Psychology of Consciousness: Theory, Research, and Practice
2018, Vol. 5, No. 3, 278–294

2326-5523/18/$12.00 http://dx.doi.org/10.1037/cns0000136

The Characteristics of Directive Future Experiences and Directive Memories

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People can mentally travel to the future to "prelive" events they might experience. This ability to mentally prelive future events is closely related to the ability to mentally relive past events. People report traveling back in time to relive experiences that happened in their past in order to direct their behavior in the present, so people may imagine future experiences for similar reasons. If people use imagined future experiences to direct their behavior, how do the characteristics of these directive future experiences compare with those of directive memories? To address that question, we asked subjects to describe either an imagined future event or a remembered event that had helped them when they thought of it. We then asked each subject to rate phenomenological and memorial characteristics of his or her event, including how vivid and emotionally evocative it was, how often he or she rehearsed it, and its emotional valence. We also classified each event according to its relationship with the cultural life script (CLS). Across two experiments, we found that directive future experiences were more evocative, more frequently rehearsed, more positive, and more often drawn from the CLS than directive memories. These results suggest that, although imagined future experiences may, like memories of past experiences, serve a directive function, the characteristics of these two classes of experience are distinct. We also found that many directive memories were negative, suggesting a special role for these memories in guiding behavior. The consequences of mental time travel on behavior warrant further study.

Keywords: autobiographical memory, cultural life script, directive function, episodic future thought, mental time travel

Supplemental materials: http://dx.doi.org/10.1037/cns0000136.supp

We are time travelers. We can travel backward through time to relive experiences from our past, and forward through time to "prelive" experiences that could happen in our future (Suddendorf & Corballis, 1997, 2007; Tulving, 1985, 2002). Why do we have this remarkable ability to mentally travel in time? One possibility is that traveling outside the present helps guide our behavior. Indeed, people report traveling back in time to relive an experience that conveys a generalizable "life lesson." That lesson—what to aim toward, what to steer clear of, how to solve a problem, and so on—guides current or anticipated behavior (Bluck, Alea, Habermas, & Rubin, 2005; Pillemer, 1998, 2001, 2003). Like expectancies, people are not necessarily aware of the lesson while they are using it, but they could articulate it if asked (Kirsch, 2004; Kirsch & Lynn, 1999). People also report that these *directive memories* have certain distinguishing characteristics (Rasmussen & Berntsen, 2009). It stands to reason, then, that traveling forward in time to prelive an

This article was published Online First September 14, 2017.

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Mevagh Sanson gratefully acknowledges support from Victoria University of Wellington, the University of Waikato, and Fulbright New Zealand. We thank Anne Rasmussen for providing us with data from Rasmussen and Berntsen (2013), David Pillemer for suggestions about our instructions to subjects, and Ira Hyman for his ideas about directiveness as an attribute. We thank Cassandra Burton-Wood for doing the cultural life script coding, and members of the Garry lab for their feedback on earlier versions of this article.

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experience might also direct people's behavior in the present; indeed, some mental simulations of the future affect later outcomes, suggesting that they lead to behavior change (Taylor, Pham, Rivkin, & Armor, 1998). But if people use imagined future experiences to guide their behavior in a similar way to how they use directive memories, how similar are the characteristics of these directive imagined futures? In two experiments, we address this question.

We already know that people frequently think about the future—a mean of nearly 60 times a day—and on many of these occasions, they are imagining a specific experience (D'Argembeau, Renaud, & Van der Linden, 2011). Although some of these *episodic future thoughts* (Atance & O'Neill, 2001; Szpunar, 2010) are probably time-killing daydreams, there is reason to expect that other thoughts about future events might guide behavior. That is, people might use imagined experiences of the future in much the same way they use remembered experiences of the past: mentally traveling outside the present to guide behavior in the present (Bluck et al., 2005; Pillemer, 1998, 2001, 2003).

In fact, several pieces of evidence support the existence of what we might call *directive future experiences*. First, people draw on overlapping neurocognitive systems when remembering previous experiences and imagining future ones (for a review, see D'Argembeau, 2012). There are differing views about the relative roles of episodic and semantic memory in the creation of imagined future experiences: In one view, people prelive future scenarios by combining, in new ways, their experiential fragments from episodic memory (Addis, Wong, & Schacter, 2007; see also, Hassabis & Maguire, 2007); but in another view, people generate possible future scenarios by first drawing upon semantic, schematic knowledge (Irish & Piguet, 2013; Rubin, 2014). Either way, remembering the past and imagining the future seem to be closely related abilities—and so might serve similar functions.

Second, when people imagine themselves in future scenarios, they show more hippocampal activity than when they are remembering past experiences, and this difference in activity is at least partially attributable to people storing these future scenarios in memory for later use (Martin, Schacter, Corballis, & Addis, 2011; for a review, see Addis & Schacter, 2012). Both these findings fit with the idea that people can construct and file away simulations of their futures, building a library of directive future experiences to guide their behavior (see also Ingvar, 1985).

Third, when people were asked to classify the purpose of various thoughts they had about the future, many of the thoughts they reported were related to setting goals or planning actions; moreover, when people imagined steps toward an outcome (rather than just the outcome itself) they were likely to get closer to achieving it (D'Argembeau et al., 2011; Taylor et al., 1998). Neither of these studies exactly captured the use of directive future experiences to guide behavior, though. We suggest that directive future experiences are autobiographical simulations that play an integral role in making predictions, intentions, and plans, which then guide behavior (for a review of these different types of thought about the future, see Szpunar, Spreng, & Schacter, 2014).

What Might Directive Future Experiences Look Like?

We know little about the characteristics of directive future experiences, but we do know about the characteristics of directive memories—research suggests that directive memories possess distinguishing characteristics. In one study, people described four memories: three that served a function, including one directive memory "that you think of to handle present or future situations," and a control memory of "a random event from the last week" (p. 480, Rasmussen & Berntsen, 2009). Next, they rated the degree to which each memory possessed various characteristics (see also Rubin, Schrauf, & Greenberg, 2003). Two findings are relevant here. First, comparing all three function memories to the control memory revealed that the function memories were different from the controls on almost every characteristic: They were more emotionally affecting, more rehearsed, and less sensorially vivid. One explanation for this pattern is that the function memories were much older than the controls. But another explanation is that function memories—including those that direct behavior—have constellations of characteristics that distinguish them from their more ordinary counterparts.

