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Mental Simulation of the Approximal Future: Imagining What Might Happen Next

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In the course of daily life, various events—such as driving in suboptimal weather conditions, going on a first date, or walking home alone at night—evoke cognitions about what might happen next in the context of ongoing experience. Nonetheless, little is currently known about the phenomenological experience of anticipating events that might occur next—or what we refer to as simulation of the approximal future. We present novel evidence from a retrospective survey, a diary study, and an experimental laboratory study indicating that people commonly experience simulations of the approximal future, and that simulations of the approximal future can be reliably distinguished, in terms of their valence and function, from simulations of future events that are expected to occur in spatiotemporal contexts that are distinct from ongoing experience. Simulation of the approximal future represents an understudied mental experience that carries important implications for understanding the nature of constructive perceptual and memory-based processes as they pertain to event cognition, threat detection, individual differences, and psychopathology.

Public Significance Statement

The study of future-oriented cognition typically focuses on the simulation of events that might occur outside of the here and now—such as simulating a weekend outing. The present set of studies highlight novel evidence demonstrating that people also commonly experience mental simulations of something that might happen next in the context of ongoing experience—such as simulating a car accident while driving in unsafe weather conditions. Unlike simulations of the more distant future that tend to focus on positive events, simulations of the approximal future appear to be closely tied to detecting possible threat in one's surrounding environment. The role of individual, occupational, and cultural factors in giving rise to simulations of the approximal future are discussed.

Keywords: approximal future, event cognition, predictive processing, threat detection

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In the course of daily life, various events—such as driving in suboptimal weather conditions, going on a first date, or walking home alone at night—evoke cognitions about what might happen next in the context of ongoing experience. Philosophers and psychologists have long considered the present moment as having a temporal structure that extends into the future (e.g., Gilbert, 2007; Hershfield & Maglio, 2020; Husserl, 1964; Stern, 2004), and the human brain is widely viewed as having been shaped by nature to make predictions that guide organisms through the uncertainty of their surroundings (e.g., Bar, 2009; Bubic et al., 2010;

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A. Clark, 2013; Pezzulo, 2014). Nonetheless, little is currently known about the phenomenological experience of anticipating events that might occur next in the context of ongoing experience—what we will refer to as simulation of the approximal future. In this article, we present novel evidence indicating that people commonly experience simulations of the approximal future, and that simulations of the approximal future can be reliably distinguished, in terms of their valence and function, from simulations of future events that are expected to occur in spatiotemporal contexts that are distinct from ongoing experience—what we will refer to as simulations of the distal future. Next, we highlight the relevance of temporal distance, emotional valence, functionality, spontaneous versus deliberate cognitive processes, and predictive processing as they pertain to the distinction between simulations of the approximal and distal future and our approach to their investigation.

Temporal Distance

Prior research on mental simulation of the future has given ample consideration to the role of temporal distance from the present. In most relevant studies, researchers ask participants to simulate events in the near and far future, and then compare the resultant simulations across various subjective indices of phenomenological experience (Arnold et al., 2011; Berntsen & Jacobsen, 2008; D’Argembeau & Van der Linden, 2004; Spreng & Levine, 2006; Trope & Liberman, 2003). The relevance of this work to our current interests is that the events studied in such experiments, whether the events are imagined to occur in the near or far future, correspond to what we operationalize as simulations of the distal future. That is, whether participants are simulating events that might occur later in the day, week, or year—timeframes that are commonly associated with the near future—or 5, 10, or 20 years later—timeframes that are commonly associated with the far future—participants are imagining events as occurring outside of the spatiotemporal context in which they are completing the experimental task (e.g., Arnold et al., 2011; D’Argembeau et al., 2011). In other words, the events are imagined as occurring in a different place and at a different time.

It is important to note that researchers have previously made a distinction between simulations of the proximal, as opposed to the approximal, and distal future. However, the distinction between the proximal and distal future was characterized as the difference between events that are more (proximal) or less (distal) similar to the present (e.g., Tamir & Mitchell, 2011), rather than reflecting a continuation of ongoing experience. Our focus on differentiating simulations that occur either within or outside the spatiotemporal context of one’s ongoing experience does not distinguish between proximal and distal simulations of the future; both are considered distal—that is, as occurring outside of the spatiotemporal context of one’s ongoing experience. For instance, a simulation occurring in one’s current setting would be considered more proximal than a simulation occurring in an exotic setting, such as a tropical island, but would not be considered approximal unless the event was also occurring at the time of one’s ongoing experience. Of course, our characterization is not meant to deny the clear differences that exist between simulations of the proximal and distal future (Trope & Liberman, 2003), but rather that both differ from simulations of the approximal future.

To help further clarify the distinction between simulations of the approximal and distal future, consider the following two examples involving the everyday task of commuting (driving) to work in the morning. An example of a simulation of the distal future in this context might involve envisioning how an important meeting might play itself out once the individual constructing the simulation arrives at work. The individual is situated in their car on the way to work and imagines an event that will take place in a distinct spatiotemporal context (i.e., in their office later that morning). On the other hand, simulations of the approximal future involve imagining events that might occur in the same spatiotemporal context as ongoing experience. For instance, while driving to work, the individual might experience the urge to look at their cellphone, but then suddenly imagine being in an accident (e.g., rear-ending another vehicle) and decide that they are better off checking their cellphone once they arrive at their destination. This latter simulation revolves around an event that would occur in the same place and time as ongoing experience.

Emotional Valence and Function

Perhaps one of the most consistent findings in the future event simulation literature is that people are more likely to think about positive than negative future events (Berntsen & Jacobsen, 2008; D’Argembeau et al., 2011; Newby-Clark & Ross, 2003). It has been suggested that this positivity bias may serve the function of fostering a close connection to the future (D’Argembeau et al., 2012; Schmuck & Sheldon, 2001). In fact, there is considerable evidence from the clinical sciences to suggest that the number of positive events that one can generate in relation to their future is reliably associated with good mental health (e.g., A. L. MacLeod, 2016; A. K. MacLeod & Conway, 2007). Nonetheless, we suspect that this positivity bias in event simulation may, at least in part, arise as a result of the fact that studies at the intersection of future thinking and mental health tend to require participants to imagine events that will occur in spatiotemporal contexts that are different from the context in which they complete those studies (e.g., later in the day, week, and so on). Whereas simulations of positive distal future events may give people something to look forward to in their lives, little is known about the valence or function of simulations of the approximal future.

To the extent that people experience simulations of the approximal future, it is possible that such simulations could foreshadow both positive and negative outcomes. For instance, research on anticipatory pleasure shows that people tend to experience mental imagery when anticipating pleasureful events (e.g., Gard et al., 2006). However, to our knowledge, there does not appear to be a distinction between simulations of the approximal and distal future in this literature, and studies of anticipatory pleasure appear to focus on simulations of the distal future (e.g., Hallford et al., 2020; Ji et al., 2021). On the contrary, theories of threat detection assume that people mentally simulate possible sources of threat to be able to avoid dangers in their environment (e.g., Mobbs et al., 2015). However, relevant studies in the threat detection literature have also not assessed the extent to which people consciously experience simulations of the approximal as opposed to the distal future.

