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10 Take the Field! Investigating prospective memory in naturalistic and real-life settings

Jan Rummel & Lia Kvavilashvili

One crucially important milestone in research on prospective memory (PM) was the development of a standard laboratory paradigm by Einstein and McDaniel (1990). Participants of this paradigm get actively engaged in some ongoing task which they perceive as their primary activity. In addition, they have to remember to respond to an infrequently occurring target event or time (e.g., a certain word occurring in the ongoing task or a particular time-point) by carrying out a simple action. As noted repeatedly throughout this volume, the Einstein-McDaniel paradigm, or its variants, have been used extensively for studying PM processes (e.g., Shelton, Scullin, & Hacker, this volume; Smith & Skinner, this volume; Strickland, Loft, & Heathcote, this volume) and applied issues (Loft, Dismukes, & Grundgeiger, this volume). Due to the importance of this paradigm to the field, some researchers have even referred to it as PM researchers' *drosophila*. Just like the drosophila model of human genetics, the laboratory PM paradigm has several obvious advantages. It enables researchers to study PM efficiently and with limited resources, as laboratory PM tasks are usually completed in less than an hour while providing multiple observations on PM responses, which increases the reliability of PM measures (Kelemen, Weinberg, Alford, Mulvey, & Kaeochinda, 2006). In addition, it allows for studying a wide range of factors meaningful to PM, as they can be easily manipulated (e.g., the nature of target events, ongoing-task complexity, etc.). Most importantly, the laboratory paradigm provides an excellent model for studying PM, as it reproduces the most critical features of real-life PM tasks (e.g., delayed intention execution, self-initiated retrieval requirements, etc.; cf. Rummel & McDaniel, this volume). However, just like insights from drosophila models of human genetics need to be re-connected to the human organism to evaluate their impact (Jackson, 2008), psychological insight about PM functioning gained in the laboratory, should be reconnected to real-life environments to test the generalizability of laboratory findings of PM.

There is very little research addressing this important question, but some positive findings do exist. For example, a J-shaped pattern of time monitoring, and superior performance in event-based than time-based tasks, often reported in the laboratory, has also been observed outside the laboratory (Kvavilashvili & Fisher, 2007; Niedzwienska & Barzykowski, 2012; Sellen, Louie, Harris, & Wilkins, 1997). In contrast, Unsworth, Brewer, and Spillers (2012) found that participants' scores on two laboratory event-based tasks did not correlate with the number of PM failures recorded by the same participants in a 1-week diary. Moreover, research on the age-PM paradox (Rendell & Thomson, 1999, see also Ballhausen, Hering, Rendell, & Kliegel, this volume) has shown that the negative effects of age on PM, typically obtained in laboratory PM tasks, can reverse in naturalistic PM tasks. These and similar findings emphasize the necessity of studying PM with both laboratory and naturalistic tasks.

In relation to this point, we consider the following issues of particular importance. First, it is necessary to keep in mind that laboratory situations are abstractions of real-life situations and that not all phenomena observed in the laboratory will map onto real-life phenomena in a one-to-one fashion. For example, laboratory research has made a clear distinction between time-based and event-based PM, which might be less straight-forward outside the laboratory. Indeed, in two naturalistic studies on self-assigned intentions, there was a clear dominance of time-based PM tasks and a remarkable absence of event-based tasks (Holbrook & Dismukes, 2009; Schnitzshpaan, Altgassen & Kvavilashvili, in press). Second, naturalistic tasks, just like laboratory tasks, should provide reliable and valid measures of the variables of interest. Third, as real-life investigations do not allow for the same degree of experimental control as experimental settings and often rely on less objective measures, researchers should be aware of potential biases associated with real-life investigations and learn how to minimize them. If these points are

considered, the way from the laboratory to real life is not a one-way street. That is, real-life studies will not only serve to re-connect laboratory findings to the real world, but they can also play an important role by suggesting novel hypotheses, which are then to be tested in controlled experimental settings (Mortenson & Cialdini, 2010).

In this chapter, we will first review previous research that used more or less naturalistic tasks for studying PM and discuss the extent to which they are suitable for re-connecting laboratory PM findings to real-life PM. We will then make the case that real-life studies on other types of future-oriented cognition (especially mind-wandering and involuntary future thinking) have identified certain processes that are relevant for PM and should thus be considered by PM researchers. We will briefly review some of the findings and methods from these research areas that seem most relevant for a naturalistic approach to PM. Finally, we will discuss pitfalls and promises of naturalistic PM studies.