In the second finding, a comparison of the three types of function memories with each other—while excluding the control memories—revealed that memories serving a directive function were distinguishable from memories that served other functions, because the directive memories alone evoked negative emotions. This finding suggests that directive memories are unusual among autobiographical memories, because people typically report more positive than negative memories from their personal pasts (for a review, see Walker, Skowronski, & Thompson, 2003). Therefore, it would be noteworthy if we, too, found that directive memories as a class are biased toward being negative, but are nonetheless useful rather than debilitating. Even more surprising would be if we found that directive future experiences also showed a bias toward the negative, because people typically have a very strong bias toward positivity when imagining the future (Berntsen & Bohn, 2010).

Why should we care about the characteristics of directive experiences if it is the lesson that is important? One possibility is that the characteristics of directive memories are not merely epiphenomena, but actually help those memories serve their function. That is, for these memories to guide behavior, they might need to be emotionally intense enough to be compelling and memorable, but not crippling; thought or talked about often enough that they are easily recalled, but not intrusive; detailed and vivid, but not so much that they lack generalizability; and negative, to the extent that directive memories are cautionary tales (Levine, Lench, & Safer, 2009; Pillemer, 1998, 2003, 2009; Rasmussen & Berntsen, 2009; Riccio, Rabinowitz, & Axelrod, 1994; Rubin, Boals, & Berntsen, 2008). If it is important for experiences that serve a directive function to have a specific constellation of certain characteristics to particular degrees, then directive future experiences should look like directive memories.

But there are also reasons to expect that directive future experiences should look different than directive memories. For one thing, we already know that imagined experiences in general look different than real experiences. For instance, imagined future experiences are typically more positive than remembered experiences, and imagined experiences (even when not future-oriented) tend to have less vivid sensory detail than real experiences (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004; Johnson, Foley, Suengas, & Raye, 1988). Therefore, we might expect directive future experiences to be more positive but less vivid than directive memories.

In line with these ideas, we know it takes cognitive effort to deliberately invent novel scenarios (Berntsen & Bohn, 2010). Accordingly, people might try to offload effort by turning to common cultural milestones, i.e., events from their cultural life script (CLS; Berntsen & Rubin, 2004). Events on the CLS are those that people expect typical members of their culture to experience at particular points in their lives (e.g., landing first jobs, having children). When people imagine their own future cultural milestones, it may yield information they can use to guide their behavior in the present. After all, CLS experiences are plausible, so they are probably worth planning for; they are important, so are worth trying to do well; and they often involve some kind of transition, so imagining them might be useful when there are no prior experiences on which to rely (Berntsen & Rubin, 2004; Pillemer, 2001, 2003). Therefore, we might expect that, compared with directive memories, a higher proportion of directive future experiences would be drawn from the CLS. Indeed, there is evidence to suggest that people do use knowledge of their CLS to structure their thinking about their own future (Bohn & Berntsen, 2011; D'Argembeau & Mathy, 2011).

If directive future experiences are indeed more often drawn from the CLS, we would expect them to look different than directive memories, if for no other reason than that the events from the CLS comprise a constrained list, whereas actual life experience is vast and idiosyncratic. Cultural milestones tend to be positive, important, and likely events (Berntsen & Rubin, 2004; Rubin, Berntsen, & Hutson, 2009). Therefore, to the extent that directive future experiences draw more often from the CLS than do directive memories, they should be positive, emotionally evocative, and worth rehearsing—more so than their remembered counterparts. Considered as a whole, these characteristics—emotional valence, emotional intensity, frequency of rehearsal, and sensory vividness—exhibited to particular degrees may, over and above being epiphenomena, make directive future experiences and the lessons they convey more likely to change behavior.

To our knowledge, no studies have yet systematically investigated what directive future experiences are like, or how they compare with directive memories on a range of characteristics. But one study has given us reason to speculate about how directive future experiences and memories compare with respect to one characteristic: valence (Rasmussen & Berntsen, 2013). In that study, researchers asked people to report two imagined future experiences and two memories—one positive and one negative of each—and rate their characteristics, including the degree to which they thought of each event "to handle present or future situations" (p. 191). People rated future experiences as possessing more "directiveness" when those experiences were positive, but rated memories similarly on directiveness no matter their valence. This finding suggests that, even though remembered past and imagined future experiences can each direct behavior, they look different on at least one significant characteristic. Further, this pattern of results leads to the prediction that directive future experiences will be mostly positive, whereas directive memories will be a mixture of positive and negative experiences, perhaps somewhat weighted toward the negative (Rasmussen & Berntsen, 2009).

We thought Rasmussen and Berntsen's (2013) dataset could provide further clues about which characteristics were especially relevant to the directive function, so after obtaining it, we correlated their directiveness measure with the other characteristics they measured, while collapsing across the valence factor. For both imagined future experiences and memories, the more directive an experience, the more affecting and rehearsed it was. These findings suggest that the strength of the emotional response and the frequency of rehearsal may be important for the directive function of both imagined future experiences and memories. But these data cannot directly tell us how the characteristics of directive future experiences compare with those of directive memories. A more informative approach would be to ask people specifically for directive future experiences and directive memories, and compare their characteristics with one another, which is what we did in the two experiments we report here.

Why should we care about what directive future experiences look like, and how they compare with directive memories? For one thing, we know that people often think about the future (D'Argembeau et al., 2011), and so it would be interesting to know more about specific classes of this kind of thought. Furthermore, learning more about how this type of imagined future experience compares with its remembered counterpart should tell us about the relationship between mentally experiencing the future and the past more generally. If directive future experiences are wholly similar to directive remembered experiences—for example, if they, too, tend to evoke negative emotions—they would be an interesting exception to the ways in which simulations of the past and future commonly differ. But to the extent that directive future experiences differ from directive memories, they may provide clues about the different ways real experiences versus imagined future experiences guide us, and how we construct them, such as by providing lessons about what to avoid versus what to approach, and by drawing on the CLS, respectively.