Although the extant literatures on anticipatory pleasure and threat detection do not offer strong predictions as to whether simulations of the approximal future might be more likely to be evoked by possible positive or negative outcomes, an extensive line of research has demonstrated that more cognitive resources are often devoted to avoiding negative outcomes as opposed to working toward positive outcomes (for a review, see Baumeister et al., 2001). Accordingly, we reasoned that simulations of the approximal future might be especially useful in helping people to avoid imminent negative outcomes. If our reasoning is correct, then simulations of the approximal future should not only be more likely to be negative than positive, but they should also indicate sources of threat to the individual and hence be especially likely to impact behavior. On the other hand, in line with extant research, we expected that simulations of the distal future would be more positive than negative, and that they would be more likely to underscore goals that participants are working toward and whose end states extend beyond the present moment.

Spontaneous and Deliberate Cognitive Processes

We further consider an orthogonal distinction between spontaneous and deliberate simulations of the future and explain its relevance to the distinction between simulations of the approximal and distal future. We begin with relevant definitions and examples. Deliberate simulations of the future occur when people actively generate details about future events. Indeed, a considerable amount of our knowledge about future event simulation has been gleaned from laboratory studies in which participants are presented with word or picture cues (e.g., the word *birthday* or a picture depicting a birthday gathering) and asked to generate specific events that might occur in their future (Szpunar & Schacter, 2018). On the other hand, spontaneous simulations of the future occur when a specific future event pops into mind in the absence of any intention on the part of the individual to think about the event (Berntsen, 2019; Berntsen & Jacobsen, 2008). Although less is known about spontaneous as compared to deliberate stimulations of the future, relevant work has shown that people tend to experience spontaneous and deliberate simulations of the future at equal rates (Finnbogadóttir & Berntsen, 2013), and some have even argued that spontaneous simulations of the future might represent an evolutionary precursor to the uniquely human capacity to deliberate on future events in a purposeful manner (e.g., Cole & Kvavilashvili, 2019).

To our knowledge, the study of both deliberate and spontaneous simulations of the future has focused almost exclusively on what we refer to as simulations of the distal future. Notably, spontaneous simulations of the future tend to be reported as less positive and more near to the present than deliberate simulations of the future (for review, see Berntsen, 2019). These differences between spontaneous and deliberate simulations of the future are strikingly similar to the differences we expected to find between simulations of the approximal and distal future—that is, simulations of the approximal future should be more negative and near to the present than simulations of the distal future. Hence, it is important to make clear how our predictions about simulations of the approximal and distal future are different from extant findings around spontaneous and deliberate simulations of the future. We highlight two points as critical. First, although spontaneous simulations of the future are consistently reported as being more near to the present than deliberate simulations of the future (e.g., Berntsen & Jacobsen, 2008), inspection of the types of events reported by participants in studies of spontaneous future thinking, much like studies of temporal distance and mental health, reveals that participants typically report events that occur in a spatiotemporal context that is outside of one's ongoing experience—that is, simulations of the distal future. Hence, although spontaneous simulations of the future are closer to the present, we know of no studies that have examined the occurrence of spontaneous (or deliberate) simulations that play out in the context of ongoing experience—that is, simulations of the approximal future. Second, although spontaneous simulations of the future are less positive than deliberate simulations of the future, both types of simulations are nonetheless more positive than negative (e.g., Berntsen & Jacobsen, 2008; del Palacio-Gonzalez & Berntsen, 2020; but see Cole et al., 2016). On the contrary, we predicted that simulations of the approximal future should be more negative than positive, whereas simulations of the distal future should be more positive than negative.

While these considerations help to differentiate our distinction between simulations of the approximal and distal future from the distinction between spontaneous and deliberate simulations of the future, it is nonetheless important to highlight that simulations of the approximal future, much like simulations of the distal future, can be spontaneous or deliberate in nature. For instance, the high place phenomenon represents the finding that people sometimes feel the urge to jump when they are in a high place, such as a high-rise building (Hames et al., 2012; Teismann et al., 2020). Although research on the high place phenomenon does not differentiate whether people spontaneously or deliberately imagine the experience of jumping, it is conceivable that the simulation of jumping could come to mind spontaneously or that one could deliberately simulate the experience. In the studies that we describe below, we asked participants to engage in retrospective reporting and daily experience-sampling to help characterize instances in which they spontaneously experienced simulations of the approximal and distal future. We also carried out an experimental laboratory study that asked participants to deliberately engage in simulations of the approximal and distal future. Our findings were consistent across these various methodological approaches.

Predictive Processing

Finally, it is also important to situate simulations of the approximal future among other well-established research on predictive processing as it relates to expectation and event perception. With regard to expectation, research has demonstrated that training participants to anticipate a visual stimulus, such as a specific visual gradient, can evoke false percepts related to those expectations in the absence of stimulation (e.g., de Lange et al., 2018; Haarsma et al., 2023). However, such observations are limited to controlled laboratory settings, and it is not clear whether similar phenomena arise in the context of complex event perception. According to event segmentation theory, event perception is guided by working event models that use schematic knowledge to aid in the prediction of what might come next in the context of ongoing experience (Zacks, 2020; Zacks et al., 2007). However, research in this domain tends to focus on how changes in the perceptual or conceptual features related to ongoing experience can evoke prediction errors that signal the need to update event models and the resultant impact of this recalibration process on the encoding and subsequent memory of events. The theory does not make predictions about whether or under what circumstances spontaneous simulations of what might happen next enter conscious awareness.

Another related area of research focuses on the role of hazard perception in the context of driving under suboptimal weather conditions. A driver may anticipate that heavy rain might make it difficult to break in a timely manner, and accordingly adjust their behavior by slowing down and keeping enough space between themselves and other motorists. Indeed, there is considerable evidence that the ability to formulate such predictions, that are believed to be based in part on accumulated schematic knowledge, is related to safe driving (Deery, 1999). However, research on hazard detection, similar to extant work on event perception, does not elucidate whether the capacity to anticipate is accompanied by mental simulations of what might happen next in the context of ongoing experience. Hence, although there exists considerable research around predictions that people make when anticipating what might happen next, consciously or implicitly (Hubbard, 2005; Winawer et al., 2008), little is known about whether people commonly experience simulations of the approximal future in relation to complex daily events or whether the emotional nature of the anticipated outcome (i.e., positive or negative) plays a role in determining how likely people are to experience these simulations.

The Present Studies

In order to characterize the valence and function of simulations of the approximal and distal future, we carried out three separate studies. In the first study, we simply wanted to gain insight into whether simulations of the approximal future represent a mental phenomenon that people are familiar with and experience in their daily lives, and whether it would be worthwhile to invest effort into a more comprehensive investigation of the phenomenon. To this end, we devised a retrospective survey that asked participants to report on whether they had previously experienced simulations of the approximal (and distal) future. To foreshadow, this first study provided strong preliminary data indicating that people not only remember experiencing simulations of the approximal (and distal) future, but that simulations of the approximal and distal future differ in terms of their valence and function. To follow up on these findings, our second investigation was a diary study that required participants to report on the occurrence of simulations of the approximal and distal future over a 2-week period. This study allowed us to document the occurrence of simulations of the approximal and distal future more systematically in daily life. Finally, our third study was an experimental laboratory investigation that aimed to delineate cognitive factors that give rise to the negative valence that typically accompanies simulations of the approximal future.

