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Divided attention interferes with fulfilling activity-based intentions

Gene A. Brewer [a,*], B. Hunter Ball [b], Justin B. Knight [b], Michael R. Dewitt [b], Richard L. Marsh [b]

[a] Department of Psychology, Arizona State University, United States
[b] Department of Psychology, University of Georgia, United States

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ABSTRACT

Two experiments were conducted to examine the effects of divided attention on activity-based prospective memory. After establishing a goal to fulfill an intention upon completion of an ongoing activity, successful completion of the intention generally suffered when attention was being devoted to an additional task (Experiment 1). Forming an implementation intention at encoding ameliorated the negative effects of divided attention (Experiment 2). The results from the present experiments demonstrate that activity-based prospective memory is susceptible to distraction and that implementing encoding strategies that enhance prospective memory performance can reduce this interference. The current work raises interesting questions about the similarities and differences between event- and activity-based prospective memories.

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Prospective memory refers to the strategic use of memory and attention processes to complete intentions in the future. The planning, retention, and retrieval of a prospective memory is influenced by a host of contextual variables including an individual's metacognitive knowledge about the intention, the future context in which the intention can be fulfilled, and their ability to successfully complete the intention (Einstein & McDaniel, 2008). Put simply, there are various types of intentions and numerous ways in which people fulfill them (Kvavilashvili & Ellis, 1996). Importantly, certain intentions are prone to disruption via distraction and prospective memory researchers have investigated strategies that can ameliorate these deficits (Chasteen, Park, & Schwarz, 2001; Kleigel, Martin, McDaniel, Einstein, & Moor, 2007; McDaniel, Einstein, Graham, & Rall, 2004; Tobias, 2009). In the current work, we sought to investigate the attentional demands of completing an activity-based prospective memory and we also investigated a technique for improving intention completion rates (i.e., implementation intentions).

Individuals may establish their prospective memories differently depending on the nature of the intention, the cues they will encounter in the future, and their metacognitive assessment of the types of cues that work well for them. Imagine planning to deliver magnets to a local high school science fair after leaving work. What characteristics will most likely help you remember to interrupt your typical routine of going home from work? Perhaps you would leave the magnets in the seat of your car to serve as a reminder that you needed to take them to the high school. In this case, the magnets would serve as an event-based prospective memory cue. A different characteristic that could effectively cue the intention would be temporal information. If, when establishing the intention, you note that the high school closes before 5:00 pm then you should rely more heavily on time-based cues. Another useful characteristic for planning would be associating the intention with some activity that you will participate in later in the day. For example, say that you have a meeting scheduled in the afternoon and you plan to deliver the magnets immediately after the meeting. In this case, you would have formed an activity-based prospective memory. Whereas much research has investigated event- and time-based prospective memory, much less research has examined activity-based prospective memory. The current experiments will not focus on comparing these different types of intentions but will investigate the attentional demands of completing activity-based intentions directly. However, a discussion of the similarities and differences between these types of intentions, as well as a theoretical framework for thinking about differences between intentions, will be provided in the general discussion.

More formally, activity-based prospective memory refers to doing "…one thing before or after another" (Kvavilashvili & Ellis, 1996 pg. 36). In this regard activity-based prospective memory shares aspects with both event- and time-based intentions, but it also differs in important ways. In standard laboratory paradigms, completing both event- and time-based intentions typically requires interruption to an ongoing task whereas activity-based intentions must be completed between tasks. By interruption, we mean that activity-based intentions are retrieved and enacted in the absence of performing an ongoing task whereas event-based and time-based intentions are typically retrieved and enacted while performing an ongoing task. For

* Corresponding author at: Department of Psychology, Arizona State University, Tempe, AZ 85287-1104, United States. Tel.: +1 4809652155.
E-mail address: gene.brewer@asu.edu (G.A. Brewer).

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this reason, some researchers have suggested that activity-based prospective memory should be less susceptible to distraction (e.g., Shum, Ungvari, Tang, & Leung, 2004). Similarly, activity-based prospective memory could be considered analogous to a contextually linked intention (Marsh, Hicks, & Cook, 2006). Based on this theorizing, activity-based prospective memory would not be susceptible to distraction over an intervening context. However, an important difference between event-, time-, and activity-based intentions is the degree of support that the environment provides for completing them. For example, event-based prospective memories are typically associated with some type of environmental cue whereas time- and activity-based prospective memories require a greater degree of self-initiated retrieval in the absence of processing any such cue (Craik, 1986; but see Kvavilashvili & Fisher, 2007). To the degree that self-initiated retrieval is a capacity consuming process (Unsworth, 2009), this view suggests that divided attention should negatively influence activity-based prospective memories. Based on these hypotheses (i.e., interruption to ongoing tasks, context linking of intentions, and self-initiated retrieval) about the effects of divided attention on activity-based prospective memory, it is not clear exactly how divided attention will affect intention completion.

