to boost internal, event-specific details of simulated events do not have a corresponding impact on subjective ratings (e.g., Madore, Szpunar, Addis, & Schacter, 2016), calling into question the usefulness of subjective ratings in evaluations of event detail (Nisbett & Wilson, 1977).

Indeed, it is important to note that most studies comparing detail between positive and negative simulations of future events have made use of subjective ratings and hence are open to similar limitations in interpretation. Nonetheless, several studies have assessed differences in objective detail between positive and negative simulations (e.g., de Vito et al., 2015; King et al., 2011). Although these latter studies also report more detail for positive than negative simulations, open-ended cueing paradigms were used in each case, leaving open the possibility that frequency of prior thinking influenced the observed pattern of data. Hence, what is needed are studies assessing differences in objective detail for positive and negative simulations that can avoid issues associated with interpreting measures of subjective detail and that also control for frequency of prior thinking.

In order to address this gap in the literature, we carried out two studies. In the first study, we asked participants to simulate positive and negative events in response to novel person-location-object triads that were generated using the experimental recombination procedure and to provide detailed descriptions of those events that could be objectively coded for internal and external detail using the Autobiographical Interview (Levine et al., 2002). In addition, we manipulated the number of times that participants simulated these events before providing a detailed account. Hence, we attempted to control for frequency of thinking in two ways: (1) The experimental recombination procedure ensured that specific events had not been thought about prior to the experiment, and (2) participants repeatedly simulated some events during the experiment. To forecast, we found a strong tendency for participants to generate greater internal detail for negative events. In order to assess the reproducibility of these findings, we carried out a second experiment in which participants again simulated positive and negative events in response to novel person-location-object triads, in the absence of an experimental manipulation of frequency.

Experiment 1

Method

Participants. Twenty-four undergraduate students were recruited through the University of Illinois at Chicago Undergraduate Psychology Subject Pool. This sample size was chosen to be similar to that of a recent study that made use of the same paradigm being implemented here (i.e., Szpunar et al., 2015) but that did not make use of an objective measure of event detail. Written consent was obtained in a manner approved by the University of Illinois at Chicago, Institutional Review Board. Participants received course credit for their participation.

Materials and procedures. The experiment consisted of four sections. First, upon arriving to the laboratory, participants were instructed to provide lists of 14 familiar people who they would most likely interact with in the Chicago area, 14 familiar locations that they had visited and would likely visit again in the Chicago area (locations needed to be specific; e.g., "Chicago" would be too broad, whereas "The Art Institute" was a better example), and 14 familiar objects that they use on a daily basis (the objects had to be portable; e.g., "cell phone" was an adequate example, whereas "desk" was a poor example). These lists were randomly reorganized to generate 14 novel person-location-object triads that served as simulation cues for practice trials (2 events) and the experiment (12 events).

Second, participants were asked to simulate/imagine a specific future event in response to 12 simulation cues. Specifically, participants were asked to simulate a future event that involved themselves interacting with the specified person, in the specified location, and in a manner that involved the specified object in response to each cue. Six of the simulation cues were paired with a positive label (the word "positive" presented above the simulation cue), and six cues were paired with a negative label (the word "negative" presented above the simulation cue). Participants were told that they should imagine an event that would result in them experiencing a positive emotion whenever the simulation cue was paired with a positive label and an event that would result in them experiencing a negative emotion whenever the simulation cue was paired with a negative label. Further, participants were told that it was completely up to them to determine what it would be about the simulated events that would evoke a positive or negative reaction, so long as they were the individual experiencing the emotion. Participants were given 12 s to simulate an event in response to each cue. After each trial, participants were asked to type a brief summary description (a few words) of the event in a response box that appeared below the simulation cue. To ensure that participants were generating positive and negative events in which they were the person experiencing the emotion, two practice trials were administered (one positive and one negative) during which they verbally described the contents of their simulation to the experimenter prior to typing their summary description (order of practice trials was counterbalanced across participants). During the experimental portion of the second phase, participants were not required to verbally describe their simulations to the experimenter. Positive and negative events during the experiment were presented in random order.