Studying prospective memory in naturalistic and real-life settings

In the absence of a well-established laboratory paradigm, early studies of PM used a variety of naturalistic tasks in and outside the laboratory (see Kvavilashvili, 1992, for a methodological review). The majority of studies conducted outside the laboratory involved asking participants to carry out simple actions on multiple occasions. For example, Meacham and colleagues introduced a simple task of posting a blank postcard (stamped and addressed to the researcher) on pre-specified dates, a method that allowed them to investigate the role of external reminders (Meacham & Leiman, 1982) and incentives (Meacham & Singer, 1977) for remembering time-based PM tasks over long delays. Another task (Wilkins & Baddeley, 1978) involved asking participants to carry a small clock devise for a week and push a button at pre-specified times several times a day. Moscovitch and Minde (described in Moscovitch, 1982)

introduced a task in which participants had to call the researcher at a pre-specified time of the day and leave a message on the answer phone several times over a particular time period (see also Maylor, 1990).

While these studies were relatively easy to carry out and enabled researchers to obtain PM performance scores based on multiple observations, they lacked control over participants' daily activities and use of external memory aids (calendars or reminders). In addition, although the tasks were executed in real-life environments (e.g., at home, post office, grocery store), the intentions themselves were not entirely natural (e.g., sending blank postcards is not something we do in everyday life) and participants knew that their PM was under the scrutiny (*cf.* Kvavilashvili, 1992). However, some studies managed to investigate naturalistic PM without participants knowing that their performance was assessed. For example, Dobbs and Rule (1987) gave participants a questionnaire to complete at home and post it back. Participants were told that it was important for the researchers to know when exactly they completed the questionnaire and, therefore, participants had to remember to indicate the completion time on the front page of the questionnaire. This PM task is more subtle than sending back postcards or making phone calls and it also minimizes the chances of using reminders (see also Bailey, Henry, Rendell, Phillips, & Kliegel, 2010; Kvavilashvili, Cockburn, & Kornbrot, 2013). Similarly, in a study by Somerville, Wellman, and Cultice (1983), caregivers (mostly mothers) asked toddlers to remind them of certain intentions at specific moments. Results showed that even 2-year olds remembered the intentions when they were of personal relevance to them (e.g., reminding to buy candy when being at the store). Here, the PM tasks were part of caregiver's meaningful everyday requests with the added bonus of caregivers being able to monitor children's behavior in the delay interval.

Ellis (1988) pioneered yet another naturalistic method, which involved asking participants to list the activities they had themselves planned for the upcoming day and in the evening, indicate which of these intended activities they had actually executed over a period of several days. Participants also kept a diary during the day to record any instances of spontaneous thoughts or recollections of their intentions specified in the morning (see also Marsh, Hicks, & Landau, 1998). In this approach, the intentions are naturalistic, but at the cost of giving up experimental control over the nature of the intentions rendering them less comparable across participants. Additionally, the central outcome (intention-execution rate) relies on retrospectively provided self-reports and is thus prone to retrospective biases.

Despite the prevalence of naturalistic studies outside the laboratory, several early researchers of PM opted for studying PM in the laboratory. In these studies, participants had to carry out an additional PM task while completing other experimental tasks during the laboratory session. A variety of simple PM tasks were used. For example, participants in Loftus' (1971) experiment had to remember to tell the researcher the state they were born after completing a survey. In a study by Meacham and Dumitru (1976), children had to remember to post a drawing into a box on the way to classroom. In other studies, participants had to remind the experimenter to carry out a particular activity, which was presented as a personal request rather than the study requirement (e.g., Kvavilashvili, 1987). Until today, many of tests for functional PM impairments used in clinical settings rely on such naturalistic laboratory tasks (e.g., Radford, Lah, Say, & Miller, 2011; Raskin, 2009; Wilson et al., 2005). Although some studies asked participants to carry out several requests during the experimental session (e.g., West, 1988), most of these studies involved assessing PM on single occasions thereby increasing the demands on sample sizes.