Generally, the effects of divided attention on memory have been studied in many paradigms including free recall, cued recall, recognition, and prospective memory (Marsh & Hicks, 1998; for a review of retrospective memory see Mulligan, 2008). In retrospective memory studies, divided attention at retrieval has the greatest effects on recall with little to no demonstrable effects on recognition (Craik, Govoni, Naveh-Benjamin, & Anderson, 1996; but see Hicks & Marsh, 2000). Similarly, dual-task paradigms have demonstrated that both event- and time-based prospective memories suffer from distraction (Einstein, McDaniel, Smith, & Shaw, 1998; Hicks, Marsh, & Cook, 2005). With regard to retrospective and prospective memories, divided attention has the greatest effects on retrieval when capacity-consuming processes are needed for accessing information from long-term memory and monitoring for intention-related cues, respectively. To date, no research has explicitly examined the effects of divided attention on activity-based prospective memory, although previous empirical research does suggest that distraction could be disrupting.

Brewer et al. (in press) examined the nature of activity-based prospective memory by having participants form an intention to say "now" after finishing two phases of lexical decision trials. After finishing the first phase, participants were given the additional event-based intention to respond to any word containing the syllable TOR (e.g., tornado) during the second phase of lexical decisions that had previously been associated to their intention to say "now". This manipulation simulated the prospective memory demands of everyday life in which some intentions have to be interrupted by other more demanding intentions. Introducing an additional intention significantly reduced the likelihood that participants remembered to say "now" at the end of the second phase of lexical decision trials. The results from this experiment were consistent with the notion that some degree of attentional processes was necessary for retrieving the intention to say "now" and that interleaving a demanding event-based intention interfered with these self-initiated retrieval processes. What is less clear is whether the interference resulted from the increased demands of the nonfocal intention *during* the task, or from some continued consideration or contemplation of the nonfocal intention *after* the task. To address this issue more formally, the current study investigated divided attention during and after a task that participants have planned to make an activity-based response upon completing.

1. The current study

To the degree that capacity-consuming processes are necessary for self-initiating retrieval we hypothesize that activity-based prospective memory will be negatively impacted by divided attention. As discussed earlier, this hypothesis is not the only prediction that can be derived from the prospective memory literature. If activity-based prospective memories reflect a contextually linked intention, they should not be sensitive to disruption over an intervening context (Marsh et al., 2006; cf. Brewer et al., in press). Also, activity-based prospective memory may not be susceptible to distraction because interrupting performance of the ongoing task is not necessary for successful completion of the intention (Shum et al., 2004). To test these competing hypotheses we had participants form the intention to say "now" after finishing a lexical decision task (LDT). In addition to completing the LDT, some participants simultaneously completed a random number generation (RNG) task. Previous research suggests that cue-triggered prospective memory processes from event-based intentions interfere with self-initiated retrieval processes (Brewer et al., in press), but it is unclear if any distraction in general is sufficient to disrupt self-initiated retrieval or whether this disruption is specific to increasing load on competing prospective memory processes by holding multiple intentions. If a general disruption to self-initiated planning and retrieval processes is sufficient to interfere with activity-based prospective memory, decreased performance should be seen when any demanding secondary task is introduced. What is less clear is whether the detrimental effects on prospective memory performance will be seen when this additional task is completed before the interval in which the activity-based intention is to be fulfilled, and perhaps more importantly, whether there are ways to buffer against the detrimental effects of dividing attention. In a second experiment we elaborated on the influence of divided attention by investigating alternative planning strategies (i.e., implementation intentions; Gollwitzer, 1999). Implementation intentions improve prospective memory by enhancing the encoding experience at intention formation. Implementation intentions are used to specify the situation in which future behavior can be achieved and to associate this situation to the intended future action (Gollwitzer, 1999). Implementation intentions have been shown to mitigate the influence of divided attention on event-based prospective memory but have yet to be applied to activity-based prospective memory (McDaniel, Howard, & Butler, 2008).