Study 1

The purpose of Study 1 was to establish that people both experience and remember the occurrence of simulations of the approximal future in their daily lives, and whether the valence and function characterizing those simulations is different from the valence and function that characterize simulations of the distal future. To this end, we asked participants to complete a retrospective survey that asked them to reflect on past instances of simulating events that either (a) represented an extension of ongoing experience (i.e., the approximal future) or that (b) occurred outside of ongoing experience (i.e., the distal future). For the distal condition, we note that participants were free to report any events that they remembered having previously simulated that occurred outside of ongoing experience. That is, participants were not limited to reporting simulations of the distal future but could also report on simulations of the distal past. This approach allowed us to replicate and extend prior work showing that people tend to simulate the (distal) future more so than the (distal) past (e.g., Stawarczyk, 2018). Given the retrospective nature of the data collection characterizing this study, we reasoned that replicating this well-known pattern of data and extending it to the domain of memory for simulations would lend some credibility to our other predictions. Those other predictions were as follows: First, we predicted that participants would remember having experienced simulations of both the approximal and distal future. Second, we predicted that simulations of the approximal future or memories of those simulations would be characterized by more negative than positive affect, but that simulations of the distal future would be characterized by more positive than negative affect. Third, we predicted that simulations of the approximal future would be more likely to be associated with threat detection, whereas simulations of the distal future would be more likely to be associated with thinking about goal states.

Method

Transparency and Openness

We describe all data exclusions, manipulations, and measures in the present study. This study was not preregistered. Full task instructions are available in the Supplemental Materials. The deidentified data on which all analyses for Study 1 are based are freely available on the Open Science Framework at https://osf.io/xzd2s/. Data were analyzed using SPSS 28.0 software and JASP 0.17.1 software. The study was completed in 2018 and approved by the University of Illinois Chicago Institutional Review Board.

Participants

Participants were 72 undergraduate students at the University of Illinois Chicago (M_{age} = 19.2 years) who completed the study for course credit. Participants indicated their gender using an open response format (female = 51; male = 21). Given the novelty of our research question, there was no comparable work on which to base a power analysis. However, our sample size was comparable to standard laboratory studies of future-oriented cognition (see Szpunar & Schacter, 2018). Moreover, the data derived from this initial exploratory investigation served as a basis for the power analysis in Study 2.

Design and Procedure

Study 1 made use of a between-participants design. Upon arriving at the laboratory, participants were randomly assigned to either the approximal or distal condition. Participants in each condition were asked to remember up to 10 relevant simulations. Specifically, participants in the approximal condition were asked to remember occasions in which they mentally simulated or imagined something that might happen next in the context of their ongoing experience. Participants in the distal condition were asked to remember occasions in which they mentally simulated or imagined something that was unrelated to the context of their ongoing experience. Finally, half of the participants were asked to recall instances in which they had *suddenly* experienced a spontaneous approximal or distal simulation, whereas the other half of participants were not presented with that adjective as part of the instructions. This latter manipulation did not turn out to impact the results in any meaningful way. It was included as part of all analyses but will not be discussed any further.

For each response, participants were asked to type a brief description of what they were doing at the time the simulation came to mind and the content of the simulation. Before moving onto subsequent responses, participants were asked to rate the memory of the simulation in terms of its detail, positive emotion, negative emotion, arousal, plausibility, and impact on subsequent behavior (all using 5-point rating scales). Participants were also allowed to describe how the simulation impacted their behavior. Prior to beginning the task, participants were given time to review the rating scales and completed one practice trial to ensure that they understood the instructions. The task was self-paced, and participants were allowed to stop the task whenever they felt they had exhausted their memory. At the end of the study, participants were asked to rate, on a 5-point scale (1 = *rarely*; 5 = *frequently*), how often they tend to experience simulating events that represent extensions of ongoing experience (approximal condition) or events occurring outside of ongoing experience (distal condition) in their daily lives. Participants were then debriefed about the purposes of the study.

Coding

For the approximal condition, responses were coded for whether they reflected an extension of ongoing experience (i.e., approximal future), something that might happen outside of ongoing experience (i.e., distal future), or other (e.g., a fantasy or some aspect of one's train of thought). Two independent coders initially coded 20% of participant responses. Interrater reliability was κ = .71 indicating substantial agreement. Both coders then coded the remainder of participant responses. Any disagreements were resolved through discussion and the final data set represents 100% agreement between coders. Only responses that reflected the approximal future were used in subsequent analyses. Most responses (70%) reflected simulations of something that might happen next in the context of ongoing experience (i.e., the approximal future). A subset of responses (14%) reflected simulations of events that were anticipated to occur at a later point in time (i.e., the distal future; often later in the day but not next in the context of ongoing experience), and an additional subset of responses (16%) reflected other aspects of ongoing cognition (e.g., descriptions of one's current train of thought as opposed to a mental simulation of what might happen next in the context of ongoing experience).

For the distal condition, responses were coded in a two-step process. First, each response was coded for whether it referred to the future, past, or whether it was atemporal. Second, each future-oriented response was coded for whether it referred to an event that occurred outside of ongoing experience. Two independent coders initially coded 20% of participant responses. Interrater reliability for whether responses represented future, past, or atemporal events was κ = .74, indicating substantial agreement. Regarding whether future events reflected occurrences outside of ongoing experience, one rater coded all responses as occurring outside ongoing experience, and so our measure of interrater reliability (κ) could not be calculated given that their coding served as a constant. Nonetheless, rater agreement was high, as both raters agreed on 91% of responses. For both sets of coding, coders then coded the remainder of participant responses. Any disagreements were resolved through discussion, and the final data set represents 100% agreement between coders. Only responses that reflected the distal future were used in subsequent analyses. This resulted in the removal of six participants who only generated distal past and/or atemporal simulations, but not simulations of the distal future.

Finally, eligible responses across both conditions were coded as to their event-specific content to provide further insight into the functions of approximal and distal simulations of the future. First, one of the authors (KR) evaluated all approximal and distal simulations and created two independent lists of event codes, one for each domain. Second, two independent coders used those lists of event codes to classify each eligible response. The two independent coders began by coding 20% of events. Interrater reliability was κ = .81, indicating substantial agreement. Both coders then coded the remainder of participant responses. Any disagreements were resolved through discussion and the final data set represented 100% agreement between coders.

Results

Frequency

For simulations of the approximal future, subjective and objective measures indicated that people do indeed experience such simulations in daily life. The subjective measure indicated that participants experienced approximal simulations often in daily life (M = 3.91, SD = 1.08; 5-point scale). Regarding the objective measure, participants remembered an average of 5.44 (SD = 2.40) simulations of the approximal future, showing further that this is a mental experience that not only occurs in daily life but that is memorable as well.

For distal simulations, the subjective measure indicated that participants also experienced such simulations often in daily life (M = 4.03, SD = 0.88; 5-point scale). Regarding the objective measure, participants remembered an average of 8.47 (SD = 2.20) distal simulations. These distal simulations are based on an aggregate of past, future, and atemporal events. For the purposes of the analyses presented below, we focus on comparing simulations of the approximal future with simulations of the distal future. To this end, we note that participants reported an average of 2.97 (SD = 2.47) distal simulations of the future. Notably, the proportion of distal simulations relating to the future (36%) was numerically higher than those relating to the past (23%), in line with prior findings (Stawarczyk, 2018).