Over the past 20 years several new naturalistic methods have been developed. Most prominently, these involve virtual simulations of real-life PM tasks in the laboratory and participants' everyday life. For example, Rendell and Craik (2000) developed a virtual week board game to impose time- and event-based PM tasks (e.g., call the plumber), embedded in simulated daily activities, such as having breakfast, meeting a friend, or watching a TV program. Rendell and Craik (2000) also developed an actual week simulation in which participants have to report remembering a set of experimenter-assigned time- and event-based intentions during a regular week in their everyday life. This *actual week task* has been shown to have good psychometric properties (Au, Vandermorris, Rendell, Craik, & Troyer, 2018). Other studies have used virtual simulations of PM in participants' work environment (see Loft et al., this volume) or specially designed laboratory environments resembling everyday environments/tasks/situations, such as a laboratory kitchen (Altgassen et al., 2015) or a laboratory apartment (Schmitter-Edgecombe, McAlister, & Weakley, 2012). With progress in technology, some recent naturalistic PM tasks even make use of virtual reality environments. For instance, Trawley, Stephens, Rendell, and Groeger (2017) asked participants to remember running an errand when arriving at the gas station in a driving simulator.

Notably, the degree to which these "naturalistic" PM tasks overlap with real-life PM requirements varies considerably across studies. We therefore believe that PM tasks are not either naturalistic or not, but that there are different degrees of naturalness (Kvavilashvili & Ellis, 2004). We further argue that both the PM task's and the ongoing task's closeness to real life should be taken into account when judging the naturalness of a PM setting. Regarding the PM task, one could broadly differentiate between the requirement of merely enacting a simple and arbitrary action (writing one's initals on an envelop one will receive later; Huppert, Johnson, &

Nickson, 2000), executing an experimenter-induced action resembling a real-life PM task (e.g., making a phone call in a couple of days; Maylor, 1990), or executing an action that originated in participants' natural future planning (Marsh et al., 1998). Regarding the ongoing-task context, the PM action may have to be executed while performing some laboratory task, which might correspond more or less strongly with real-life activities, while performing an experimenter-imposed daily task, either in an experimenter-provided setting or in a natural environment, or a daily task one would naturally engage anyway during the test period. Of course, different levels of naturalness may be desirable for answering different types of research questions. However, the "litmus test" for laboratory findings' generalizability are certainly PM actions that are as naturalistic as possible and are to be executed in real-life environments.

PM studies using a fully naturalistic approach are still rare, but we believe that this is a particularly promising area for future research. On the one hand, psychology research does not aim to understand laboratory models of cognitive functions per se, but rather the human cognitive abilities as reflected in a particular paradigm (Meiser, 2011), and therefore, generalizability of laboratory findings should speak to their (external) validity. On the other hand, naturalistic approaches may allow to investigate certain aspects of PM that are not easily accessible in the laboratory. Most obviously, real-life PM approaches allow to investigate how PM intentions are maintained over longer retention intervals (i.e., over several days rather than just several minutes), which appears to be a question of critical importance. In this regard, other areas that are interested in understanding future-oriented cognition, namely research on spontaneous future thoughts and future-oriented mind wandering, can provide good starting point for identifying and investigating these PM processes (Kvavilashvili & Rummel, in preparation).

Can prospection research inform the understanding of prospective memory?

There are several related but rather independent research areas interested in future-oriented cognition or prospection. Szpunar, Spreng, and Schacter (2014) broadly differentiate between four basic types of prospection which include *(1) simulation*: constructing a mental representation of future or possible future states and events, *(2) prediction*: estimating the likelihood of a certain future state or event, *(3) intention:* setting a goal for the future, and *(4) planning:* identifying and organizing steps for achieving a future goal. At first glance, one may be tempted to subsume PM under *(3)* in this taxonomy but, as Szpunar et al. point out, this would reduce the scope of PM to just one of its components. As evident throughout this book and particularly from the phase model of PM (*cf.* Rummel & McDaniel, this volume), PM is not limited to goal setting (or intention formation), but also includes goal/intention maintenance and, most importantly, self-initiated goal/intention retrieval.

Although Szpunar et al.'s (2014) taxonomy does not fully cover all cognitive processes contributing to PM, their central argument that different types of future-oriented cognition interact with each other, highlights the need of more integrative views on prospection. In the case of PM research, several phenomena involving prospection have been shown to influence intention encoding. For example, mental future simulation of intention execution (Altgassen, Kretschmer, & Schnitzspahn, 2017; Brewer & Marsh, 2010) and making predictions about future PM performance (Meier, von Wartburg, Matter, Rothen, & Reber, 2011; Rummel, Kuhlmann, & Touron, 2013) during intention encoding have been shown to improve PM performance. Additionally, when intentions become more complex, PM execution has been shown to profit from detailed prior planning (Kliegel, Martin, McDaniel, Einstein, & Moor, 2007). Other prospection-related phenomena that seem to be particularly relevant for maintaining intentions

over retention intervals and retrieving them later at the appropriate moment have been referred to as spontaneous future thoughts and future-oriented mind wandering.