2. Experiment 1

2.1. Participants

University of Georgia undergraduates volunteered in exchange for credit toward a research requirement. Participants (N = 120) were randomly assigned to one of three between-subject conditions (40 in each). In the No Divided Attention (No DA) condition participants formed an intention to say "now" when they finished the LDT. In the Divided Attention End (DA End) condition participants generated random numbers while performing the LDT and both tasks ended simultaneously. This condition was included to investigate whether divided attention *during* the activity that participants had previously associated their intention to would reduce its likelihood of being completed. In the Divided Attention Continue (DA Continue) condition participants continued generating random numbers after finishing the LDT. In both the DA End and DA Continue conditions, participants had the same intention as in the No DA condition.

2.2. Materials and procedure

The ongoing LDT consisted of 210 trials, with equal numbers of valid English words and pronounceable nonwords that were randomly presented on a computer monitor (for a complete description of the LDT procedure see Marsh, Hicks, & Watson, 2002). Upon stimulus presentation, participants were instructed to press the "word" key with their right index finger or the "nonword" key with their left index finger as quickly as possible. Trials were separated by a "waiting" message. In the No DA condition, participants received instructions for the LDT displayed on the computer monitor. Participants then read the activity-based intention instructions that instructed them to say "now" when they completed the LDT. These instructions were presented as secondary, with the primary emphasis placed on speed and accuracy in completing the LDT. The experimenter reiterated the instructions for the LDT and the intention before beginning the experiment.

In the two divided attention conditions, participants first received instructions for the RNG task (e.g., Marsh & Hicks, 1998; see also McDaniel et al., 2008). They were told to randomly generate numbers between 1 and 10 upon hearing a short beep provided by an audio recording every 1.5 s. Participants were instructed to continue until the audio recording was turned off. Participants then practiced the RNG task (baseline RNG in Table 1) to become familiar with the process before performing both tasks simultaneously. After completing the baseline RNG, participants were given the same LDT and activity-based intention instructions that were given in the No DA condition. The only difference between the two divided attention conditions was that the RNG ended simultaneously with the LDT in the DA End condition, whereas in the DA Continue condition the RNG continued for 15 s after the LDT ended. All participants were given 10 s to say "now" upon completion of the LDT in order for the intention to be considered successfully completed. Upon completion of the LDT, a screen appeared that said "Thanks and Goodbye." During this 10 s interval, the experimenter filled out a form regarding participation credit (in the No DA and DA End conditions) or continued writing down numbers on the RNG sheet (in the DA Continue condition) in order to avoid any interaction with the participant.

2.3. Results and discussion

Table 1 contains means for all variables analyzed in the following two experiments (prospective memory performance, LDT word accuracy and response latency, and RNG performance). Of greatest interest for the current study is the proportion of participants who responded "now" after finishing the LDT. A binary logistic regression analysis indicated significant differences in the probability that the intention was completed between conditions, $\chi^2(2,N=120)=6.00$, $p=0.05$. Participants in the No DA condition (M = .70) fulfilled their intention to say "now" more often than participants in the DA Continue condition (M = .43), $\chi^2(1,N=80)=5.97$, $p<0.05$. Despite a fairly large mean difference between the two divided attention conditions, and the No DA and DA End (M = .58) conditions, there were no other statistically significant differences in prospective memory performance, $\chi^2(1,N=80)=1.79$, $p=.18$ and $\chi^2(1,N=80)=1.34$, $p=.25$, respectively. It should be noted that no participants (including those in Experiment 2) said "now" after the 10 second response interval expired or after the end of the 15 second RNG task in the DA Continue condition, suggesting a failure of prospective memory rather than any misinterpretation of instructions.

We also analyzed accuracy and latencies for the LDT word trials. Once again, there was a significant difference in average accuracy and response latencies between conditions, $F(2,117)=18.19$, $p<.05$, $\eta_p^2=.24$ and $F(2,117)=62.26$, $p<.05$, $\eta_p^2=.52$ respectively. Accuracy on the LDT was significantly greater in the No DA condition (M = .96) relative to the DA End condition (M = .93; $t(78)=3.54$, $p<.05$), while performance in the DA Continue condition (M = .89) was worse than the DA End condition, $t(78)=2.93$, $p<.05$. Participants in the No DA condition (M = 646 ms) had faster latencies than the DA Continue condition (M = 1135 ms; $t(78)=10.99$, $p<.05$), whereas there were no differences in latencies between DA End (M = 1193 ms) and DA Continue, $t(78)=.90$ ns. These results indicate that divided attention made the ongoing LDT more difficult leading to reductions in both accuracy and response latency. Furthermore, there were no differences in any of the random number generation statistics calculated for the DA End and DA Continue groups (for both Redundancy and RNG, $t<1$; Towse & Neil, 1998; see Table 1).