Phenomenological Ratings

Table 1 presents a summary of the phenomenological ratings for Study 1. Of particular interest was the valence associated with each type of simulation. The mean valence rating, calculated by subtracting the negative from the positive valence rating, for simulations of the approximal future was negative (M = −2.19, SD = 1.36) and reliably different from 0, $t(35) = 9.68$, $p < .001$, $d = 1.61$, whereas the mean valence rating for simulations of the distal future was positive (M = 1.86, SD = 1.61) and also reliably different from 0, $t(28) = 6.22$, $p < .001$, $d = 1.16$. The mean valence ratings for approximal and distal simulations of the future were also reliably

Table 1
Mean Phenomenological Ratings (Study 1)

Rating scale	Approximal	Distal	Fixed effect estimate
Valence	−2.19 (1.36)	1.86 (1.61)	**$b = 2.00$, $SE = 0.15$, $t = 13.44$, $p < .001$**
Detail	3.85 (0.63)	4.02 (0.74)	$b = 0.09$, $SE = 0.08$, $t = 1.13$, $p = .262$
Arousal	3.67 (0.79)	3.46 (0.79)	$b = 0.08$, $SE = 0.10$, $t = 0.87$, $p = .386$
Plausibility	3.12 (0.98)	3.85 (0.80)	**$b = 0.37$, $SE = 0.12$, $t = 3.06$, $p = .003$**
Influence	3.37 (0.83)	3.85 (0.70)	$b = 0.21$, $SE = 0.10$, $t = 2.01$, $p = .049$

Note. Standard deviation are presented in parentheses. Details about rating scales available in Supplemental Materials. Bold text reflects statistically significant effects. Given the exploratory nature of some of these comparisons, we adopted a significance threshold ($p < .01$) that accounted for the number of reported tests (5). SE = standard error.

different from one another, $t(63) = 11.00$, $p < .001$, $d = 2.72$. A multilevel model analysis confirmed that these data were significant when accounting for the fact that different participants reported different numbers of events ($b = 2.00$, $SE = 0.15$, $t = 13.44$, $p < .001$). For completeness, ratings of detail, arousal, plausibility, and influence on behavior are also reported in Table 1. Only ratings of plausibility were reliability different from one another when accounting for the fact that different participants reported different numbers of events, such that participants rated simulations of the distal future as more plausible than simulations of the approximal future.

Content Analysis

Table 2 presents the event-specific content for approximal and distal simulations of the future. Approximal simulations tended to focus on detecting threat in one's immediate surroundings, such as those related to walking home alone, heights/falling, and driving. Distal simulations tended to focus on goal states, such as tasks associated with meals, school/work, and future plans.

Study 2

The results of Study 1 demonstrated that simulations of the approximal future are common and memorable experiences. Moreover, the results indicated that simulations of the approximal future tend to be negative and related to threat detection, whereas simulations of the distal future tend to be positive and related to goal states.

However, the results of Study 1 are not without their limitations. First, Study 1 relied on retrospective reports. We had adopted this approach given our assumption that simulations of the approximal future might serve a threat detection function, and that it might not be prudent to request participants to report on such experiences in the moment. While it is not clear how the use of a retrospective questionnaire could explain the pronounced valence-based dissociation between simulations of the approximal and distal future in Study 1, we surmised that it would nonetheless be important to reduce the influence of retrospection in the study of simulations of the approximal future. Indeed, past work on memory and future thinking has made use of diary methods (Berntsen & Jacobsen, 2008) that allow participants to report on mental simulations of the (distal) future as soon as they feel as though they are able to safely do so. While this approach may also require some retrospection on the part of the participant, it is certainly minimized in the context of a diary study. Accordingly, Study 2 made use of a thought sampling diary approach that assessed, for the first time, the occurrence of simulations of the approximal future in daily life.

Table 2
Proportion of Participants Who Reported Specific Approximal and Distal Events

Approximal	Proportion	Distal	Proportion
Study 1—Retrospective reports			
Public danger (e.g., walking home alone)	0.36	Food/eating	0.56
Heights/falling	0.36	School/work	0.39
Car accident	0.33	Future plans	0.31
Getting hurt (e.g., cutting self)	0.28	Vacation/travel	0.22
Interpersonal interaction	0.28		
Crossing street	0.22		
Getting hurt (someone else)	0.22		
Study 2—Diary reports			
Slipping/tripping	0.37	School/work	0.71
Heights/falling	0.33	Future plans	0.40
Interpersonal interaction	0.28	Food/eating	0.35
Dropping/breaking something	0.27	Interpersonal interaction	0.32
Getting hurt (e.g., cutting self)	0.25	Leisure activity	0.28
Car accident	0.23	Responsibility/chore	0.22

Note. Only events that were simulated by more than 20% of participants are reported.

Second, Study 1 made use of a between-subjects design, and so it is not yet clear whether the valence-based dissociation between simulations of the approximal and distal future exists within individuals. To address this point, participants in Study 2 reported on simulations of both the approximal and distal future. In addition, whereas participants in the distal condition in Study 1 were free to report any distal events that came to mind, including past, future, or atemporal events, participants in Study 2 were limited to reporting on simulations of the distal (and approximal) future.

Third, there is a considerable amount of prior work that has been conducted on intrusive imagery in healthy individuals (D. A. Clark & Rhyno, 2005). Notably, intrusive images tend to be negative, and one could assert that approximal simulations of the future may simply represent an example of intrusive imagery. However, intrusive imagery is further defined as unwanted and recurrent (D. A. Clark & Rhyno, 2005; Rachman, 1981). It is certainly possible that at least some of the mental simulations that participants generated in Study 1 could have represented intrusive imagery (e.g., suddenly imagining jumping off a bridge for no apparent reason). To address this interpretational gap, participants in Study 2 were asked to rate each simulation on the extent to which it was negative, unwanted, and recurrent.

Method

Transparency and Openness

We describe all data exclusions, manipulations, and measures in the present study. This study was not preregistered. Full task instructions are available in the Supplemental Materials. The deidentified data on which all analyses for Study 2 are based are freely available on the Open Science Framework at https://osf.io/xzd2s/. Data were analyzed using SPSS 28.0 software and JASP 0.17.1 software. The study was completed between late 2018 and early 2019, and approved by the University of Illinois Chicago Institutional Review Board.

Participants

A power analysis (G*Power, Version 3.1) estimated that eight participants would be needed to replicate the smaller of the two valence effects observed in Study 1 ($d = 1.16$; $\alpha = .05$, $\beta = .80$). However, as noted earlier, the present study incorporated a number of unique design features, including using a diary technique, recording approximal and distal future events in a within-subjects design, and assessing the extent to which simulations of the approximal future are distinct from intrusive imagery. Notably, a previous study that used a diary technique to compare spontaneous memories and spontaneous distal simulations of the future in a within-subjects design collected data from 21 participants (Berntsen & Jacobsen, 2008). While this number would likely be sufficient to replicate the critical interaction observed in Study 1, we decided a priori to administer as many surveys as possible over the course of one academic semester. We managed to administer 70 surveys, 60 of which were completed by participants (86% completion rate; $M_{\text{age}} = 19.3$ years). Participants indicated their gender using an open response format (Female = 37, Male = 23).

Design and Procedure

Study 2 consisted of two sessions that were modeled around a prior investigation of spontaneous mental time travel (Berntsen & Jacobsen, 2008). During the first session, participants arrived at the laboratory for informed consent, a briefing of all instructions and procedures of the experiment, and the provision of materials (i.e., diary booklet). To begin with, the researcher explained to participants the difference between simulations of the approximal and distal future and provided relevant examples. Once it was clear that participants fully comprehended the difference between the approximal and distal future, they received a booklet that they were asked to always carry.