Next, after completing the first simulation task, participants were asked to resimulate half of the events (i.e., three positive and three negative, randomly selected from the experimental set) three times each. During this resimulation phase, the subset of selected simulation cues was presented along with their emotion label (above the simulation cue) and the brief summary description that participants had provided in the previous phase of the experiment (presented below the simulation cue). Participants were given 12 s to reimagine each event the same way they had before, without including any additional details. The brief summary descriptions ensured that participants resimulated the same events as before. The six events (i.e., three positive and three negative) were presented in three random sequences. In order to ensure that participants remained on task, they were asked to rate each instantiation of each event on ease of simulation (1 = *low difficulty*, 5 = *high difficulty*), strength of emotional reaction (1 = *low positive/negative emotion*, 5 = *high positive/negative emotion*), or level of emotional arousal (1 = *very calm*, 5 = *very excited*) in a random and distributed manner. That is, each event was rated on one of these dimensions during the first random sequence, then on another dimension during the second random sequence, and then on the third dimension during the third random sequence. For instance, over the course of the resimulation phase, one event may have been rated for ease, emotion, and then arousal across the three random sequences, whereas another event may have been rated for arousal, emotion, and then ease. Participants used a computer keyboard to make their ratings. After completing the resimulation phase, participants were given a mental break during which they played an online videogame (Tetris) for 5 min.

Finally, participants were asked to resimulate all 12 events (i.e., those that had and those that had not been repeated 5 min earlier). During this last phase, participants first saw the simulation cue paired with its emotion label and summary description and were given 12 s to bring the event back to mind without adding any extra detail. Once the event was back in mind, participants were given 2 min to verbally describe the event in as much detail as was available to them. The descriptions were audio-recorded and later transcribed for analysis. After providing each description, participants were asked to make two additional ratings (presented in random order): level of detail (1 = *low detail*, 5 = *high detail*) and plausibility of future occurrence (1 = *low plausibility*, 5 = *high plausibility*). After the experiment, participants were asked whether they had thought about any of the events reported in the study. All participants reported that they had not previously thought about any of the events. All stimuli were presented using E-Prime 2.0 software on a Dell desktop computer. The experiment lasted approximately 1.5 hr.

Event coding. We adapted the Autobiographical Interview scoring procedure (Levine et al., 2002) in order to code the transcribed audio-recordings for the level of event detail. First, a central event was identified for each response. Next, each response was scored for internal and external details. Internal details were event-specific details, including the time of day, people involved with the event, sensory details, actions, and thoughts/feelings. External details were event specific and unrelated to the central event (e.g., in cases where participants described more than one event), semantic or general knowledge, or miscellaneous thoughts (e.g., repetition, metacognition). The first author coded all protocols. A second rater who was unaware of the purpose of the study coded 20% of the transcripts (cf. Race, Keane, & Verfaellie, 2013). Standardized Cronbach's alpha was .86 for internal details and .96 for external details.

Results

Objective measures. A 2 (trial type: positive, negative) by 2 (repetition: repeated, nonrepeated) repeated-measures analysis of variance (ANOVA) on internal, event-specific details revealed a main effect of trial type, $F(1, 23) = 22.96$, $p < .001$, $\eta_p^2 = .50$; no effect of repetition, $F(1, 23) < 1$; and no interaction, $F(1, 23) < 1$. The main effect of trial type reflected the fact that participants generated more internal, event-specific details for negative ($M = 14.59$) as compared to positive ($M = 12.28$) events. Notably, 21 of 24 participants showed this pattern of results. A similar analysis on external details revealed no effect of trial type, $F(1, 23) < 1$, $Mpos = 4.79$, $Mneg = 4.52$; no effect of repetition, $F(1, 23) = 3.81$, $p = .06$, $\eta_p^2 = .14$; and no interaction, $F(1, 23) = 3.38$, $p = .08$, $\eta_p^2 = .13$, suggesting that the difference in detail between negative and positive events was restricted to internal, event-specific details.