In accordance with previous studies exhibiting detrimental effects of divided attention on retrospective and prospective memory performances, the results from Experiment 1 demonstrated that activity-based prospective memory performance was impaired when attention was divided. Generating random numbers in the divided attention conditions usurped participants' processing capacity, leading many participants in these conditions to fail to complete their intention (note that the difference in the DA End condition was large but nonsignificant). Of course, the results from Experiment 1 do not completely demonstrate whether divided attention caused participants to fail to remember their intention or merely prevented them from being able to complete it because the divided attention task was too demanding, even though they may have still remembered the intention. Thus, in Experiment 2 we sought to replicate these findings as well as improve participants' likelihood of fulfilling their intentions even under distracting conditions. To achieve these goals, we replicated the No DA and DA Continue conditions and used an implementation intention encoding strategy (Gollwitzer, 1999). Previous research has demonstrated that implementation intentions can help support event-based prospective memory under demanding conditions (Cohen & Gollwitzer, 2008; McDaniel et al., 2008; but see McDaniel & Scullin, 2010).

Concerning event-based prospective memory, it has been suggested that implementation intentions activate the mental representation of the cue such that once the cue is encountered execution of the intended action occurs immediately and automatically (Gollwitzer, 1999); thus, this automatic process should occur even under situations that are cognitively demanding. An alternative hypothesis is that implementation intentions may increase the importance of fulfilling the intention, which may change the attentional allocation policy at the outset of the experiment (Meeks & Marsh, 2009). If increased attention is devoted to intention fulfillment, ongoing task performance may suffer (e.g. slower response latencies and poor accuracy).

Table 1
Mean (standard error) task performance in Experiments 1 and 2.

	Prospective memory		Lexical decision task		Random number generation			
					Baseline		Dual task	
	Condition	PMP	Accuracy	RT	Redundancy	RNG	Redundancy	RNG
Experiment 1								
	No DA	.70 (.07)	.96 (.01)	646 (14)				
	DA end	.58 (.08)	.93 (.01)	1193 (49)	2.51 (.25)	.23 (.01)	2.73 (.30)	.43 (.01)
	DA continue	.43 (.08)	.89 (.01)	1135 (42)	3.24 (.29)	.24 (.01)	3.08 (.37)	.43 (.01)
Experiment 2								
Standard	No DA	.82 (.06)	.96 (.01)	672 (16)				
	DA continue	.53 (.08)	.91 (.01)	1189 (45)	3.30 (.37)	.25 (.01)	2.98 (.31)	.44 (.01)
Implementation	No DA	.98 (.02)	.96 (.01)	696 (13)				
	DA continue	.91 (.03)	.88 (.02)	1223 (42)	2.94 (.27)	.24 (.01)	3.05 (.30)	.41 (.01)

Prospective memory performance (PMP), lexical decision accuracy and response latency (RT) on word trials, and redundancy and random number generation (RNG) statistics.

However, if implementation intentions truly do make intention completion automatic, we should not expect to see any cost during the ongoing task. Therefore, in addition to examining whether the results from Experiment 1 reflect a failure to remember to execute the intended action, a secondary goal of Experiment 2 was to test whether implementation intentions make the intention relatively automatic or simply increase the importance of the intention during an activity-based prospective memory task.

3. Experiment 2

3.1. Participants

Volunteers were selected from the University of Georgia in exchange for partial credit toward a research requirement. Participants (N = 180) were randomly assigned to one of four conditions (45 in each).

3.2. Materials and procedure

The procedure was a 2 × 2 design, with attention during the LDT (No DA versus DA Continue) and the type of intention (activity-based versus activity-based + implementation intention) varying between conditions. The instructions for the No DA and DA Continue conditions were the same as in Experiment 1. Only participants in the divided-attention groups performed the baseline RNG; after which they read the instructions for the LDT and formed the intention. The intention instructions were identical to Experiment 1. Participants with implementation intention instructions wrote the following sentence down on a piece of paper three times: "Whenever I am finished with the word and nonword judgments, I will say now as fast as possible!" The experimenter reiterated the instructions and intention before beginning the experiment. Upon completion of the LDT participants had 10 s to say "now" for the intention to be considered successfully completed.