Participants were instructed that they would be required to record a total of 10 simulations of the approximal future and 10 simulations of the distal future that spontaneously came to mind over a period of 2 weeks, with a maximum of two simulations of each type per day. Prior work has shown that such instructions encourage participants to follow task requirements and avoid reporting as many future events as possible in one sitting (Berntsen & Jacobsen, 2008). The instructions specified that participants would need to answer a short initial set of questions about a simulation as soon as they experienced it. This method was implemented to further minimize participants' use of retrospection (Nisbett & Wilson, 1977). There were 12 questions in total that focused on delineating the circumstances under which the future simulation came to mind, along with phenomenological ratings associated with the simulation, including positive and negative emotion. Finally, the questions provided insights into whether the future simulation was unwanted and recurrent to help assess the relation of simulations of the approximal future to intrusive imagery. For questions that required participants to write, rather than fill out rating scales, participants were instructed to simply write a few key words that they could expand on later to facilitate reporting on the simulations as soon as possible following their occurrence (see Supplemental Materials). Finally, at a self-chosen time of the same day, participants were asked to expand on the questions for which they had provided a preliminary set of keywords (see Supplemental Materials).

Participants returned for a second visit after 2 weeks had passed. Participants who had recorded the maximum number of future simulations (20 events) before the 2 weeks had passed were instructed to hold onto their materials until their scheduled visit. Participants who had not completed the maximum number of future simulations were asked to bring what they managed to complete. We chose to schedule the second visit 2 weeks later for all participants to discourage them from rushing through the study. During the second session, participants returned all materials and then completed individual difference measures related to worry (Penn State Worry Questionnaire; Meyer et al., 1990) and depression (Beck Depression Inventory-II; Beck et al., 1996). These measures were included for exploratory purposes (see Supplemental Materials). Finally, participants were debriefed and given course credit for their participation. The debriefing portion of the session included a discussion of the purpose of the study, a feedback interview on the procedure, questions about whether the diary study resulted in subjective changes in how often participants thought about the future in daily life, and questions about whether participants censored any thoughts.

Coding

All responses were coded for whether they reflected an extension of ongoing experience (i.e., approximal future), something that might happen outside of ongoing experience (i.e., distal future), or other (e.g., a fantasy or some aspect of one's train of thought). Two independent coders initially coded 20% of participant responses. Interrater reliability was $\kappa = .85$, indicating near perfect agreement. Both coders then coded the remainder of participant responses. Any disagreements were resolved through discussion and the final data set represents 100% agreement between coders. Only responses that reflected either the approximal or distal future were used in subsequent analyses. For the approximal condition, most responses (80%) reflected simulations of something that might happen next in the context of ongoing experience (i.e., the approximal future), a subset of responses (10%) reflected simulations of events that were anticipated to occur at a later point in time (i.e., the distal future; often later in the day but not next in the context of ongoing experience), and an additional subset of responses (10%) reflected other aspects of ongoing cognition (e.g., descriptions of one's current train of thought as opposed to a mental simulation of what might happen next in the context of ongoing experience). For the distal condition, most responses (95%) reflected simulations of something that might happen at a later point in time (i.e., the distal future) and a small subset of responses (5%) reflected other aspects of ongoing cognition (e.g., descriptions of one's current train of thought as opposed to a mental simulation of what might happen at some later point in time). Participants generated no simulations of the approximal future in place of the distal future.

As with Study 1, eligible responses were coded as to their event-specific content to provide further insight into the functions of approximal and distal simulations of the future. First, one of the authors (KR) evaluated all approximal and distal simulations and created two independent lists of event codes, one for each domain. Second, two independent coders used those lists of event codes to classify each eligible response. The two independent coders began by coding 20% of events. Interrater reliability was $\kappa = .79$, indicating substantial agreement. Both coders then coded the remainder of participant responses. Any disagreements were resolved through discussion and the final data set represented 100% agreement between coders.

Results

Frequency

The data revealed that simulations of the approximal ($M = 5.72$, $SD = 2.52$; range = 2–10 simulations) and distal ($M = 6.75$, $SD = 3.06$, range = 1–10 simulations) future were both common, but that participants tended to report more simulations of the distal than the approximal future, $t(59) = 3.25$, $p = .002$, $d = 0.42$. Note that in Study 1 participants reported more approximal than distal simulations of the future, but this is likely due to the fact that participants in Study 1 were free to generate distal simulations that were either based in the past, future, or atemporal.

Phenomenological Ratings

Table 3 presents a summary of the various ratings and responses that participants recorded over the course of the 2-week period with their diaries. Of particular interest was the valence associated with each type of simulation. Replicating the findings from Experiment 1, the mean valence rating, calculated by subtracting the negative from the positive valence rating, for approximal simulations of the future was negative ($M = -1.53$, $SD = 1.66$) and reliably different from 0, $t(59) = 7.32$, $p < .001$, $d = 0.92$, whereas the mean valence rating for distal simulations of the future was positive ($M = 0.78$, $SD = 2.19$) and also reliably different from 0, $t(59) = 2.77$, $p = .004$, $d = 0.36$. The mean valence ratings for mental ratings for simulations of the approximal and distal future were also reliably different from one another, $t(59) = 7.33$, $p < .001$, $d = 0.96$. As with Study 1, a multilevel model analysis confirmed that these data were significant when accounting for the fact that different participants reported different numbers of events ($b = 1.24$, $SE = 0.15$, $t = 8.41$, $p < .001$).

For completeness, summaries related to ratings of detail and arousal, whether simulations were associated with an identifiable cue, whether simulations impacted mood and/or behavior, and ratings of intrusiveness and prior experience are also reported in Table 3. All analyses were carried out using mixed effects models to account for different numbers of events across participants. As with the results of Study 1, simulations of the approximal and distal future did not differ in terms of detail. Although the comparison did not meet our significance cutoff (see Table 3), participants did rate approximal simulations as being more arousing

Table 3
Mean Phenomenological Ratings (Study 2)

Rating scale	Approximal	Distal	Fixed effect estimate
Valence	−1.53 (1.66)	0.78 (2.19)	**$b = 1.24$, $SE = 0.15$, $t = 8.41$, $p < .001$**
Detail	3.28 (0.94)	3.37 (0.83)	$b = 0.03$, $SE = 0.05$, $t = 0.69$, $p = .49$
Arousal	2.27 (1.02)	2.56 (1.04)	$b = 0.15$, $SE = 0.06$, $t = 2.68$, $p = .01$
Trigger[a]	0.69 (0.30)	0.65 (0.28)	$b = 0.16$, $SE = 0.10$, $t = 1.66$, $p = .10$
Mood[a]	0.46 (0.31)	0.67 (0.27)	**$b = 0.42$, $SE = 0.11$, $t = 3.81$, $p < .001$**
Behavior[a]	0.50 (0.30)	0.29 (0.26)	**$b = 0.61$, $SE = 0.10$, $t = 5.88$, $p < .001$**
Intrusive	3.13 (0.93)	2.36 (0.99)	**$b = 0.42$, $SE = 0.08$, $t = 5.51$, $p < .001$**
Prior	3.25 (0.89)	3.18 (0.79)	$b = 0.03$, $SE = 0.07$, $t = 0.37$, $p = .72$

Note. Standard deviations are presented in parentheses. Details about rating scales available in Supplemental Materials. Bold text reflects statistically significant effects. Given the exploratory nature of some of these comparisons, we adopted a significance threshold ($p < .006$) that accounted for the number of reported tests (8). SE = standard error.
[a] Mixed effects logistic regressions were run on variables with binary outcomes.

than distal simulations. There were no differences in the proportion of approximal and distal simulations for which participants could identify a trigger. However, participants reported that a greater proportion of simulations of the distal than the approximal future impacted their mood, whereas a greater proportion of simulations of the approximal than the distal future altered their behavior. One question that we were particularly interested in addressing was whether approximal simulations of the future might meet criteria for intrusive thoughts (D. A. Clark & Rhyno, 2005). Participant ratings of intrusiveness/unwantedness and prior frequency of thought were modest. Notably, although participants rated simulations of the approximal future as more unwanted than simulations of the distal future, approximal and distal simulations did not differ in terms of frequency of prior thinking. Taken together, while simulations of the approximal future are particularly negative and experienced as relatively unwanted, they do not appear to be experienced with any greater level of frequency than other forms of spontaneous future thinking.