We addressed these issues across two experiments, guided by this question: When people draw on imagined future experiences to guide their behavior, what are those experiences like, compared with remembered past experiences that guide behavior? To answer this question, we asked subjects to describe either an experience they had previously imagined or an experience they had remembered in order to help them, and then to rate the characteristics of this directive experience.

Experiment 1

Method

Subjects. A total of 184 introductory psychology students at Victoria University of Wellington participated for course credit. Because we used a between-subjects design rather than the within-subject design employed by Rasmussen and Berntsen (2009, 2013, in which sample sizes were 120 and 158, respectively), we aimed for a larger sample size, and as large a sample as possible, contingent on allocations from our department's subject pool. We did not collect demographic data from individual subjects, but we have data about the population from which our sample was randomly drawn: 14% were ages 16–17, 74% were 18–20, 7%, 21–24, 4%, 25–39, and 1%, ≥40; 28% were male, 72%, female;

92% had English as a first language, 3% learned English before age 4, 3% between 5 and 7, 1%, 8–11, and 1%, ≥12; 78% were born in New Zealand, 22% were not.

Design. We manipulated type of directive event (directive future experience, directive memory) between subjects to avoid order effects. Although we asked our subjects to *recall* a directive future experience they had imagined previously, for our purposes here we use "memory" to refer only to past experiences that really happened.

Procedure. Subjects completed the experiment in groups of up to five, at individual computers. Graduate and undergraduate students conducted the data-collection sessions. Each group was randomly assigned to one type of directive event. We told subjects that "people frequently think about the [future/past]" and that some of the "specific events that we [imagine/remember] happening to us in the [future/past] are important, because when we think of them, they help us in the present." We then asked subjects to "think of an event that you [have previously imagined/remember] happening to you in the [future/past]," one that "when you [imagined/remembered] it, helped you to deal with a present situation or plan for an anticipated future situation in some way" (brackets indicate places in which the instructions differed by type of directive event; cue adapted from Rasmussen & Berntsen, 2009). Once subjects had an event in mind, we asked them to first "write a detailed description of this event," and then to write another description of "how thinking of this event has helped you to handle a present or anticipated future situation" (see supplementary materials for the entirety of instructions subjects received about these tasks).

Next, we asked subjects to rate 21 phenomenological and memorial characteristics of their event (see left panel of Table 1 for full list of items and anchors). These items addressed characteristics such as the intensity of the feelings elicited by the described event, how often it was brought to mind, how vivid it was, and the valence of the feelings it elicited. Nineteen of these items were rated on Likert-type scales, one on a whole-number scale, and one was a two-alternative forced choice. All items but one were taken from Rasmussen and Berntsen (2009; Item 14 was adapted from D'Argembeau & Van der Linden, 2004; see also Rubin et al., 2003). We adapted the wording of items so that they would require as few changes as possible between the two types of directive event.

Results

The primary purpose of this experiment was to examine the characteristics of directive future experiences, compared with those of directive memories. Before addressing that issue, we first excluded two subjects from the dataset, because their descriptions of events and how they had helped them reflected semantic knowledge rather than a personal experience. This exclusion left 92 subjects in the memory condition and 90 in the future-experience condition.

Manipulation check. As a manipulation check, we used Linguistic Inquiry and Word Count software (LIWC2007 Version 1.14; Pennebaker, Booth, & Francis, 2007) to compare how often subjects who were asked to describe an imagined future event used the past, present, and future tense in their description compared with those asked to describe a remembered past event. This application analyzes text (in this case, each subject's description of a directive event) to determine the percentage of total words belonging to various linguistic categories, such as verb tense. For each subject's description, we took these percentages and classified them according to whether the subject had been asked to describe a directive future experience or a directive memory. These findings suggest that the manipulation was successful in eliciting the right type of event descriptions from subjects. More specifically, subjects who described directive future experiences used less past tense and more present or future tense than subjects who described directive memories (past tense: $M_{future} = 2.87\%$, $SD_{future} = 4.07$, $M_{memory} = 9.09\%$, $SD_{memory} = 3.92$, $M_{difference} = -6.22$, 95% CI [−7.39, −5.05]; present tense: $M_{future} = 4.94\%$, $SD_{future} = 5.24$, $M_{memory} = 2.20\%$, $SD_{memory} = 2.44$, $M_{difference} = 2.75$, 95% CI [1.56, 3.94]; future tense: $M_{future} = 1.27\%$, $SD_{future} = 2.16$, $M_{memory} = 0.39\%$, $SD_{memory} = 0.82$, $M_{difference} = 0.88$, 95% CI [0.40, 1.35]).

Characteristics of directive future experiences versus directive memories. We now turn to our primary question: When people draw on an imagined future to guide their behavior, what are those directive future experiences like, compared with directive memories? To answer

Table 1
Wording of Characteristics Items and Subjects' Mean Ratings as a Function of Type of Directive Event and Experiment

		Experiment 1						Experiment 2					
Order	Characteristics items and anchors	Future mean	Future *SD*	Memory mean	Memory *SD*	Lower 95% CI diff	Upper 95% CI diff	Future mean	Future *SD*	Memory mean	Memory *SD*	Lower 95% CI diff	Upper 95% CI diff
	Emotional response												
1	When I think of this event today it triggers a physical reaction, e.g. palpitations, feeling restless, tense, tears, laughter (1 = *Not at all,* 7 = *To a very high degree*)	3.72	1.84	3.16	1.73	.04	1.08	3.73	1.93	3.24	1.86	−.07	1.06
2	When I think of this event today it affects my mood (1 = *Not at all,* 7 = *To a very high degree*)	4.38	1.64	3.42	1.54	.49	1.42	4.60	1.52	4.06	1.72	.06	1.02
11	When I think of this event today the feelings I experience are intense (1 = *Not at all,* 7 = *To a very high degree*)	3.84	1.59	3.50	1.82	−.16	.84	4.55	1.72	4.36	1.85	−.35	.71
	Rehearsal frequency												
15	Before today I have deliberately thought about the event (1 = *Almost never,* 7 = *Extremely often*)	4.74	1.59	3.82	1.75	.44	1.42	5.22	1.49	4.34	1.71	.41	1.35
16	Before today I have talked about the event (1 = *Almost never,* 7 = *Extremely often*)	3.88	1.95	3.29	1.77	.04	1.13	3.95	1.90	3.89	1.85	−.50	.62
17	Before today I have had the event pop up in my mind by itself—that is, without my trying to think of it (1 = *Almost never,* 7 = *Extremely often*)	4.47	1.72	3.75	1.82	.20	1.24	4.80	1.57	4.29	1.72	.03	1.00
	Sensory vividness												
4	When I think of this event today it appears vivid and clear (1 = *Not at all,* 7 = *To a very high degree*)	4.94	1.35	4.70	1.68	−.20	.70	5.09	1.56	5.13	1.48	−.49	.42
5	When I think of this event today I can see it in my mind (1 = *Not at all,* 7 = *To a very high degree*)	5.43	1.29	5.23	1.50	−.20	.61	5.55	1.22	5.48	1.36	−.31	.46
6	When I think of this event today I can hear it in my mind (1 = *Not at all,* 7 = *To a very high degree*)	4.10	1.86	3.67	2.02	−.14	.99	4.54	1.80	4.90	1.83	−.91	.18