3.3. Results and discussion

Replicating Experiment 1, and as can be seen in Table 1, divided attention hindered participants' ability to execute their intention to say "now" at the end of the LDT, $\chi^2(1,N = 180) = 8.62$, $p < 0.05$. Also, participants who formed an implementation intention generally fulfilled their intentions more often than when they did not, $\chi^2(1,N = 180) = 16.63$, $p < 0.05$. Critically, forming an implementation intention to say "now" shielded participants from the deleterious consequences of divided attention, $\chi^2(1,N = 90) = 13.23$, $p < 0.05$. As in Experiment 1, we also investigated performance on the LDT. Divided attention decreased accuracy and slowed performance on the LDT, $F(1,176) = 26.94$, $p < .05$, $\eta_p^2 = .13$ and $F(1,176) = 250.22$, $p < .05$, $\eta_p^2 = .58$, respectively. However, implementation intentions had no influence on accuracy or response latencies, $F(1,176) = .67$ ns and $F(1,176) = .78$ ns, respectively. In addition, implementation intentions and divided attention did not interact to selectively influence accuracy or response latencies $F(1,176) = 1.35$, $p = .25$, $\eta_p^2 = .008$, and $F(1,176) = .023$ ns, respectively. There were no differences in RNG performance when accounting for baseline performance ($t < 1$).

To examine the influence of implementation intentions to ongoing task performance, we separately analyzed accuracy and response latencies under full attention, as well as under divided attention, relative to the standard encoding condition. With full attention, neither accuracy nor response latencies differed between the two encoding conditions $F(1,86) = .102$ ns and $F(1,86) = .016$ ns, respectively. Furthermore, prospective memory performance and encoding instructions did not interact to influence accuracy or response latencies, $F(1,86) = .462$ ns and $F(1,86) = .13$ ns, respectively. Similar null results were found between the two divided attention encoding conditions, finding no differences in accuracy or response latencies, $F(1,86) = .12$ ns and $F(1,86) = .517$ ns, respectively, nor an interaction of prospective memory performance and encoding instructions for accuracy or response latencies, $F(1,86) = .148$ ns and $F(1,86) = .147$ ns. These results suggest that implementation intentions did not cause a change in attentional allocation policy by increasing the importance of fulfilling the intention thereby causing cost to the ongoing activity, but rather support the proposal that implementation intentions made prospective memory responding automatic even under divided attention.

One residual issue from Experiment 1 concerns whether or not the DA End condition truly had reduced performance. Although this issue cannot be directly addressed in Experiment 2, the possibility exists that we did not have enough power in Experiment 1 to detect the effect. The astute reader will keep in mind that each participant can only contribute one response to prospective memory performance thereby creating difficulty in deriving stable estimates of prospective memory performance. Thus, we aggregated the No DA conditions from both Experiments 1 and 2 and compared prospective memory performance (M = .77) in this overall group to the DA End group from Experiment 1 (M = .58). With the addition of these participants from Experiment 2 the difference in prospective memory performance between No DA and DA End conditions is now significant, $\chi^2(1,N = 125) = 4.58$, $p < 0.05$. We also aggregated the DA Continue conditions from Experiments 1 and 2, finding no differences in prospective memory performance in the DA Continue conditions (M = .48) relative to the DA End condition, $\chi^2(1,N = 125) = .93$ ns. Therefore, divided attention seems to interfere with activity-based prospective memory even when it does not continue into the time when the intention should be fulfilled. Although this additional analysis suggests that divided attention more generally hurts prospective memory performance, future research should increase power by using a more sensitive paradigm (e.g. multiple data points) or increase the number of participants in order to better understand the attentional processes that are necessary during the ongoing task for successful (or unsuccessful) self-initiated retrieval processes.

4. General discussion

In the current study, we investigated whether or not attentional processes were necessary for retrieving and completing activity-based prospective memories. The results from both Experiments 1 and 2 demonstrated that divided attention had a profound influence on participants' likelihoods of completing their activity-based intention. Moreover, divided attention during the ongoing task that people plan to make a special response after has a negative effect *both* when it simultaneously ends with the task as well as when it continues after the task. Of the three hypotheses about the effects of divided attention provided earlier (interruptions, context linking, and self-initiated retrieval), the results favor the self-initiated retrieval account. In this account, activity-based prospective memory is dependent on self-initiated processing and divided attention interferes with an individual's ability to successfully fulfill their intention even after completing a task. A secondary purpose of the current study was to discover whether encoding strategies such as implementation intentions could be applied to activity-based intentions and whether or not they would shield against divided attention. Based on the results reported herein, the answer is affirmative in both cases. Implementation intentions are successful in improving activity-based prospective memory, and they help protect against the distracting effects of divided attention when it continues into the period where the intention should be fulfilled.