Content Analysis

Table 2 presents the event-specific content for approximal and distal simulations of the future. Similar to Study 1, approximal simulations tended to focus on detecting threat in one's immediate surroundings, such as those related to slipping/tripping, heights/falling, and interpersonal interactions. Distal simulations tended to focus on goal states over the coming days and weeks, such as tasks associated with school/work, future plans, and meals.

Study 3

In Studies 1 and 2, we established that approximal and distal simulations of the future differ both in terms of their valence and function. The finding that approximal simulations of the future tend to be more negative than positive represents a departure from how the field tends to characterize simulations of the future. Nonetheless, based on the data that we have reported thus far, it is not clear what feature(s) of experience are driving the negative valence that tends to accompany approximal simulations of the future. The purpose of Study 3 was to examine the role of contextual and temporal features, and their possible interaction, in evoking negative valence in the context of approximal simulations of the future.

First, regarding contextual features, given that approximal simulations of the future tend to focus on threat detection, it is possible that people are simply more likely to experience negative simulations of the future when they are in potentially threatening situations. For example, one might be more likely to entertain negative simulations of the approximal and distal future when they find themselves in a threatening scenario as compared to a nonthreatening scenario. Alternatively, the key feature driving the negative valence that accompanies approximal simulations of the future may be temporal rather than contextual. That is, people may be especially likely to simulate negative events when they are thinking about something that might happen next as opposed to something that might happen at some later point in time, irrespective of whether the context in which they find themselves is characterized as threatening or nonthreatening. Finally, the critical feature driving negative valence in approximal simulations of the future may not depend on contextual or temporal features in isolation, but rather on their interaction. In this case, people should only simulate negative events when thinking about something that might happen next in the context of a threat-laden situation.

To evaluate these three alternate possibilities, we asked participants to simulate events that varied in terms of their contextual (high or low threat) and temporal (next, next week, or next year) features. Based on participant reports from Studies 1 and 2, we predicted that the negative valence characterizing approximal simulations of the future would primarily arise as a function of the interaction between contextual and temporal features. That is, people should predict negative outcomes when they think about what might happen next in the presence of some external threat, but that simply thinking about something that might happen next or thinking about the future in the presence of some external threat alone would not necessarily result in the simulation of negative events.

Method

Transparency and Openness

We describe all data exclusions, manipulations, and measures in the present study. This study was not preregistered. Full task instructions are available in the Supplemental Materials. The deidentified data on which all analyses for Study 3 are based are freely available on the Open Science Framework at https://osf.io/xzd2s/. Data were analyzed using SPSS 28.0 software. The study was carried out in 2020 and approved by the Toronto Metropolitan University Research Ethics Board.

Participants

Participants were 50 undergraduate students at Toronto Metropolitan University (M_{age} = 22.3 years) who completed the study for course credit. Participants indicated their gender using an open response format (female = 34, male = 14, nonbinary = 2). As with Study 1, given the novelty of our research question, there was no comparable work on which to base a power analysis. However, our sample size was comparable to most laboratory studies of future-oriented cognition (see Szpunar & Schacter, 2018).

Design and Procedure

The study was a 2 (contextual features: high- vs. low-threat) × 3 (temporal features: event occurring next vs. next week vs. next year) within-subject design. Participants were presented with simulation cues that varied by the threat-level of the context (high vs. low) and imminence of the simulation (i.e., next, next week, or next year).

Participants were presented with 18 simulation cues. For each cue, there were two possible variations: a high-threat version of the context and a low-threat version of the context. For example, for the action "walking home alone," an example of a high-threat context would be "walking home alone at night," whereas the low-threat version would be "walking home alone during the day." For each cue, participants received either the high-threat version or the low-threat version.

The 18 high- and low-threat versions of each context were determined through pilot testing of a larger list of 48 contexts. Volunteers (N = 20) rated the high- and low-threat versions of each context on a 5-point Likert scale based on how likely they thought something negative or threatening would occur in each scenario

(1 = *very unlikely*, 5 = *very likely*). The contexts for which the high-threat version was consistently rated above the midpoint and for which the low-threat version was consistently rated below the midpoint were retained for the experiment. This ensured that high-threat scenarios were generally considered threatening, and low-threat scenarios were generally considered nonthreatening.

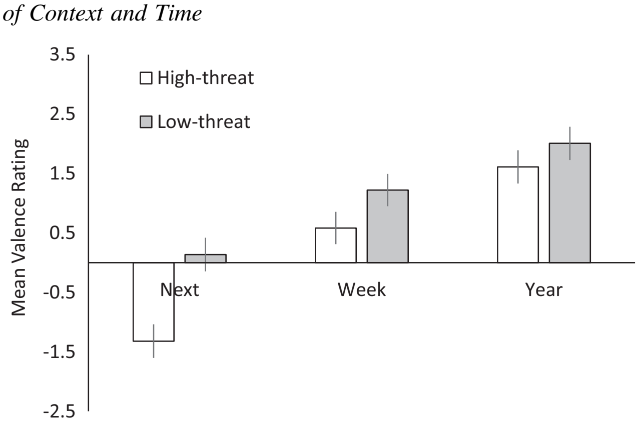
During the study, the 18 cues were evenly split across the six possible conditions, such that participants were required to simulate three events in response to each of the following cues: next in a high-threat context; next in a low-threat context; next week in a high-threat context; next week in a low-threat context; next year in a high-threat context; and next year in a low-threat context. The order of cues was randomized for each participant. An example of a cue for the next in a high-threat context condition would be: *You are walking home alone at night. Imagine something that might happen next*.

Once participants constructed each simulation, they were asked to provide a brief description of what they imagined. This was followed by a sequence of phenomenological ratings. Participants were asked to rate each simulation on the following indices using 5-point scales: positive emotion, negative emotion, detail, plausibility, and frequency of prior thinking.