(*table continues*)

Table 1 (*continued*)

Order	Characteristics items and anchors	Experiment 1 Future mean	Future *SD*	Memory mean	Memory *SD*	Lower 95% CI diff	Upper 95% CI diff	Experiment 2 Future mean	Future *SD*	Memory mean	Memory *SD*	Lower 95% CI diff	Upper 95% CI diff
7	When I think of this event today I can smell or taste it in my mind (1 = *Not at all,* 7 = *To a very high degree*)	2.76	1.74	2.28	1.64	−.02	.97	2.94	1.88	2.65	1.88	−.27	.85
8	When I think of this event today I can recall the physical surroundings (1 = *Not at all,* 7 = *To a very high degree*)	4.52	1.84	5.25	1.44	−1.21	−.24	4.54	1.85	5.50	1.59	−1.48	−.45
	Other items (including valence)												
12	When I think of this event today the feelings I experience are (1 = *Extremely negative,* 7 = *Extremely positive*)	5.19	1.59	3.95	1.50	.79	1.69	5.38	1.74	3.81	1.71	1.05	2.08
3	When I think of this event today it makes me feel as if I am travelling in time to the actual situation (1 = *Not at all,* 7 = *To a very high degree*)	4.23	1.78	3.34	1.77	.38	1.42	4.13	1.95	3.69	1.97	−.14	1.03
9	When I think of this event today it feels as though I am [pre–experiencing/re–experiencing] it in my mind (1 = *Not at all,* 7 = *To a very high degree*)	4.56	1.78	4.33	1.89	−.31	.77	4.85	1.79	4.75	1.71	−.43	.62
10	When I think of this event today it seems to come to me as a coherent story, as opposed to incoherent or in flashes (1 = *Not at all,* 7 = *To a very high degree*)	3.94	1.70	4.34	1.88	−.92	.13	4.54	1.88	5.06	1.72	−1.07	.01
13	When I think of this event today I see it from the perspective of (1 = *My own eyes,* 7 = *An observer's eyes*)	2.87	1.90	2.49	1.94	−.18	.94	2.74	2.06	3.08	2.28	−.98	.31
14	When I think of this event today it subjectively feels, regardless of when it actually [takes/took] place (1 = *Very close in time,* 7 = *Very far away in time*)	3.58	1.77	3.86	1.73	−.79	.23	4.00	1.67	3.53	1.76	−.04	.99
18	Before today I have experienced consequences in my life due to this event (1 = *Not at all,* 7 = *To a very high degree*)	3.63	1.89	3.64	1.86	−.56	.54	4.10	1.99	4.31	1.90	−.79	.37

Table 1 (*continued*)

		Experiment 1						Experiment 2					
Order	Characteristics items and anchors	Future mean	Future *SD*	Memory mean	Memory *SD*	Lower 95% CI diff	Upper 95% CI diff	Future mean	Future *SD*	Memory mean	Memory *SD*	Lower 95% CI diff	Upper 95% CI diff
21	The event I described [will take/took] place as I [imagine/remember] it (1 = *Not at all likely,* 7 = *Very likely*)	3.94	1.62	5.93	1.16	−2.40	−1.58	4.66	1.71	6.13	.93	−1.89	−1.04
20	The event I described [takes/took] place when I [am/was] age (enter your age in years)	22.10	5.55	14.36	4.20	6.34	9.21	32.93	12.07	23.23	11.17	6.23	13.18
	Noncontinuous item and categories	Future specific	Future general	Memory specific	Memory general	Lower 95% CI diff	Upper 95% CI diff	Future specific	Future general	Memory specific	Memory general	Lower 95% CI diff	Upper 95% CI diff
19	The event I described [occurs/occurred] once on a specific day, a "specific event" OR is a mix of similar events that [occurs/occurred] on more than one day, a "general event"	.37	.63	.68	.32	−.45	−.17	.39	.61	.73	.28	−.47	−.18

Note. Brackets denote differences in the wording of items between the directive future experience and directive memory conditions. The last item (19) is categorical, so instead of mean ratings, proportion of subjects choosing each category and the confidence interval around the difference in proportion of subjects choosing the specific category, are presented. These proportions do not add to 1 for Experiment 2's directive future experience condition because of rounding.

this question, we first calculated—for each of the 20 phenomenological and memory characteristics reported on continuous scales—a mean score, and display these data in the middle panel of Table 1, classified by type of directive event. Thinking of these events evoked some sense of mental time travel, a finding we can understand as another manipulation check, suggesting the right type of events were elicited (see means for Items 3 and 9 in Table 1; 95% CIs did not overlap with the bottom of the scale: Item 3, 95% CI_{future} [3.86, 4.61], 95% CI_{memory} [2.97, 3.70]; item 9, 95% CI_{future} [4.18, 4.93], 95% CI_{memory} [3.94, 4.72]).