Activity-based intentions are an important and understudied area in the prospective memory literature. The current study highlights two important similarities between activity-based prospective memory and other forms of intentions (e.g., event- and time-based). Distraction during the ongoing activity that people plan to respond after, as well as distraction during the period when people have the opportunity to fulfill their intention reduced performance. This is an interesting finding because it indicates that divided attention *during* a task which people have associated their activity-based intention to has consequences for appropriately responding after that task ends. Notably, we refer to divided attention generally in the current work whereas it is not clear whether these effects are domain general or domain specific. Future research should examine how divided attention that is either domain general or domain specific influences activity-based prospective memory. Regardless, perhaps participants in the current study revisited their intention to say “now” while making lexical decisions and divided attention reduced the number of times this happened. However, implementation intentions equated performance between full- and divided-attention conditions suggesting that an account of the results based solely on minimizing refreshing of the intention during the performance interval cannot fully explain the effects of distraction.

There have been several propositions for how implementation intentions operate to improve prospective memory performance. Previous research examining event-based prospective memory has shown that implementation intention instructions cause slowing to the ongoing task relative to standard encoding instructions (Meeks & Marsh, 2009). Meeks and Marsh suggested that implementation intentions changed participants' attentional allocation policy at the outset of the experiment by placing more weight to intention fulfillment, thus less resources were available to complete the ongoing task. An alternative theoretical account of implementation intentions suggests that they automatize the cognitive processes that support prospective memory (Gollwitzer, 1999). Obviously, this line of theorizing is supported by the current results but recent experimental work has demonstrated that implementation intentions do not necessarily routinize all types of intentions (McDaniel & Scullin, 2010). In addition, to the degree to which the intended action is associated with the end of the ongoing task, participants might not have placed any weight to the LDT in either encoding conditions since theoretically attention to the ongoing task is not necessary for successful fulfillment of the intention (in contrast to event-based prospective memory in which attention is necessary to detect cues that are imbedded within ongoing task). Therefore, examining cost may not be sufficient to detect differences in an attentional allocation policy in the current set of experiments. Therefore, it is an open question whether implementation intentions can truly make realizing and executing an activity-based prospective memory automatic although the current results do support this view. Another way that implementation intentions improve prospective memory is by providing a more standardized encoding experience that specifies clearly the environmental circumstances related to fulfilling intentions (McDaniel et al., 2008). In the current work this account also predicts that prospective memory performance should get better under divided-attention conditions. These theoretical positions are typically evaluated in event-based prospective memory paradigms, whereas the current research suggests that these theories also account for the effects of implementation intentions on activity-based prospective remembering.

The foregoing results and comments raise another interesting question about activity-based intentions and that is, “Is activity-based prospective memory merely the same thing as event-based prospective memory?” We have argued in previous work that event-, time-, and activity-based prospective memories differ with regard to the characteristics that people use to encode and retrieve their intentions (Brewer et al., in press). In our view, all types of intentions rely on the same memory and attention system but what differs is the nature of the cues that are feeding into that system. Essentially, what differs between these intentions is exactly how people associate their intentions to future circumstances. More specifically, any intention will be composed of multiple features including expectations of upcoming perceptual cues, temporal cues, and action and coordination cues that all serve to activate the intention. Typically, in laboratory investigations researchers have attempted to constrain prospective memory performance to be dependent on only one of these specific cues (e.g., make a special response whenever a specific word occurs in a lexical decision task). However, in more ecologically valid settings we propose that people actually rely on multiple perceptual and conceptual (event-based), temporal (time-based), and planning and coordination (activity-based) cues. Returning to the magnet example provided at the outset, perhaps multiple pieces of contextual information signal that it is appropriate to execute your intention to make the delivery (i.e., you leave work after your meeting around 4:00 and notice the magnets in the passenger's seat). Clearly, future research should investigate whether encoding and retrieval strategies that rely on combining prospective memory cues (e.g., perceptual + temporal) can improve prospective memory under divided attention in a way similar to implementation intentions.

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