Results

The primary analysis of interest was to assess the impact of contextual features, temporal features, and their interaction on the mean valence ratings, calculated by subtracting the negative from the positive valence, of simulated future events. These mean valence ratings are presented in Figure 1. A 2 (contextual features: high- and low-threat) × 3 (temporal features: next, next week, and next year) within-subject analysis of variance revealed a main effect of contextual features, $F(1, 42) = 14.57$, $p < .001$, $\eta_p^2 = .26$, a main effect of temporal features, $F(2, 84) = 44.68$, $p < .001$, $\eta_p^2 = .52$, and an interaction, $F(1, 42) = 5.36$, $p = .006$, $\eta_p^2 = .11$. The main effect of contextual features arose because high-threat contexts ($M = .23$, $SD = 1.34$) were associated with a lower mean valence than low-threat contexts ($M = 1.13$, $SD = 1.21$). The main effect of temporal features arose because increasing time from the present was associated with increasing mean valence, such that events occurring next year ($M = 1.84$, $SD = 1.42$) were rated as more positive than events occurring next week ($M = 0.88$, $SD = 1.50$) and events occurring next ($M = -0.57$, $SD = 1.52$), $t(43) = 4.25$, $p < .001$, $d = .64$ and $t(43) = 8.10$, $p < .001$, $d = 1.22$, respectively. Events occurring next week were also rated as more positive than events occurring next, $t(45) = 6.40$, $p < .001$, $d = 0.94$. Critically, the interaction arose because the difference in valence between high- and low-threat contexts was disproportionately greater when participants simulated events occurring next as compared to events occurring next week, $t(45) = 2.33$, $p = .024$, $d = .34$ and next year, $t(43) = 3.11$, $p = .003$, $d = .47$. In fact, the only class of events that were consistently rated as having a negative valence were events simulated as occurring next in a high-threat context.

Figure 1
Mean Valence Ratings (Positive—Negative Valence) as a Function of Context and Time



Note. Error bars represent 95% confidence intervals.

For completeness, a series of 2 (contextual features) × 3 (temporal features) within-subjects analyses of variance were also carried out on ratings of detail, plausibility, and frequency of prior thinking (see Table 4). These analyses only revealed a main effect of temporal features on detail, $F(2, 84) = 11.08$, $p < .001$, $\eta_p^2 = .21$, such that increasing time from the present was associated with decreasing detail ratings. This pattern of data corroborates extensive evidence of similar patterns within the temporal construal literature (Trope & Liberman, 2003). No other effects were significant, indicating that contextual features did not impact detail ratings, and that neither contextual nor temporal features were related to plausibility of event occurrence or frequency of prior thinking, largest $F(1, 42) = 2.75$, $p = .10$.

General Discussion

The results of the three experiments demonstrate that simulations of the approximal future represent a natural phenomenon that appears to be distinct from simulations of the distal future. First, participants readily recalled and reported the occurrence of simulations of the approximal future in daily life. Second, simulations of the approximal future tended to be negative and focused on threat detection, whereas simulations of the distal future tended to be positive and related to goal states. Third, the negative valence associated with simulations of the approximal future appears to arise as the result of the confluence of both temporal (i.e., next as opposed to more distant) and contextual (i.e., threatening as opposed to nonthreatening) features of the event. In what follows, we situate the phenomenon of simulations of the approximal future in the broader literature on goal-oriented event cognition. We further elaborate how individual differences and psychopathology might contribute to the frequency with which people experience simulations of the approximal future. We conclude by outlining limitations of our work and directions for future research.

Goal-Driven Simulation

The finding that people commonly experience and remember both simulations of the approximal and distal future is generally in keeping with the notion that the present moment possesses temporal extent that stretches into the near past and future (Hershfield & Maglio, 2020; Stern, 2004). For instance, Conway's self memory system model of autobiographical memory (Conway, 2005; Conway & Pleydell-Pearce, 2000; see also, Conway et al., 2019) posits that goals interact with autobiographical knowledge to constrain what aspects of the personal past and future are accessible at any given

Table 4
Mean Phenomenological Ratings as a Function of Context and Time

Rating scale	Next	Next week	Next year
High threat			
Detail	3.34 (0.95)	3.00 (0.99)	2.88 (1.00)
Plausibility	3.51 (0.94)	3.51 (0.95)	3.56 (0.88)
Prior thinking	2.73 (1.06)	2.90 (1.02)	2.96 (0.96)
Low threat			
Detail	3.42 (0.98)	2.98 (0.96)	2.95 (0.90)
Plausibility	3.59 (0.82)	3.61 (0.98)	3.47 (0.87)
Prior thinking	2.88 (0.98)	3.09 (1.06)	3.06 (0.97)

Note. Standard deviations are presented in parentheses. Details about rating scales available in Supplemental Materials.

moment. Indeed, it has been well documented that temporally near past and future events more readily come to mind than temporally distant past and future events (Spreng & Levine, 2006), and that this pattern of data is especially prevalent for events related to the near future (Berntsen, 2019). Conway et al. (2016) proposed that the enhanced accessibility of the recent past and future reflects the functioning of a remembering-imagining system that helps to create the sense of an "extended now" that allows individuals to better plan for and execute actions in daily life (for related discussion, see also Berntsen, 2019). For example, in the context of daily experience, it would be more pragmatic for an individual to be spontaneously reminded about the fact that they need to pay their bills by the end of the week than about their desire to be promoted at work within the next few years (Kvavilashvili & Rummel, 2020). Our data related to simulations of the distal future, which revealed that people tended to experience simulations related to school/work activities, fit neatly within this perspective on the functions of future event cognition.

Similar ideas have been espoused in relation to the approximal future. For instance, as we alluded to in the Introduction, Event Segmentation Theory posits that event perception is guided by schematic knowledge that helps to predict what might come next in the context of ongoing experience (Zacks, 2020; Zacks et al., 2007). Although, the theory does not make predictions about the circumstances under which simulations of the approximal future might come to mind, it does propose that conceptual knowledge related to goals can influence event cognition. Along these lines, we propose that goals related to ongoing experience, much like goals that extend into the distal future, can serve as a basis for simulations of the approximal future. In other words, simulations of the approximal future may reflect an elaborated form of goal-directed prediction that is consciously apprehended as a simulation by the individual.

The conceptualization of simulations of the approximal future in terms of goal-directed prediction helps to accommodate the fact that such simulations tend to focus on threat. A considerable body of research has demonstrated that an overarching goal of ongoing experience is to avoid harm and that humans, and other animals (Pessoa & Adolphs, 2010), are adept at detecting threatening stimuli in their surrounding environment (Blanchette, 2006; March et al., 2017; Subra et al., 2017). Most relevant to our work, Mobbs et al. (2015, 2020; see also Tashjian et al., 2021) have argued for the role of mental simulation in threat detection, and that the type of simulation engaged may depend in part on the imminence of the threatening stimulus (Fanselow, 2018; Fanselow & Lester, 1988). Although Mobbs and colleagues do not specifically differentiate between simulations of the approximal and distal future, their theorizing about the role of simulation in the absence and presence (perceived or real) of threat is broadly in line with the distinction that we make between these domains of simulation. Specifically, simulations of the distal future can help to anticipate and ultimately avoid possible threatening events that may transpire in a different place and time. On the other hand, simulations of the approximal future signal sources of threat that may be nearby (preencounter threat) or that are tied to one's current spatiotemporal context (postencounter threat), and that provide the individual with a warning signal that something may or should be avoided in the here and now.

It may be important to highlight that most simulations of the approximal future do not materialize. For example, one may simulate being hit by a car when crossing the street but not actually experience the event. From this perspective, simulations of the approximal future may, under many circumstances, represent prediction errors. This interpretation of simulations of the approximal future raises some interesting considerations for future research. For instance, as we had alluded to earlier, event segmentation theory posits that elements of perceptual experience in the external environment that violate expectations result in the updating of event models. Do internally generated violations of ongoing experience, such as those that arise in the context of simulations of the approximal future that do not materialize, also result in the need to update event models? While our data cannot address this question, we note that such interpretations could help explain why people are readily able to remember simulations of the approximal future, much in the same way as they remember violations of ongoing experience that are encountered in the external environment (for reviews, see Kurby & Zacks, 2008; Zacks & Swallow, 2007).