Next, to simplify our dataset, we created three new variables: emotional response, rehearsal frequency, and sensory vividness. We created these new variables by grouping conceptually related characteristics together and calculating the mean across the characteristics that comprised each grouping. The specific characteristics that comprise each variable are indicated in Table 1. Because the emotional valence characteristic (Item 12 in Table 1) used the anchors *extremely negative* and *extremely positive*, unlike for other characteristics, higher ratings do not simply indicate "more valence." As such, we could not include valence in this new emotional response variable and instead consider valence separately, below. For each of these new variables, Cronbach's alpha showed good internal consistency: emotional response, $\alpha = .76$; rehearsal frequency, $\alpha = .71$; sensory vividness, $\alpha = .82$ (Cronbach, 1951). Finally, we classified these new variables according to whether subjects were asked to report a directive future experience or directive memory, and display the results in the left panel of Figure 1.

As the figure shows, there were three important findings. First, comparing the leftmost pair of bars to one another reveals that directive future experiences elicited a stronger emotional

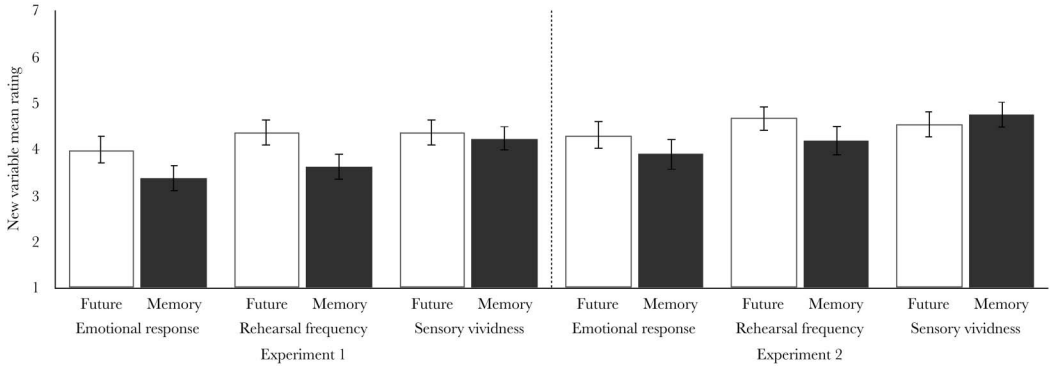

Figure 1. Mean ratings of new characteristics variables (created by averaging across individual items) as a function of type of directive event (directive future experience, directive memory) for Experiment 1 (left panel) and Experiment 2 (right panel). Error bars represent 95% CIs of cell means. For Experiment 1, a one-way multivariate analysis of variance (MANOVA) on these three new variables and the valence item revealed a main effect of type of directive event: Hotelling's trace = 0.24, $F(4, 177) = 10.54$, $p < .01$. Follow-up univariate tests revealed significant differences between types of directive event for emotional response, $t(180) = 3.00$, $p < .01$, rehearsal frequency, $t(180) = 3.60$, $p < .01$, and valence $t(180) = 5.43$, $p < .01$, but not for sensory vividness $t(180) = 0.67$, $p = .51$. A MANOVA on the 12 individual characteristics, rather than the new variables, was also significant, Hotelling's trace = 0.43, $F(12, 169) = 6.04$, $p < .01$, as was a MANOVA on all 19 ratings characteristics, Hotelling's trace = 1.16, $F(19, 162) = 9.92$, $p < .01$. Similarly for Experiment 2, a one-way MANOVA on the three new variables and the valence item revealed a main effect of type of directive event, Hotelling's trace = 0.34, $F(4, 172) = 14.64$, $p < .01$. Follow up univariate tests revealed a marginally significant difference between types of directive event for emotional response, $t(175) = 1.81$, $p = .07$, and significant differences for rehearsal frequency, $t(175) = 2.30$, $p = .02$, and valence $t(175) = 6.01$, $p < .01$, but not for sensory vividness $t(175) = 1.01$, $p = .31$. A MANOVA on the 12 individual characteristics was also significant, Hotelling's trace = 0.49, $F(12, 164) = 6.70$, $p < .01$, as was a MANOVA on all 19 ratings characteristics, Hotelling's trace = 0.92, $F(19, 157) = 7.61$, $p < .01$.

response than directive memories, $M_{difference}$ = 0.62, 95% CI [0.21, 1.03]; these mean differences are raw effect sizes, with possible ranges from 0–6. Second, the middle pair of bars reveals that directive future experiences were rehearsed more often than directive memories, $M_{difference}$ = 0.74, 95% CI [0.34, 1.15]. Third, the last pair of bars reveals that directive future experiences were only trivially more vivid than directive memories, $M_{difference}$ = 0.13, 95% CI [−0.24, 0.50]. These results suggest that directive future experiences and directive memories are similar yet distinguishable. That is, although they share many characteristics, the degree to which they exhibit them differs: Directive future experiences were more affecting, more rehearsed, and—in contrast to typical findings about imagined experiences—no less sensorially vivid than their remembered counterparts.

Although our results so far tell us that directive future experiences can be distinguished from directive memories on at least two characteristics, our results do not tell us about valence. But if we turn back to Table 1, Item 12, we see that directive future experiences were clearly positive; by contrast, directive memories were neither clearly negative nor positive, instead the mean rating is close to the midpoint between *extremely positive* and *extremely negative*. How are we to interpret such a result? Were some directive memories positive and others negative, or were they effectively neutral?

One way to address interpretation is to examine the distribution of valence ratings for directive memories. When we did so, we found they were approximately normally distributed, suggesting directive memories were not a bimodal group of very negative and very positive events (see supplementary materials for distributions). But the distribution still does not give us insight into whether most of these directive memories were neutral. We therefore adopted Rasmussen and Berntsen's (2009) approach, and categorized each subject's valence rating as positive, neutral, or negative according to whether it fell above, at, or below the midpoint of the scale, respectively.