Emerging research on spontaneous future cognition is concerned with involuntary thoughts about the future that people frequently experience in their daily life (see Berntsen, in press; Cole & Kvavilashvili, in press). In the initial research on this topic, it has been customary to compare these thoughts with the experience of involuntary autobiographical memories (i.e., memories of past events that come to mind without deliberate intention to recall them; Berntsen & Jacobsen, 2008). Researchers in this area usually use various diary methods to investigate why some (future) thoughts occur involuntarily (e.g., whether they were triggered by a particular cue), how frequently they pop into mind and what are their phenomenological characteristics (but see Cole, Staugaard, & Berntsen, 2016 who used a laboratory method).

Mind wandering, on the other hand, describes the ubiquitous phenomenon of one's thoughts drifting away from the here-and-now (e.g., from a currently ongoing activity) towards inner thoughts or feelings (Smallwood & Schooler, 2015). Most mind wandering episodes seem to occur involuntarily (Seli, Risko, Smilek, & Schacter, 2016) and thus spontaneous future thoughts and future-oriented mind wandering are related phenomena, inasmuch as they are both concerned with spontaneous cognition (a theme also of particular relevance for PM; Shelton et al, this volume). Mind wandering is sometimes assessed by self-caught method (i.e., by asking participants to indicate, when they realize that their thoughts trailed off). However, self-caught assessment requires participants to be aware of their wandering mind and they are often not (Smallwood & Schooler, 2015). For this reason, mind wandering is more frequently assessed by probe-caught method, by asking participants from time to time to report on their momentary thoughts and experiences while performing a concurrent task (usually vigilance or go/no-go

tasks). Although mind-wandering research strongly relies on self-report data, this momentary experience-sampling method has been proven to be valid and to minimize risks of retrospective biases (Schooler & Schreiber, 2004).

Several laboratory studies, using this method, have shown that mind-wandering episodes are often future-oriented, a finding that has been referred to as the prospective bias in mind-wandering (Stawarczyk, Majerus, Maj, Van der Linden, & D'Argembeau, 2011). Another interesting finding is that the majority of such future-oriented spontaneous thoughts (60%), obtained in a sample of young non-dysphoric participants, referred to upcoming PM tasks and plans (e.g., *need to start a diet after my revision period*; *must buy a new duvet cover set*) rather than future events without PM component or wishful/hypothetical thinking (Plimpton, Patel, & Kvavilashvili, 2015).

Importantly, broadly similar results have been obtained in experience-sampling studies outside the laboratory, where participants carried special devices or special smartphone applications that were set to probe participants' thoughts while they performed their daily activities. For example, using this method, Song and Wang (2012) demonstrated the prospective bias in mind wandering in a sample of Chinese participants who were probed 6 times per day over a 3-day period. Warden, Plimpton, and Kvavilashvili (2018) used 30 probes over a 10-hour period in one day (Study 2) and found that both young and old participants reported significantly higher number of task-unrelated future thoughts about upcoming PM tasks than future events without a PM component or hypothetical scenarios.

Taken together, these insights from research on prospection have interesting implications for PM research. They suggest that the prospective bias in mind-wandering may at least partly be explained by participants' spontaneous thoughts about PM tasks that have to be carried out later

on the same day or in the near future (next few days, next week, etc.). An important research question, raised in the literature on mind-wandering, concerns the functional significance of such prospective thoughts and whether they actually help people to carry out their planned actions (Stawarczyk, 2018). Initial findings in relation to this question have emerged predominantly from research on PM. For example, a few studies that implemented the probe-caught method in laboratory PM paradigms, found that periodically thinking about a pending intention while performing other tasks was beneficial for event-based and time-based intention execution (Rummel, Smeekens, & Kane, 2017; Seli, Smilek, Ralph, & Schacter, 2018). Moreover, such intention-related thoughts occurred even after the PM task had been canceled or finished (Anderson & Einstein, 2017).