The Role of Memory Content and Constructive Perceptual Simulation

While goals may serve as the impetus for simulations of the approximal and distal future, they do not necessarily elucidate the source of the content of these various simulations. Recent theorizing about the spontaneous occurrence of simulations of the distal future have focused on the fact that people have often thought about those simulations on prior occasions (e.g., Cole et al., 2016; Jeunehomme & D'Argembeau, 2016; Plimpton et al., 2015). For instance, a student preparing for an exam may simulate the act of studying for an exam over the weekend, and the contents of that simulation may return to mind on a subsequent occasion when asked about their plans for the weekend by another student. Such patterns of data led Cole and Kvavilashvili (2021) to propose the premade hypothesis of spontaneous simulations of the future, which argues that spontaneous simulations of the future may effectively represent "memories of the future" (Ingvar, 1985; Szpunar et al., 2013) that serve an important reminding function in support of goal-oriented behavior.

We propose that the mechanism(s) underlying the generation of content for simulations of the approximal future likely overlap but also diverge from those that have been proposed to operate in the context of simulations of the distal future. Indeed, participants in our second and third studies indicated moderate levels of prior thinking for simulations of the approximal future (midpoint of scale). While this does not appear indicative of some overly repetitive pattern of thinking, future work will need to more carefully disentangle whether this prior thinking reflects the fact that the individual is recasting a specific prior instance of the simulation in the present, which would lend support to the premade hypothesis for simulations of the approximal future, or whether there is some relevant past experience that evokes the simulation of the approximal future, but that the simulation revolves around the novel features of the individual's surrounding environment. To illustrate the latter possibility, consider the example of spontaneously simulating being in a car accident while driving in unsafe whether conditions. Having nearly experienced such an event in the past, heard about a similar negative experience from a friend, observed such an event in a movie or television program, or read about such an occurrence in the news could all potentially increase the likelihood of spontaneously simulating a car accident under such circumstances. Indeed, there is extensive evidence that people can learn to vicariously anticipate threat (Baczkowski et al., 2023). However, although the simulation may be triggered by some relevant information in memory, the simulation itself revolves around details, for example, the specific road, automobiles, and so on, that are present in the surrounding environment. That is, simulations of the approximal future build on the contents of active visual, and possibly other sensory, perceptions to create a possible outcome of ongoing experience, or what we term *constructive perceptual simulation*.

The notion that the contents of perception can aid in cognitive and behavioral processing is not new (e.g., Suwa & Tversky, 2003). However, whether simulations of the approximal future reflect the work of constructive processes that are operating on the contents of perception, memory, or both remains an open question. Future research on the topic promises to add to a growing literature demonstrating that perception and memory often interact with one another to support cognition and behavior (Addis, 2018, 2020; Baldassano et al., 2017; Bornstein et al., 2023; Bubic et al., 2010; Budson et al., 2022; Martin & Barense, 2023; Summerfield et al., 2006).

Individual Differences and Psychopathology

Beyond further elucidating the cognitive mechanisms that support simulations of the approximal future, we believe that it will also be important to examine instances in which the proposed threat-detection function of simulations of the approximal future may go awry and result in maladaptive patterns of cognition and behavior. Consider again the example of spontaneously imagining being in a car accident. While such an experience may serve to alert the individual to some plausible threat, the same experience might not be so adaptive if it were to occur whenever someone sat behind the wheel of an automobile (e.g., Rachman & Cuk, 1992; see also, Taylor, 2006). Along these lines, specific phobias can be accompanied by intrusive and unwanted simulations related to a particular source of threat. For instance, people with spider phobias or obsessive–compulsive disorder often report experiencing visual distortions wherein a spider or germ, respectively, appears to approach them even though no such movement occurs in reality (e.g., Riskind et al., 1992). According to the looming vulnerability model of anxiety (Riskind, 1997; Riskind & Calvete, 2020), "anxiety derives from the prospection and mental simulation of future threats and feared future selves and their rapid progression or the person's sense that such possible negative events are actively moving and projecting toward the present." (Riskind & Calvete, 2020, p. 36).

While the above noted examples related to spider phobia and obsessive–compulsive disorder represent instances of simulations of the approximal future, such that they are occurring in the same spatiotemporal context as ongoing experience, the looming vulnerability model of anxiety also describes similar experiences related to more distal threats, such as a looming sense that one's career aspirations or long-term health are in jeopardy (e.g., Riskind, 1997). Along these lines, another related but distinct phenomenon, namely, flash forwards in the context of suicidal ideation, involves presently simulating taking one's life, but at a future point in time (i.e., the distal future). For instance, Holmes et al. (2007; see also Crane et al., 2012) provided an example in which an individual envisions themselves on a cliff and describes their choice to jump. Given the prominent role of visual imagery in the context of mood and anxiety disorders (Holmes & Mathews, 2010; Pearson et al., 2015) and substance abuse (May et al., 2015), a particularly fruitful avenue for future research may be to distinguish what disorders are characterized by simulations of the approximal as compared to the distal future. Moreover, we believe that such studies, in addition to studies conducted with nonclinical populations, would benefit from clarifying the extent to which simulations of the approximal and distal future spontaneously come to mind as opposed to being actively generated by the individual (Jeunehomme & D'Argembeau, 2016; Uzer et al., 2012).

Constraints on Generality

Simulations of the approximal future are common experiences that appear to highlight possible sources of threat and result in changes in ongoing behavior. Nonetheless, our ability to make broad conclusions is limited because our samples were constrained to young, college students from Western, educated, industrialized, rich, and democratic nations. First, more work will be needed to determine whether such simulations commonly occur in other parts of the world. Second, given that we believe that personal and/or vicarious memories can impact when these experiences occur, it is likely that factors such as the life stage, vocational background, and age of the individual may determine the circumstances that will give rise to simulations of the approximal future. For instance, a parent might experience such simulations while vigilantly watching their young children engage in haphazard play (while the young children may not have accrued the relevant experiences necessary to be aware of possible sources of threat), a police officer might experience such simulations in the line of duty, and an older adult might be more likely than a young adult to experience such simulations in the context of daily routines, such as going up and down stairs, that are now more threatening than they were in the past. Third, individual difference variables such as the tendency for one's mind to wander away from ongoing experience or to engage in risk-seeking behavior may determine how often people experience simulations of the approximal future. For instance, those whose minds tend not to wander or who tend to avoid engaging in risky behaviors may experience more approximal simulations of the future, which we surmise require engagement with the external environment and considerations of one's interactions with it, than individuals who tend to experience high levels of mind wandering or who frequently engage in risky behaviors.

Conclusion

Recent work on future event simulation (Szpunar et al., 2014) and spontaneous cognition (Berntsen, 2019; Cole & Kvavilashvili, 2019) has shown that these are each highly varied mental phenomena that account for a considerable portion of human cognitive activity. Prior work on spontaneous nonmemory phenomena has hinted at the presence of approximal simulations in the context of healthy and disordered cognition (Brewin et al., 2010; Çili & Stopa, 2022; Krans et al., 2015; Oulton et al., 2018); however, no prior study has made a distinction between simulations of the approximal and distal future. Our work highlights content and functional differences between these two domains of future thinking and opens the doors for new work that promises to further advance our understanding of how perception and memory work together to generate simulations of events that can both support and impede adaptive functioning in daily life.

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