Subjective measures. Separate 2 (trial type: positive, negative) by 2 (repetition: repeated, nonrepeated) ANOVAs were carried out on subjective ratings of detail and plausibility. The analysis of subjective detail revealed no main effect of trial type, no main effect of repetition, and no interaction; all Fs $(1, 23) < 1$. Similarly, the analysis of plausibility revealed no main effect of trial type, $F(1, 23) = 1.66$, $p = .210$, $\eta_p^2 = .07$; no main effect of repetition, $F(1, 23) < 1$; and no interaction, $F(1, 23) < 1$, although we note that positive events ($M = 2.93$) tended to be rated as more plausible than negative events ($M = 2.66$), in line with prior research on event plausibility (e.g., Szpunar & Schacter, 2013; see also results of Experiment 2 below). For completeness, we also report the results of the subjective ratings collected for half of the events during repeated simulation (i.e., ease of simulation, strength of emotional reaction, and emotional arousal). We found that positive and negative events did not differ in terms of difficulty, $t(23) < 1$, and strength of emotional reaction, $t(23) < 1$—that is, positive events were rated as strongly emotional (1 = low positive emotion, 5 = high positive emotion) as negative events (1 = low negative emotion, 5 = high negative emotion), but positive events ($M = 3.34$) were rated as more emotionally arousing than negative events ($M = 2.79$), $t(23) = 2.38$, $p = .03$, 95% CI = [.07, 1.03], $d = 0.49$ (cf. Mason et al., 2007).

Summary. In line with our predictions, participants simulated negative future events in more internal, event-specific detail than positive future events when controlling for the frequency of prior thinking and in the context of an objective measure of detail. Notably, our subjective measure of detail revealed no differences between conditions, a finding that is not uncommon in the literature (e.g., Mason et al., 2007; Szpunar & Schacter, 2013) and provides further evidence that caution should be exercised in drawing relations between subjective and objective measures of detail (Madore et al., 2016; see also De Brigard et al., 2016).

One surprising aspect of our data was that there was no influence of repeated simulation on objective or subjective event detail. Although prior work has demonstrated boosts in subjective detail following repeated simulation (Szpunar et al., 2015; Szpunar & Schacter, 2013; Wu et al., 2015), it is possible that methodological differences between our study and earlier studies might account for this discrepancy. First, with regard to our objective measure of detail (i.e., internal, event-specific details as scored by the Autobiographical Interview), it is possible that the extensive time allotted to participants to describe events (i.e., 2 min) may have obscured any differences that may have arisen in the context of earlier resimulations that occurred over short trial durations (i.e., 12 s per resimulation). Second, with regard to subjective ratings of detail, it is possible that giving participants 2 min to verbalize their simulations obscured any influence of prior resimulation on the subsequent subjective rating of detail. Notably, a power analysis of a prior study showing a boost in subjective detail as a result of repetition (Szpunar et al., 2015) revealed that six participants would have given us a statistical power of 80% (with alpha .05, two-tailed) to detect a within-group difference with an effect size of $d = 1.44$ (the estimated effect size obtained from Szpunar et al., 2015). Hence, the lack of observed difference in repeated versus nonrepeated trials in terms of subjective detail was not the result of a lack of statistical power. A similar power analysis on subjective plausibility (statistical power of 80% to detect a within-group difference with an effect size of $d = 0.99$; Szpunar et al., 2015) revealed that 11 participants would be needed, again indicating that the lack of a statistically significant difference in plausibility between repeated and nonrepeated events was not due to a lack of statistical power.