Experience-sampling and diary methods will be particularly useful for investigating spontaneous PM-related thoughts over long retention intervals outside the laboratory to address the question about whether prospective bias in mind wandering helps people to accomplish their daily plans and intentions. One early study on this topic was conducted by Kvavilashvili and Fisher (2007). Their participants formed the intention to call the experimenter (either at a certain time or when receiving a specific text message). During a one-week intention retention interval, they had to record every instance when they happened to think about this PM task and to indicate whether these thoughts were triggered by stimuli in the environment, by their own thoughts, or whether there was no trigger. Results showed, among others, that time-based PM-related thoughts seemed to occur with no apparent triggers more often than event-based PM-related thoughts. Most importantly, the number of such thoughts in young participants was positively correlated with remembering to make a phone call within 10 minutes of the target time (Study 2 and 3), but this correlation was not significant in older adults (Study 2).

More recently, Mason and Reinholtz (2015) asked participants to send text messages or emails to the experimenter at certain times and had them meanwhile count their intention-related thoughts using a special smartphone application. They found that more frequent PM-related thoughts were associated with a higher likelihood of executing an intention. Szarras and Niedzwienska (2011) used an even more naturalistic approach asking participants to list ten intentions they wanted to execute within the next ten days and to collect PM-related thoughts that occurred to them in the meantime in a diary. They found that those intentions that were actually executed were more frequently mentioned in the diaries than those that were not executed.

Notably, in all these studies, PM-related thoughts were assessed via self-caught method and, thus, only thoughts that participants were meta-cognitively aware of, could be considered. In contrast, in two studies, Anderson and McDaniel (2018), who probed their participants six times over a 5-day period, found that participants reported thinking about their intentions in 12-17% of thought probes, and about future in general (i.e., without PM component) in 13-18% of thought probes. Importantly, about 60% of these PM-related thoughts were reported to have been deliberately (self-) generated rather than coming to mind spontaneously (*cf*. Warden et al., 2018). Another study that compared the frequency of intention related thoughts in young and older adults, using an average of 220 prompts per participant over a 3-week period, found that younger and older adults reported intention-related thought in 10% and 21% of thought probes, respectively (Gardner & Ascoli, 2015). The studies just reviewed show how experience-sampling methods and diary-like momentary thought assessment can be used to study real-life PM and particularly spontaneous PM-related thoughts. However, although these methods are very promising. there are also some limitations that should be taken into account.

Potential pitfalls associated with real-life prospective memory investigations

In comparison to hundreds of laboratory studies on PM, the amount of research on naturalistic PM is relatively modest (about 75 published articles at the point this chapter was written according to searches on the Web-of-Science with the keywords "prospective memory" and "naturalistic" or "real-life," respectively). The reader may wonder why there is less published studies on real-life PM and we can only speculate upon the reasons. To begin with, employing experience-sampling and momentary thought assessment methods in real-life only recently have become a more standard method for psychology researchers (Trull & Ebner-Priemer, 2014). One important step in the development of these so called ambulatory assessment techniques was certainly that smartphones became more and more common and therefore ambulatory assessments do not need to rely on participants carrying around special devices any more (Trull & Ebner-Priemer, 2014). A more mundane, but certainly important point may also be that real-life investigations tend to be more costly. That is, they regularly require higher monetary investments (e.g., to compensate participants for the often quite high time investment and the inconveniences associated with ambulatory assessment) as well as time investments (e.g., by the researcher to repeatedly interact with participants). However, on the positive side, recent findings from diary and experience-sampling studies by Laughland and Kvavilashvili (2018) and Warden et al. (2018) suggest that shorter periods of recording may be desirable as they produce more participant engagement and higher rates of recording compared to more standard one week long or longer recording periods.

Finally, naturalistic studies do not allow for strict experimental control (Kvavilashvili, 1992). Thus, these methods seem less suitable to study cognitive processes via effective manipulation of different independent variables. Additionally, in the case of PM, these methods

are particularly bias prone as participants could easily "cheat" in real-life PM studies by using external reminders or other memory aids to better remember their intentions. Indeed, it is not possible to observe participants' behavior in naturalistic tasks that require several days or even weeks to complete. Even when participants do not cheat, researchers still have to rely on bias-prone self-reports. An easy solution to several of these problems may be to use more controlled (semi-) naturalistic approaches, like naturalistic laboratories or virtual environments. However, the problem with these approaches is that PM requirements still differ considerably from those in real-life environments while experimental control is still reduced as compared to laboratory settings. That is why we argue that fully naturalistic PM studies are nevertheless needed. Our recommendation would be to fight these pitfalls by using online rather than retrospective assessments, trying to minimize reactivity and various biases as well as to maximize participants compliance, and considering to not only collect self-reports, but also objective data (e.g., on intention execution) when possible. A detailed review of these methods would be beyond the scope of this chapter, but we recommend the *Handbook of Research Methods for Studying Daily Life* (Mehl & Conner, 2011), for this purpose. Some advice on studying spontaneous future thoughts using paper and smartphone diaries can be found in Laughland and Kvavilashvili (2018).