We found that, of the subjects who described directive memories, 35% gave a positive rating, 18% a neutral rating, and 47% a negative rating. These data paint a picture not of neutral directive memories, but a mix of positive and negative events with the largest number being negative. This finding fits with previous research in which directive memories were mostly negative, setting apart directive memories from typically positive autobiographical memories (Rasmussen & Berntsen, 2009; Walker et al., 2003). By way of comparison, subjects who described directive future experiences, gave 73% positive, 8% neutral, and 19% negative ratings; these results fit with literature showing that people tend to generate and remember idyllic imagined future scenarios (Berntsen & Bohn, 2010; Szpunar, Addis, & Schacter, 2012). In further support of this interpretation, when we turned to subjects' descriptions and again used the LIWC2007 application (Pennebaker et al., 2007) to determine how often subjects used words reflecting positive and negative emotions, we found that subjects who described directive memories used a similar percentage of words reflecting negative emotions to words reflecting positive emotions, whereas subjects who described directive future experiences used far more positive than negative words (memory: $M_{positive}$ = 2.30%, $SD_{positive}$ = 2.71, $M_{negative}$ = 2.51%, $SD_{negative}$ = 3.38, $M_{difference}$ = 0.20, 95% CI [−0.74, 1.15]; future: $M_{positive}$ = 3.55%, $SD_{positive}$ = 4.16, $M_{negative}$ = 0.88%, $SD_{negative}$ = 1.63, $M_{difference}$ = 2.67, 95% CI [1.67, 3.67]).

Directive future experiences versus directive memories on the CLS. Finally, recall that we suspected that more directive future experiences would involve cultural milestones than would directive memories. We examined the proportion of directive experiences that people drew from the CLS. In the absence of a CLS for New Zealand, a coder blind to condition and hypotheses used the American CLS to code, for each description, which CLS event was described or if the experience was not on the CLS at all (Rubin et al., 2009). One of us (M. S.) also coded 40 randomly selected descriptions, and coders agreed in 90% of cases, with disagreements resolved through discussion. We found that 61% of directive future experiences were drawn from the CLS compared with 38% of directive memories (95% $CI_{difference}$ [0.08, 0.37]), a pattern that aligns with our results about the characteristics of these experiences. That is, many cultural milestones are positive, important, and plausible—and so it makes sense that the directive future experiences were typi-

cally more positive, more affecting, and more often rehearsed.

Discussion

Taken together, these results suggest that directive future experiences are in some ways an amplified version of directive memories. More specifically, we found that directive future experiences were more emotionally evocative, rehearsed more often, and more positive than directive memories. But directive future experiences were vivid to a similar degree as to directive memories, a result contrary to the common finding that remembered experiences are more vivid than imagined experiences (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004; Johnson et al., 1988). We also found that directive memories were a mix of negative and positive events—a result in line with Rasmussen and Berntsen's (2013) finding that negative and positive memories were similar in the degree to which they served a directive function, and fitting with the idea that negative autobiographical memories have an important role in guiding behavior (Rasmussen & Berntsen, 2009; see also Pillemer, 2009). And finally, directive future experiences were more likely to be drawn from the CLS, which could help us understand why they are rated higher on these characteristics than directive memories, and fits with work showing that people use the CLS when imagining their future (Berntsen & Rubin, 2004; Bohn & Berntsen, 2011; Rubin et al., 2009).

Of course, it is possible the fact that we used college students served to inflate the intensity of directive future experiences. After all, people may rely more on directive experiences during periods of major transition, such as beginning college, when they do not already have personal scripts to guide them (Berntsen & Rubin, 2004; Pillemer, 2001, 2003). To address this concern, we repeated the experiment with a different sample: people who were less likely to be in a period of major transition, i.e., workers on Amazon's Mechanical Turk service (MTurk; www.mturk.com; Buhrmester, Kwang, & Gosling, 2011).

Experiment 2

Method

We used the same method as in Experiment 1, except as noted.

Subjects. A total of 335 MTurk workers participated for $0.50 Amazon credit. We collected a larger sample than in Experiment 1 because we aimed for the same final sample size, but anticipated excluding data from a third to a half of our subjects because of our stringent compliance checks (Oppenheimer, Meyvis, & Davidenko, 2009). Of the subjects we retained for analysis, 47% were male and 53% female; patterns were similar for each, so we did not consider sex further. Their ages ranged from 18 to 66, M_{age} = 30.71, SD_{age} = 11.05, $Median_{age}$ = 27, suggesting that this sample was older than the one in Experiment 1. All reported English as their first language, and 89% reported their nationality as American, 2% as British, Polish, or German (the rest of the sample reported ethnicity: 9% as White or Caucasian, and <1% as Black).

Procedure. Prior to completing the experiment proper, we asked subjects to follow procedures we have used in other research in which we obtained similar findings, regardless of the data being collected in a laboratory or on MTurk (e.g., Michael, Newman, Vuorre, Cumming, & Garry, 2013). More specifically, we asked subjects to maximize their web browsers, to refrain from engaging in other tasks during the experiment, and to complete the experiment in an environment free of distractions (see supplementary materials for the full wording). After the experiment proper, we incorporated several attention checks (Oppenheimer et al., 2009) and asked subjects if they had complied with our instructions. We also asked some demographics questions (see supplementary materials for details).

Results

The primary purpose of this experiment was to replicate the findings of Experiment 1 with respect to the characteristics of directive future experiences and directive memories. Before turning to that issue, we first made a number of exclusions. We excluded 153 subjects (46%) for failing the attention checks, or failing to comply with all instructions, or both. Although high, this rate of exclusion is the same as one reported by Oppenheimer et al. (2009). Moreover, the validity of our data depends on subjects carefully reading the instructions about the type of event to describe, and taking seriously the rating of each characteristic. Indeed, had we retained

those 153 subjects, the pattern of results would have remained the same, but the effects would have been smaller (except for vividness, which was larger), suggesting these subjects added error to the dataset. We then excluded a further four subjects for describing a remembered event rather than an imagined event, and one for not describing a personally experienced event. The net sample size was 80 subjects in the memory condition and 97 in the future experience condition.

Manipulation check. We again used LIWC2007 software (Pennebaker et al., 2007) to compare how often subjects used the past, present, and future tense to describe each type of directive event. As in Experiment 1, subjects who described directive future experiences used less past tense and more present or future tense than subjects who described directive memories, suggesting the manipulation was successful in eliciting the right type of event descriptions from subjects (past tense: M_{future} = 2.73%, SD_{future} = 3.74, M_{memory} = 8.89%, SD_{memory} = 4.06, $M_{\text{difference}}$ = −6.16, 95% CI [−7.32, −5.00]; present tense: M_{future} = 5.31%, SD_{future} = 5.26, M_{memory} = 3.09%, SD_{memory} = 3.31, $M_{\text{difference}}$ = 2.22, 95% CI [0.88, 3.56]; future tense: M_{future} = 2.51%, SD_{future} = 2.99, M_{memory} = 0.72%, SD_{memory} = 1.27, $M_{\text{difference}}$ = 1.80, 95% CI [1.09, 2.50]).