In sum, novel negative future events were consistently simulated in more internal, event-specific detail than novel positive future events. Given the discrepancy of this finding with the extant literature on emotional simulation, we conducted a second experiment to replicate this pattern of results. The second study was identical to the first, except that we did not manipulate event repetition.

Experiment 2

Method

Participants. Twenty-four undergraduate students were recruited through the University of Illinois at Chicago Psychology Subject Pool. The sample size was chosen to reflect that of Experiment 1. The University of Illinois at Chicago Institutional Review Board approved all study procedures, and written consent was obtained prior to the study. Participants received course credit for their participation.

Materials and procedures. The second experiment consisted of two sections. First, as with Experiment 1, participants were instructed to provide lists of 14 familiar people, 14 familiar locations, and 14 familiar objects (see Materials and Procedures for Experiment 1 for additional details). These details were randomly reorganized to generate 14 novel person-location-object triads that served as simulation cues for practice trials (2 events) and the experiment (12 events).

Second, participants were asked to simulate/imagine and verbally describe a specific future event in response to the 12 simulation cues. As before, six of the simulation cues were paired with a positive label (the word "positive" presented above the simulation cue) and six cues were paired with a negative label (the word "negative" presented above the simulation cue). Participants were given 2 min to simulate and verbally describe an event in response to each cue. The descriptions were audio-recorded and later transcribed for analysis. Prior to the experimental trials, two practice trials were administered to ensure that participants were generating positive and negative events in which they were the person experiencing the emotion (the order of the positive and negative practice trials was counterbalanced across participants). During the experiment, positive and negative events were presented in random order. After simulating each event, participants were asked to provide ratings of detail (1 = *low detail*, 5 = *high detail*), plausibility (1 = *low plausibility*, 5 = *high plausibility*), and strength of emotional reaction (1 = *low positive/negative emotion*, 5 = *high positive/negative emotion*). These ratings were presented in a random order following each event. After the experiment, participants were asked whether they had thought about any of the events reported in the study. All participants reported that they had not previously thought about any of the events. All stimuli were presented using E-Prime 2.0 software on a Dell desktop computer. The experiment lasted approximately 1 hr.

Event coding. As in the first experiment, transcriptions of audio-recordings of each event were used to identify a central event and coded for the presence of internal and external details using an adapted version of the Autobiographical Interview scoring procedure (Levine et al., 2002; see above for further details). The first author coded all protocols. A second rater who was unaware of the purpose of the study coded 20% of the transcripts. Standardized Cronbach's alpha was .98 for internal details and .92 for external details.

Results

Objective measures. A paired samples t test revealed that, as in Experiment 1, participants generated more internal, event-specific details for negative future events ($M = 24.12$) than for positive future events ($M = 18.30$), $t(23) = 5.94$, $p < .001$, 95% CI = [3.80, 7.85], $d = 1.21$ (20 of 24 participants showed this pattern of results). Interestingly, a similar test examining external details revealed that participants generated more external details for positive ($M = 8.97$) as compared to negative events ($M = 7.19$), $t(23) = 2.52$, $p = .019$, 95% CI = [0.32, 3.23], $d = .51$.

Subjective measures. Analyses of subjective ratings revealed no differences between positive and negative events in terms of detail, $t(23) < 1$, and strength of emotional reaction, $t(23) < 1$, but positive events ($M = 2.85$) were rated as more plausible than negative events ($M = 2.20$), $t(23) = 3.35$, 95% CI = [.25, 1.06], $p = .003$, $d = .69$.

Summary. Replicating our results from Experiment 1, we found that participants generated more internal, event-specific details for novel negative future events than for novel positive future events. Although participants in this experiment produced more external details for positive than negative events, these details constituted information that was irrelevant to the central events, provided background knowledge for the event, or had details that were repeated by the participant (Levine et al., 2002). Hence, it appears that when the frequency of prior thinking about an event is taken into account and when event detail is scored in an objective manner, participants produce more internal, event-specific details for negative than positive future events. In addition, the results of Experiment 2 support prior findings indicating that participants rate positive future events as more plausible than negative future events (cf. Szpunar & Schacter, 2013).