Conclusions and outlook

A brief review of research methods used to study PM since its inception in 1970s, appears to suggest that PM research may have come a full circle. It started off by using naturalistic PM tasks in and outside the laboratory until the introduction of a standard laboratory paradigm in 1990, which greatly accelerated and transformed the research on PM. However, with the increased popularity of ambulatory assessments of cognitive processes in everyday life over

the past decade, PM researchers have started using these methods and naturalistic PM tasks to address a variety of research questions. Despite all the pitfalls of real-life PM investigations, listed in the previous section, it seems that researchers are prepared going the extra mile to investigate when and how the effects and mechanisms observed with the laboratory paradigm of PM transfer to real-life PM. Most importantly, we hope that, in the near future, naturalistic methods can be used for the investigation of PM processes that are particularly difficult to isolate in the laboratory, such as the marked absence of event-based PM tasks when participants are asked to list their own real life intentions (Schitzspahn et al, in press), the mechanisms behind the age-PM paradox (Rendell & Craik, 2000), and spontaneous self-reminding of intentions in everyday life (Anderson & McDaniel, 2018; Warden et al., 2018).

References

Altgassen, M., Kretschmer, A., & Schnitzspahn, K. M. (2017). Future thinking instructions improve prospective memory performance in adolescents. *Child Neuropsychology, 23*, 536-553.

Altgassen, M., Rendell, P. G., Bernhard, A., Henry, J. D., Bailey, P. E., Phillips, L. H., & Kliegel, M. (2015). Future thinking improves prospective memory performance and plan enactment in older adults. *Quarterly Journal of Experimental Psychology, 68*, 192-204.

Anderson, F. T., & Einstein, G. O. (2017). The fate of completed intentions. *Memory*, *25*, 467-480.

Anderson, F. T., & McDaniel, M. A. (2018). Hey buddy, why don't we take it outside: An experience sampling study of prospective memory. *Memory and Cognition*.

Bailey, P. E., Henry, J. D., Rendell, P. G., Phillips, L. H., & Kliegel, M. (2010). Dismantling the "age-prospective memory paradox": The classic laboratory paradigm simulated in a naturalistic setting. *The Quarterly Journal of Experimental Psychology, 63*, 646-652.

Berntsen, D., & Jacobsen, A. S. (2008). Involuntary (spontaneous) mental time travel into the past and future. *Consciousness and Cognition, 17*, 1093-1104.

Brewer, G. A., & Marsh, R. L. (2010). On the role of episodic future simulation in encoding of prospective memories. *Cognitive Neuroscience, 1*, 81-88.

Cole, S. N., Staugaard, S. R., & Berntsen, D. (2016). Inducing involuntary and voluntary mental time travel using a laboratory paradigm. *Mem Cognit, 44*, 376-389.

Dobbs, A. R., & Rule, B. G. (1987). Prospective memory and self-reports of memory abilities in older adults. *Canadian Journal of Psychology-Revue Canadienne De Psychologie, 41*, 209-222.

Einstein, G. O., & McDaniel, M. A. (1990). Normal aging and prospective memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 16*, 717-726.

Ellis, J. A. (1988). Memory for future intentions: Investigating pulses and steps. In M. M. Gruneberg, P. E. Morris & R. N. Sykes (Eds.), *Practical aspects of memory: Current research and issues* (pp. 371-376). Chichester: John Wiley & Sons.

Gardner, R. S., & Ascoli, G. A. (2015). The natural frequency of human prospective memory increases with age. *Psychology & Aging, 30*, 209-219.

Holbrook, J., & Dismukes, K. (2009). Prospective memory in everyday tasks. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 53*, 590-594.

Huppert, F. A., Johnson, T., & Nickson, J. (2000). High prevalence of prospective memory impairment in the elderly and in early-stage dementia: Findings from a population-based study. *Applied Cognitive Psychology, 14*, S63-S81.

Jackson, G. R. (2008). Guide to understanding drosophila models of neurodegenerative diseases. *Plos Biology, 6*, 236-239.