Characteristics of directive future experiences versus directive memories. We return now to our primary question: Would we find a similar pattern when we compared the characteristics of directive future experiences and directive memories using a more diverse sample? The answer is yes.

The right panel of Table 1 shows mean scores for the 20 phenomenological and memory characteristics. As in Experiment 1, Table 1 suggests that we elicited events evoking a sense of mental time travel. Specifically, 95% CIs around the means did not overlap with the bottom of the scale for Item 3 (95% CI_{future} [3.74, 4.53], 95% CI_{memory} [3.25, 4.12]) or Item 9 (95% CI_{future} [4.48, 5.21], 95% CI_{memory} [4.37, 5.13]). We again reduced the characteristics down to the new emotional response, rehearsal frequency, and sensory vividness variables, and again Cronbach's alpha showed good internal consistency for each new variable: emotional response α = .79, rehearsal frequency α = .76, sensory vividness α = .84 (Cronbach, 1951). We display these results in the right panel of Figure 1.

A comparison of the bars within each pair in the figure shows that we replicated these three main findings from Experiment 1. First, directive future experiences elicited stronger emotional responses than directive memories, $M_{\text{difference}}$ = 0.40, 95% CI [−0.04, 0.85]. Although in the current experiment, the 95% CI around the difference just included zero as a plausible value, the more plausible values for the difference fall near the middle of the CI (Cumming, 2012). Second, directive future experiences were rehearsed more often than directive memories, $M_{\text{difference}}$ = 0.49, 95% CI [0.07, 0.90]. Third, directive future experiences were only trivially less vivid than directive memories, $M_{\text{difference}}$ = −0.20, 95% CI [−0.59, 0.19].

Turning now to valence, recall that in Experiment 1 we found directive future experiences were highly positive, whereas directive memories were a mix of positive and negative events, tending toward the negative. We replicated those findings in Experiment 2. Table 1 shows that on the valence characteristic, subjects rated directive future experiences close to the *extremely positive* end of the scale, whereas they rated directive memories close to the midpoint between *extremely positive* and *extremely negative*. Again, the distribution of ratings for directive memories was approximately normal (see supplementary materials), and therefore we again categorized each subject's valence rating as positive, neutral, or negative according to whether it fell above, at, or below the midpoint of the scale. We found that, of the subjects who described directive memories, 35% gave a positive rating, 19% a neutral rating, and 46% a negative rating, whereas subjects who described directive future experiences gave 76% positive, 9% neutral, and 14% negative ratings.

As in Experiment 1, we used the LIWC2007 application (Pennebaker et al., 2007) to analyze subjects' descriptions, and found additional support for the patterns of valence—those who described a directive memory used a slightly greater percentage of words reflecting negative emotions than words reflecting positive emotions, whereas those who described a directive future experience used far more positive than negative words (memory: M_{positive} = 1.85%, SD_{positive} = 2.27, M_{negative} = 2.81%, SD_{negative} = 3.09, $M_{\text{difference}}$ = 0.96, 95% CI

[0.02, 1.90]; future: $M_{positive}$ = 3.70%, $SD_{positive}$ = 3.89, $M_{negative}$ = 0.85%, $SD_{negative}$ = 1.95, $M_{difference}$ = 2.85, 95% CI [1.92, 3.79]).

Directive future experiences versus directive memories on the CLS. Finally, we examined the proportion of directive experiences subjects described that were drawn from the CLS (Rubin et al., 2009), using the same procedure as in Experiment 1. Coders agreed in 80% of cases. As in Experiment 1, we found that 46% of directive future experiences and 15% of directive memories were drawn from the CLS (95% $CI_{difference}$ [0.17, 0.44]).

Discussion

These findings provide additional evidence for our conclusions from Experiment 1. Specifically, directive future experiences are more affecting, more rehearsed, and similar to directive memories in vividness; directive future experiences are largely positive, and directive memories are a mix of positive and negative events, somewhat tending toward the negative; and directive future experiences are more likely to involve events that are cultural milestones.

To more precisely estimate the differences between directive future experiences and directive memories, we conducted mini meta-analyses using our data from both Experiments 1 and 2. We used Exploratory Software for Confidence Intervals (Cumming, 2012) to conduct four random-effects-model meta-analyses. These yielded much narrower confidence intervals around the effect sizes—emotional response: $M_{difference}$ = 0.52, 95% CI [0.22, 0.82]; rehearsal frequency: $M_{difference}$ = 0.62, 95% CI [0.33, 0.91]; sensory vividness: $M_{difference}$ = −0.03, 95% CI [−0.35, 0.29]; valence: $M_{difference}$ = 1.38, 95% CI [1.05, 1.72]—and together support the idea that directive future experiences are similar to, yet distinguishable from, directive memories.

General Discussion

In two experiments we asked people to describe and rate the characteristics of experiences—either imagined or remembered—that they had drawn on to guide their behavior. Our findings suggest that these two classes of mental time travel are similar in some ways but distinct in others. We found that, compared with their directive memory counterparts, directive future experiences were more emotionally affecting, more positive, more frequently rehearsed, and more likely to be drawn from the CLS, yet similarly vivid. These results largely fit with previous literature. But our experiments extend that work to directive experiences that people report using in the real world, while preserving experimental rigor. Considered together, our results suggest that directive future experiences are, on many characteristics, an amplified version of directive memories.