General Discussion

The purpose of the present investigation was to assess the level of detail with which participants simulate hypothetical positive and negative events when controlling for amount of prior thinking and assessing objective levels of event-specific detail. Using the experimental recombination procedure as a means of ensuring that participants had not thought about specific events, two experiments showed that participants were more likely to generate internal, event-specific details in relation to negative as opposed to positive simulations of the future. This finding is in stark contrast to the existing literature on episodic simulation in which researchers consistently find that participants generate more details for positive as compared to negative events. Indeed, we found that our observed pattern of results was rather consistent: 41 of our 48 participants (85%) across both experiments simulated more internal, event-specific details for negative as compared to positive future events.

We interpret our findings through the lens of theorizing that it can be useful for negative, as compared to positive, stimuli to be processed in a more cognitively complex manner (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Holland & Kensinger, 2010; Peeters & Czapinksi, 1990; Rozin & Royzman, 2001). In terms of episodic simulation, we propose that detailed simulations of the negative future provide a means of evaluating how/why those events may play out (Abele, 1985) and preparing the individual for future-oriented action (Bunn & Salo, 1993; Schacter, 2012; Szpunar, 2010). Along these lines, extensive investigations have assessed the influence of anticipated negative emotions on behavior (Baumeister, Vohs, DeWall, & Zhang, 2007). For instance, research on anticipated regret, stress, and guilt suggests that people may use information gleaned from negative simulations to make adaptive behavioral choices (e.g., proactive coping; Aspinwall & Taylor, 1997; see also Barsics et al., 2016; Jing, Madore, & Schacter, 2016).

Next, we consider the long-term consequences of simulating highly detailed negative events. Specifically, how do the present findings align with the general positivity bias that people hold about their future? We believe that two points are important to highlight in this regard. First, although people may simulate negative events in more detail than positive events, it is likely that people spend more time thinking about positive events in their daily lives (de Vito et al., 2015; Rasmussen et al., 2013). Second, recent work has demonstrated that people may be more likely to forget details about negative as compared to positive simulations over time (Szpunar et al., 2012). Accordingly, we further interpret our findings in the context of the mobilization-minimization hypothesis of event cognition, which purports that while it may be useful to exert considerable cognitive resources in anticipating/preparing for negative events, it is also likely beneficial to have mechanisms in place to quell the impact of those cognitions in the long term (Taylor, 1991). Based on our present findings and earlier work, we suggest that (a) under the correct experimental conditions, it is clear that negative simulations may be particularly detailed as compared to positive simulations, which possibly helps the individual to anticipate undesirable scenarios, and (b) details of these negative simulations may be disproportionately likely to be forgotten over time (Szpunar et al., 2012; see also Gallo, Korthauer, McDonough, Teshale, & Johnson, 2011).

One important caveat the deserves mention has to do with limitations in external validity that may be introduced by using the experimental recombination procedure as a means of ensuring that participants simulate events they have not thought about before. That is, although the procedure helps to limit the influence of frequency of prior thinking on measures of detail (as was intended here) and memory (e.g., Szpunar et al., 2012), it is also possible that simulations based on random person-location-triads may not be particularly relevant to the self. Along this line of reasoning, more open-ended event cues that do not control for frequency of prior thinking may nonetheless evoke thoughts about future events that are more likely to occur and relevant to the self and so evoke more detailed thinking in relation to positive as compared to negative events. Hence, it will be important for future work to tease apart the influence of event novelty and self-relevance on the detail (subjective and objective) with which events are simulated.