Kelemen, W. L., Weinberg, W. B., Alford, H. S., Mulvey, E. K., & Kaeochinda, K. F. (2006). Improving the reliability of event-based laboratory tests of prospective memory. *Psychonomic Bulletin & Review, 13*, 1028-1032.

Kliegel, M., Martin, M., McDaniel, M. A., Einstein, G. O., & Moor, C. (2007). Realizing complex delayed intentions in young and old adults: The role of planning aids. *Memory and Cognition, 35*, 1735-1746.

Kvavilashvili, L. (1987). Remembering intention as a distinct form of memory. *British Journal of Psychology, 78*, 507-518.

Kvavilashvili, L. (1992). Remembering intentions: A critical review of existing experimental paradigms. *Applied Cognitive Psychology, 6*, 507-524.

Kvavilashvili, L., Cockburn, J., & Kornbrot, D. E. (2013). Prospective memory and ageing paradox with event-based tasks: A study of young, young-old, and old-old participants. *Quarterly Journal of Experimental Psychology, 66*, 864-875.

Kvavilashvili, L., & Ellis, J. (2004). Ecological validity and twenty years of real-life/laboratory controversy in memory research: A critical (and historical) review. *History and Philosophy of Psychology, 6*, 59-80.

Kvavilashvili, L., & Fisher, L. (2007). Is time-based prospective remembering mediated by self-initiated rehearsals? Role of incidental cues, ongoing activity, age, and motivation. *Journal of Experimental Psychology: General, 136*, 112-132.

Kvavilashvili, L., & Rummel, J. (submitted?). The nature of prospection in everyday life: At the intersection of prospective memory, mind-wandering and future thinking.

Laughland, A., & Kvavilashvili, L. (2018). Should participants be left to their own devices? Comparing paper and smartphone diaries in psychological research. *Journal of Applied Research in Memory and Cognition*, Advanced online publication.

Loftus, E. F. (1971). Memory for intentions: The effect of presence of a cue and interpolated activity. *Psychonomic Science, 23*, 315-316.

Marsh, R. L., Hicks, J. L., & Landau, J. D. (1998). An investigation of everyday prospective memory. *Memory & Cognition, 26*, 633-643.

Mason, M. F., & Reinholtz, N. (2015). Avenues down which a self-reminding mind can wander. *Motivation Science, 1*, 1-21.

Maylor, E. A. (1990). Age and prospective memory. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology 42*, 471-493.

Meacham, J. A., & Dumitru, J. (1976). Prospective remembering and external retrieval cues *Catalog of Selected Documents in Psychology* (Vol. 6, pp. 1284).
Meacham, J. A., & Leiman, B. (1982). Remembering to perform future actions. In U. Neisser (Ed.), *Memory observed: Remembering in natural contexts* (pp. 327-336). San Francisco: Freeman.
Meacham, J. A., & Singer, J. (1977). Incentive effects in prospective remembering. *Journal of Psychology, 97*, 191-197.
Mehl, M. R., & Conner, T. S. (2011). *Handbook of research methods for studying daily life*. New York: Guilford Press.
Meier, B., von Wartburg, P., Matter, S., Rothen, N., & Reber, R. (2011). Performance predictions improve prospective memory and influence retrieval experience. *Canadian Journal of Experimental Psychology, 65*, 12-18.
Meiser, T. (2011). Much pain, little gain? Paradigm-specific models and methods in experimental psychology. *Perspectives on Psychological Science, 6*, 183-191.
Mortenson, C. R., & Cialdini, R. B. (2010). Full-cycle social psychology for theory and application. *Social and Personality Psychology Compass, 4*, 53-63.
Moscovitch, M. (1982). A neuropsychological approach to memory and perception in normal and pathological aging. In F. I. M. Craik & S. Trehub (Eds.), *Aging and cognitive processes* (pp. 55-78). New York: Plenum Press.
Niedzwienska, A., & Barzykowski, K. (2012). The age prospective memory paradox within the same sample in time-based and event-based tasks. *Aging, Neuropsychology, and Cognition, 19*, 58-83.
Plimpton, B., Patel, P., & Kvavilashvili, L. (2015). Role of triggers and dysphoria in mind-wandering about past, present and future: A laboratory study. *Consciousness and Cognition, 33*, 261-276.
Radford, K. A., Lah, S., Say, M. J., & Miller, L. A. (2011). Validation of a new measure of prospective memory: The royal prince alfred prospective memory test. *Clinical Neuropsychologist, 25*, 127-140.
Raskin, S. A. (2009). Memory for intentions screening test: Psychometric properties and clinical evidence. *Brain Impairment, 10*, 23-33.
Rendell, P. G., & Craik, F. I. M. (2000). Virtual week and actual week: Age-related differences in prospective memory. *Applied Cognitive Psychology, 14*, 43-62.
Rendell, P. G., & Thomson, D. M. (1999). Aging and prospective memory: Differences between naturalistic and laboratory tasks. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences, 54*, P256-P269.
Rummel, J., Kuhlmann, B. G., & Touron, D. R. (2013). Performance predictions affect attentional processes of event-based prospective memory. *Consciousness & Cognition, 22*, 729-741.
Rummel, J., Smeekens, B. A., & Kane, M. J. (2017). Dealing with prospective memory demands while performing an ongoing task: Shared processing, increased on-task focus, or both? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 43*, 1047-1062.
Schmitter-Edgecombe, M., McAlister, C., & Weakley, A. (2012). Naturalistic assessment of everyday functioning in individuals with mild cognitive impairment: The day-out task. *Neuropsychology, 26*, 631-641.
Schooler, J. W., & Schreiber, C. A. (2004). Experience, meta-consciousness, and the paradox of introspection. *Journal of Consciousness Studies, 11*, 17-39.