These findings comport with at least three lines of research in the wider domain of autobiographical memory. First, that directive future experiences were more emotionally evocative and more often rehearsed than directive memories fits with the idea that, to the extent that directive future experiences are more often drawn from the CLS, they would show these characteristics to a greater degree (Berntsen & Rubin, 2004). Second, the finding that directive future experiences were largely positive fits with studies showing that people tend to imagine their future through "rose-tinted glasses" (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004). In addition, that directive memories were a mix of positive and negative lends support to the previous finding that both positive and negative memories direct behavior, and the notion that, although autobiographical memories are usually biased toward the positive, negative memories may have a special role in guiding behavior (Rasmussen & Berntsen, 2009, 2013; Walker et al., 2003). This difference points to the possibility that future experiences may typically convey lessons about what to approach, whereas lessons from the past may more often convey lessons about what to avoid. Third, that directive future experiences were more likely to be drawn from the CLS than were the directive memories fits with previous work showing that people tend to structure their imagined future in terms of cultural expectations, whereas the memories they recall from their past are more idiosyncratic (Berntsen & Rubin, 2004; Bohn & Berntsen, 2011; D'Argembeau & Mathy, 2011; Rasmussen & Berntsen, 2013).

For all this consistency with previous literature, we were surprised that directive future experiences and directive memories were similarly vivid. This finding diverges from the larger

literature showing that imagined experiences typically come to mind with less detail than those experienced in reality (Berntsen & Bohn, 2010; D'Argembeau & Van der Linden, 2004; Johnson et al., 1988). One explanation for our atypical but consistent finding is that in our experiments, people did not construct their imagined future experiences for the first time—so perhaps people were biased to recall imagined experiences that possessed certain characteristics. For example, one recent study found that vivid imagined future events were more memorable (McLelland, Devitt, Schacter, & Addis, 2015). This finding raises the possibility that directive future experiences may not tend to be particularly vivid, but the ones that are, are more likely to later be recalled and reported.

Memory biases could also be relevant to our findings about another characteristic, valence. Positive imagined future experiences tend to be more memorable than neutral or negative ones (Szpunar et al., 2012), which could help to explain why the directive future experiences reported here were highly positive. These are issues that future research could examine more directly by asking people to construct novel directive future experiences during the experiment, for instance by asking people to imagine and rate a particular scenario in which a life lesson is evident. But a challenge with that approach would be ensuring genuinely directive experiences, because experiences constructed in the moment will not have had the opportunity to guide behavior in the real world.

Our ability to draw conclusions about the characteristics of directive experiences is limited in at least four ways. First, asking for only one event from each subject means it is likely that many of them reported a highly accessible experience. But our primary interest was in comparing directive future experiences and directive memories, and this tendency to report highly accessible experiences was likely present in both conditions. Nonetheless, to the extent that highly accessible directive experiences systematically differ from those less accessible, the generalizability of our results is limited.

Second, we collected only self-report data, and so we have no direct evidence that people have actually drawn on these experiences to change their behavior. After all, directiveness may simply be an attribution that people make, regardless of whether that attribution is correct (Nisbett & Wilson, 1977). There is existing experimental work that gives some basis to the idea that imagined experiences may guide behavior (e.g., Bernstein & Loftus, 2009; Taylor et al., 1998; Thomas, Hannula, & Loftus, 2007). But future experiments should build on this work by measuring changes in people's behavior after they have brought to mind an autobiographical future experience with a directive message that they can articulate. Indeed, a critic might wonder if directive future experiences are largely comprised of prospective memory tasks for solving everyday problems. But if that were true, we would not expect to see so many of them drawn from the CLS.

Third, we collected data only about voluntarily recalled experiences whereas it would be more efficient for directive experiences to come to mind involuntarily (Pillemer, 1998, 2003; Rasmussen & Berntsen, 2009). Moreover, people are not always meta-aware when their minds are wandering, and so they could be using a directive experience without realizing it, meaning they would be unable to report using that experience (Takarangi, Strange, & Lindsay, 2014). But even if all the experiences people reported were the product of deliberate, aware mental effort in our experiments, they could also have recalled those same experiences involuntarily at the time they guided their behavior.

Fourth, although our work was not designed to compare the characteristics of directive events relative to "ordinary" events, that question is an interesting one to consider. Such an endeavor is not as easy as it might seem. For instance, what is the right control event? One could speculate that some sort of applicable life lesson could be distilled from almost any scenario, and so any experience could become directive as future scenarios arise. Again, these are not trivial issues, but are important ones for future work to address.

Despite these limitations, our findings help clarify the characteristics of at least some of the experiences, both imagined and remembered, that people use to guide their behavior. These findings suggest that different degrees of these characteristics may be important for the extent to which experiences guide people's behavior. Future research could examine, given imagined future experiences and memories differ in some

ways, if these two classes of directive experiences work to guide people's behavior via different mechanisms, and find out which characteristics matter most for changing behavior—or if the content is more important than the characteristics. Relatedly, to more directly test the idea that directive experiences are autobiographical simulations that aid in making predictions, intentions, and plans, in subsequent work it would be interesting to ask subjects to classify their directive experiences according to which types of thinking about the future they involve (Szpunar et al., 2014).

Our findings have theoretical and practical implications. On the theory side, the finding that many directive future experiences are drawn from the CLS helps us to understand the kinds of experiences people turn to when they look forward in time seeking guidance about how to behave in the present. Although our experiments were not designed to distinguish between the differing views on how people construct future experiences, our findings fit with the idea that both episodic details and schematic knowledge are important aspects of directive future experiences. On the one hand, directive future experiences showed surprising levels of sensory detail, similar to those of directive memories. And on the other hand, directive future experiences often involved events on the CLS, a finding indicative of a guiding role of this schematic knowledge. Taken together, our results lend support to calls by others that the field should continue delineating the relative roles of each source of memorial information in imagining the future in a variety of circumstances (Cordonnier, Barnier, & Sutton, 2016; D'Argembeau & Mathy, 2011). In particular, the idea of the CLS as a source of directive experiences is one worthy of future study: There are no lessons intrinsic to these milestones, so what determines the lesson extracted from imagining them? For example, two people may imagine getting married, but while one extracts a lesson that prompts him to go shopping for an engagement ring, the other extracts a lesson that prompts her to break up with her partner.

On the practical side, imagined future experiences may be even more useful for guiding behavior than memories, because as long as people have the raw ingredients, they can imagine things that have never happened to them. Our findings may contribute to developing effective interventions for groups such as first-in-family college students, who often struggle to do well in their studies (Stephens, Hamedani, & Destin, 2014). Helping students believe they can succeed in college—by leading them to create future experiences infused with directive characteristics—may help them do just that.

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Received June 27, 2016
Revision received June 8, 2017
Accepted July 27, 2017 ■