Finally, it would be valuable for future work to distinguish more clearly whether participants are simulating emotions that might be experienced in the future (i.e., anticipated emotion) versus emotions that may be experienced presently when thinking about a future (i.e., anticipatory emotion; Baumgartner, Pieters, & Bagozzi, 2008). For instance, Barsics et al. (2016) found that people thought more about positive than negative events that involved anticipated but not anticipatory emotions. Yet, the authors found that positive events were rated as more detailed than negative events, whether those events involved anticipated or anticipatory emotions (i.e., whether frequency of prior thinking was equated or not). Notably, Barsics et al. (2016) made use of subjective ratings of detail, which we suggest may be difficult to interpret (e.g., De Brigard et al., 2016; Madore et al., 2016), and it is possible that objective ratings of detail might reveal interesting differences between positive and negative events that are based on anticipated and anticipatory emotions.

A wealth of psychological research has demonstrated that people tend to devote considerable cognitive resources to processing negative stimuli. Although prior research on episodic simulation had consistently found that positive future events are simulated in greater detail than negative future events, we show here that this pattern is reversed when frequency of prior thinking is taken into account and objective measures of detail are used to assess the content of simulations. The extent to which internal, event-specific detail-associated negative future events bestows a preparatory advantage for behavior warrants further investigation.

References

Abele, A. (1985). Thinking about thinking: Causal, evaluative and finalistic cognitions about social situations. *European Journal of Social Psychology, 15,* 315–332. http://dx.doi.org/10.1002/ejsp.2420150306

Addis, D. R., Sacchetti, D. C., Ally, B. A., Budson, A. E., & Schacter, D. L. (2009). Episodic simulation of future events is impaired in mild Alzheimer's disease. *Neuropsychologia, 47,* 2660–2671. http://dx.doi.org/10.1016/j.neuropsychologia.2009.05.018

Addis, D. R., Wong, A. T., & Schacter, D. L. (2008). Age-related changes in the episodic simulation of future events. *Psychological Science, 19,* 33–41. http://dx.doi.org/10.1111/j.1467-9280.2008.02043.x

Aspinwall, L. G., & Taylor, S. E. (1997). A stitch in time: Self-regulation and proactive coping. *Psychological Bulletin, 121,* 417–436. http://dx.doi.org/10.1037/0033-2909.121.3.417

Barsics, C., Van der Linden, M., & D'Argembeau, A. (2016). Frequency, characteristics, and perceived functions of emotional future thinking in daily life. *Quarterly Journal of Experimental Psychology, 69,* 217–233. http://dx.doi.org/10.1080/17470218.2015.1051560

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5,* 323–370. http://dx.doi.org/10.1037/1089-2680.5.4.323

Baumeister, R. F., Vohs, K. D., DeWall, C. N., & Zhang, L. (2007). How emotion shapes behavior: Feedback, anticipation, and reflection, rather than direct causation. *Personality and Social Psychology Review, 11,* 167–203. http://dx.doi.org/10.1177/1088868307301033

Baumgartner, H., Pieters, R., & Bagozzi, R. P. (2008). Future-oriented emotions: Conceptualization and behavioral effects. *European Journal of Social Psychology, 38,* 685–696. http://dx.doi.org/10.1002/ejsp.467

Bunn, D. W., & Salo, A. A. (1993). Forecasting with scenarios. *European Journal of Operational Research, 68,* 291–303. http://dx.doi.org/10.1016/0377-2217(93)90186-Q

D'Argembeau, A., Renaud, O., & Van der Linden, M. (2011). Frequency, characteristics and functions of future-oriented thoughts in daily life. *Applied Cognitive Psychology, 25,* 96–103. http://dx.doi.org/10.1002/acp.1647

D'Argembeau, A., Stawarczyk, D., Majerus, S., Collette, F., Van der Linden, M., Feyers, D., . . . Salmon, E. (2010). The neural basis of personal goal processing when envisioning future events. *Journal of Cognitive Neuroscience, 22,* 1701–1713.