Seli, P., Risko, E. F., Smilek, D., & Schacter, D. L. (2016). Mind-wandering with and without intention. *Trends in Cognitive Sciences, 20*, 605-617.
Seli, P., Smilek, D., Ralph, B. C. W., & Schacter, D. L. (2018). The awakening of the attention: Evidence for a link between the monitoring of mind wandering and prospective goals. *Journal of Experimental Psychology: General, 147*, 431-443.
Sellen, A. J., Louie, G., Harris, J. E., & Wilkins, A. J. (1997). What brings intentions to mind? An in situ study of prospective memory. *Memory, 5*, 483-507.
Smallwood, J., & Schooler, J. W. (2015). The science of mind wandering: Empirically navigating the stream of consciousness. *Annual Review of Psychology, 66*, 487-518.
Somerville, S. C., Wellman, H. M., & Cultice, J. C. (1983). Young childrens deliberate reminding. *Journal of Genetic Psychology, 143*, 87-96.
Song, X., & Wang, X. (2012). Mind wandering in chinese daily lives--an experience sampling study. *PLoS One, 7*, e44423.
Stawarczyk, D. (2018). Phenomenological properties of mind-wandering and daydreaming: A historical overview and functional correlates. In K. Christoff & K. C. R. Fox (Eds.). New York: Oxford University Press.
Stawarczyk, D., Majerus, S., Maj, M., Van der Linden, M., & D'Argembeau, A. (2011). Mind-wandering: Phenomenology and function as assessed with a novel experience sampling method. *Acta Psychologica, 136*, 370-381.
Szarras, K., & Niedzwienska, A. (2011). The role of rehearsals in self-generated prospective memory tasks. *International Journal of Psychology, 46*, 346-353.
Szpunar, K. K., Spreng, R. N., & Schacter, D. L. (2014). A taxonomy of prospection: Introducing an organizational framework for future-oriented cognition. *Proceedings of National Academy of Sciences, 111*, 18414-18421.
Trawley, S. L., Stephens, A. N., Rendell, P. G., & Groeger, J. A. (2017). Prospective memory while driving: Comparison of time- and event-based intentions. *Ergonomics, 60*, 780-790.
Trull, T. J., & Ebner-Priemer, U. (2014). The role of ambulatory assessment in psychological science. *Current Directions in Psychological Science, 23*, 466-470.
Unsworth, N., Brewer, G. A., & Spillers, G. J. (2012). Variation in cognitive failures: An individual differences investigation of everyday attention and memory failures. *Journal of Memory and Language, 67*, 1-16.
Warden, E. A., Plimpton, B., & Kvavilashvili, L. (2018). Absence of age effects on spontaneous past and future thinking in daily life. *Psychological Research*.
Wilkins, A. J., & Baddeley, A. D. (1978). Remembering to recall in everyday life: An approach to absentmindedness. In M. M. Gruneberg, P. E. Morris & R. N. Sykes (Eds.), *Practical aspects of memory*. London: Academic Press.
Wilson, B. A., Emslie, H., Foley, J., Shiel, A., Watson, P., Hawkins, K., . . . Evans, J. (2005). *The cambridge prospective memory test*. London: Harcourt-Assessment.