D'Argembeau, A., & Van der Linden, M. (2004). Phenomenal characteristics associated with projecting oneself back into the past and forward into the future: Influence of valence and temporal distance. *Consciousness and Cognition: An International Journal, 13,* 844–858. http://dx.doi.org/10.1016/j.concog.2004.07.007

D'Argembeau, A., Xue, G., Lu, Z. L., Van der Linden, M., & Bechara, A. (2008). Neural correlates of envisioning emotional events in the near and far future. *NeuroImage, 40,* 398–407. http://dx.doi.org/10.1016/j.neuroimage.2007.11.025

De Brigard, F., Giovanello, K. S., Stewart, G. W., Lockrow, A. W., O'Brien, M. M., & Spreng, R. N. (2016). Characterizing the subjective experience of episodic past, future, and counterfactual thinking in healthy younger and older adults. *Quarterly Journal of Experimental Psychology, 69,* 2358–2375. http://dx.doi.org/10.1080/17470218.2015.1115529

de Vito, S., Neroni, M. A., Gamboz, N., Della Sala, S., & Brandimonte, M. A. (2015). Desirable and undesirable future thoughts call for different scene construction processes. *Quarterly Journal of Experimental Psychology, 68,* 75–82. http://dx.doi.org/10.1080/17470218.2014.937448

Gallo, D. A., Korthauer, L. E., McDonough, I. M., Teshale, S., & Johnson, E. L. (2011). Age-related positivity effects and autobiographical memory detail: Evidence from a past/future source memory task. *Memory, 19,* 641–652. http://dx.doi.org/10.1080/09658211.2011.595723

Holland, A. C., & Kensinger, E. A. (2010). Emotion and autobiographical memory. *Physics of Life Reviews, 7,* 88–131. http://dx.doi.org/10.1016/j.plrev.2010.01.006

Jing, H. G., Madore, K. P., & Schacter, D. L. (2016). Worrying about the future: An episodic specificity induction impacts problem solving, reappraisal, and well-being. *Journal of Experimental Psychology: General, 145,* 402–418. http://dx.doi.org/10.1037/xge0000142

King, M. J., Williams, L. A., MacDougall, A. G., Ferris, S., Smith, J. R., Ziolkowski, N., & McKinnon, M. C. (2011). Patients with bipolar disorder show a selective deficit in the episodic simulation of future events. *Consciousness and Cognition: An International Journal, 20,* 1801–1807. http://dx.doi.org/10.1016/j.concog.2011.05.005

Levine, B., Svoboda, E., Hay, J. F., Winocur, G., & Moscovitch, M. (2002). Aging and autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and Aging, 17,* 677–689. http://dx.doi.org/10.1037/0882-7974.17.4.677

Madore, K. P., Szpunar, K. K., Addis, D. R., & Schacter, D. L. (2016). Episodic specificity induction impacts activity in a core brain network during construction of imagined future experiences. *Proceedings of the National Academy of Sciences of the United States of America, 113,* 10696–10701. http://dx.doi.org/10.1073/pnas.1612278113

Mason, M. F., Norton, M. I., Van Horn, J. D., Wegner, D. M., Grafton, S. T., & Macrae, C. N. (2007). Wandering minds: The default network and stimulus-independent thought. *Science, 315,* 393–395. http://dx.doi.org/10.1126/science.1131295

Newby-Clark, I. R., & Ross, M. (2003). Conceiving the past and future. *Personality and Social Psychology Bulletin, 29,* 807–818. http://dx.doi.org/10.1177/0146167203029007001

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84,* 231–259. http://dx.doi.org/10.1037/0033-295X.84.3.231

Painter, J. M., & Kring, A. M. (2015). Back to the future: Similarities and differences in emotional memories and prospections. *Applied Cognitive Psychology, 29,* 271–279. http://dx.doi.org/10.1002/acp.3105

Peeters, G., & Czapinski, J. (1990). Positive-negative asymmetry in evaluations: The distinction between affective and informational negativity effects. *European Review of Social Psychology, 1,* 33–60. http://dx.doi.org/10.1080/14792779108401856

Race, E., Keane, M. M., & Verfaellie, M. (2013). Losing sight of the future: Impaired semantic prospection following medial temporal lobe lesions. *Hippocampus, 23,* 268–277. http://dx.doi.org/10.1002/hipo.22084

Rasmussen, A. S., & Berntsen, D. (2013). The reality of the past versus the ideality of the future: Emotional valence and functional differences between past and future mental time travel. *Memory & Cognition, 41,* 187–200. http://dx.doi.org/10.3758/s13421-012-0260-y

Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review, 5,* 296–320. http://dx.doi.org/10.1207/S15327957PSPR0504_2

Schacter, D. L. (2012). Adaptive constructive processes and the future of memory. *American Psychologist, 67,* 603–613.

Schacter, D. L., Addis, D. R., Hassabis, D., Martin, V. C., Spreng, R. N., & Szpunar, K. K. (2012). The future of memory: Remembering, imagining, and the brain. *Neuron, 76,* 677–694. http://dx.doi.org/10.1016/j.neuron.2012.11.001

Sharot, T., Riccardi, A. M., Raio, C. M., & Phelps, E. A. (2007). Neural mechanisms mediating optimism bias. *Nature, 450,* 102–105. http://dx.doi.org/10.1038/nature06280

Shepperd, J. A., Klein, W. M., Waters, E. A., & Weinstein, N. D. (2013). Taking stock of unrealistic optimism. *Perspectives on Psychological Science, 8,* 395–411. http://dx.doi.org/10.1177/1745691613485247

Szpunar, K. K. (2010). Episodic future thought an emerging concept. *Perspectives on Psychological Science, 5,* 142–162. http://dx.doi.org/10.1177/1745691610362350

Szpunar, K. K., Addis, D. R., & Schacter, D. L. (2012). Memory for emotional simulations: Remembering a rosy future. *Psychological Science, 23,* 24–29. http://dx.doi.org/10.1177/0956797611422237

Szpunar, K. K., Jing, H. G., Benoit, R. G., & Schacter, D. L. (2015). Repetition-related reductions in neural activity during emotional simulations of future events. *PLoS ONE, 10,* e0138354. http://dx.doi.org/10.1371/journal.pone.0138354

Szpunar, K. K., & Schacter, D. L. (2013). Get real: Effects of repeated simulation and emotion on the perceived plausibility of future experiences. *Journal of Experimental Psychology: General, 142,* 323–327. http://dx.doi.org/10.1037/a0028877

Szpunar, K. K., Spreng, R. N., & Schacter, D. L. (2014). A taxonomy of prospection: Introducing an organizational framework for future-oriented cognition. *Proceedings of the National Academy of Sciences of the United States of America, 111,* 18414–18421. http://dx.doi.org/10.1073/pnas.1417144111

Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin, 110,* 67–85. http://dx.doi.org/10.1037/0033-2909.110.1.67

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39,* 806–820. http://dx.doi.org/10.1037/0022-3514.39.5.806

Williams, J. M. G., Ellis, N. C., Tyers, C., Healy, H., Rose, G., & MacLeod, A. K. (1996). The specificity of autobiographical memory and imageability of the future. *Memory & Cognition, 24,* 116–125. http://dx.doi.org/10.3758/BF03197278

Wu, J. Q., Szpunar, K. K., Godovich, S. A., Schacter, D. L., & Hofmann, S. G. (2015). Episodic future thinking in generalized anxiety disorder. *Journal of Anxiety Disorders, 36,* 1–8. http://dx.doi.org/10.1016/j.janxdis.2015.09.005

Received September 12, 2016
Revision received January 9, 2017
Accepted January 11, 2017 ■