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Prospective memory: A narrative review on theoretical models, methodological approaches, and main findings

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Abstract: The planning of a future intention, maintaining it during a variable period of time, and recovering it in the expected moment and/or context has been explored under the umbrella term of Prospective Memory (PM). For instance, remember to deliver a message to a certain person or to take some medication at the appropriate time are activities decidedly dependent on a good PM function. In this context, the present work aims to provide a brief overview of the uprising research dedicated to PM, including an analysis of the definition, of the current theoretical approaches, and of the main procedures used in this field. Additionally, this review also covers some of the results obtained concerning the study of PM across development, the advanced neural correlates, and the strategies proposed to boost PM functioning. As final considerations, we pinpoint the main shortcomings and the potentialities ascribed to the PM research domain.

Keywords: *Delayed intentions; episodic memory; prospective memory; review.*

Memória prospectiva: Uma revisão narrativa sobre modelos teóricos, abordagens metodológicas e principais achados: O planeamento de intenções futuras, mantendo-as durante um período variável de tempo e recuperando-as no momento e/ou contexto esperado, tem sido explorado segundo a designação generalista de memória prospectiva (MP). Por exemplo, lembrar de entregar uma mensagem a uma determinada pessoa ou de tomar uma dada medicação na altura apropriada são actividades que dependem decisivamente de um bom funcionamento da MP. Neste contexto, o presente trabalho procura oferecer uma breve visão geral sobre a crescente investigação dedicada à MP, incluindo uma análise da definição, dos modelos teóricos actuais e das principais metodologias usadas neste campo. Adicionalmente, a presente revisão também procura abordar alguns dos resultados obtidos no estudo da MP ao longo do desenvolvimento, os principais correlatos neurais, bem como algumas estratégias propostas para melhorar o funcionamento da MP. Enquanto considerações finais, apontamos as principais limitações e potencialidades atribuídas ao domínio de investigação da MP.

Palavras-chave: *Intenções adiadas; memória episódica; memória prospectiva; revisão.*

A widely shared representation about memory is based on the notion that it supports the acquisition, storage and retrieval of different types of information during variable periods of time, ranging from seconds to years. It makes somehow tangible the idea of time travel, not only for revisiting past events but to conceive future-oriented ideas (Tulving, 1985, 2002). The recollection of past and projection of future events are even hypothesized to share similar supporting mechanisms (Schacter, Addis, & Buckner, 2007). In this sense, memory cannot be secluded to the past as it plays a prominent role in future projection and planning. Due to the crescent interest in these future oriented processes, concepts such as episodic future thinking (Atance & O'Neill, 2001) and prospective memory (PM) (Einstein et al., 2005) have been gaining a significant coverage in the research domain. More specifically, remember to bring a book to lend a friend in the next day or remember to attend an appointment in a specific time constitute some examples of pervasive activities that populate our everyday lives. Interestingly, more than forgetting past related information, people commonly fail to recall things they intended to do in a particular time in the future (Terry, 1988). The systematic investigation of the cognitive processes that support the retrieval of these future delayed intentions has been accomplished under the designation of

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PM. This concept has been defined as the ability to establish a future intention, maintaining it during a variable period of time, and recovering it in the expected circumstances (Einstein & McDaniel, 1990; McDaniel & Einstein, 2007; McDaniel, Glisky, Rubin, Guynn, & Routhieaux, 1999). In this context, the present review aims to discuss some of the central topics that have been characterizing the PM movement. It does not aim to be exhaustive, but rather a brief compilation of the main ideas that have been under debate in this field. It intends to provide an introductory overview on the theoretical models, methodological approaches, and important findings, without forgetting some advances, applications, and nebulous issues contemporaneous to this research enterprise. To this end, we start by introducing the definition of PM, then we move to the discussion of methodological and theoretical approaches, and we conclude with the selection of three major research lines, namely PM across development, the neural correlates, and how can we contribute for the successful functioning of PM retrieval.

WHAT BOUNDARIES FOR THE NOTION OF PM? AN ANALYSIS OF THE DEFINITION

It is easily recognizable that remembering to undertake intended activities in the expected moment is an indispensable ability in our daily lives, and that failures in this context can generate significant frustrations (e.g., how does it feel to forget an important meeting?). Yet it is relevant to ask if the pervasiveness of these kind of activities and the lower volume of studies dedicated to this matter in comparison with other fields of memory justify the specification of another memory mechanism. In other words, it is important to probe the unique features that endow the conceptual individualization of PM.

One idea consistently found in the PM literature is that, historically speaking, the study of memory has been biased towards Retrospective Memory (RM) mechanisms with only recent incursions concerning PM. Accordingly, PM distinctiveness has been grounded in a side-by-side comparison between traditional RM activities and the PM ones. More specifically, in episodic RM studies, the participants are usually instructed to work with concrete sets of information which they are supposed to acquire and then to retrieve when prompt to do so. The subjects are commonly aware of the nature of the task and there is also an external agent, the experimenter, responsible for the initiation of the retrieval process. PM tasks, in their turn, require the participants to be actively engaged in a specific activity during which they have a window of opportunity to recover and to perform an intention previously formed. In here there are two main aspects that contrast with typical RM tasks: first, the intention recuperation rests entirely upon the participants' initiative and there is no external retrieval signal (Einstein & McDaniel, 1990, 2005; Ellis & Kvavilashvili, 2000; Kvavilashvili, 1992; McDaniel & Einstein, 2000; McDaniel, Robinson-Riegler, & Einstein, 1998); second, the participants have to interrupt the ongoing activity and switch momentarily to the PM implementation (Ellis & Kvavilashvili, 2000; Einstein & McDaniel, 2005; Graf & Uttl, 2001; Smith, 2003). Even so, one could argue that PM functioning overlaps with RM in the sense that participants must recover which intention was initially conceived. In response, some authors argue that although remembering the intention's content is important, this feature is not enough to assure PM success, especially because the remembrance of the intention in the expected situational context is one the PM singular characteristics (Ellis & Kvavilashvili, 2000; Kopp & Thöne-Otto, 2003; Kvavilashvili, 1987). Graf and Uttl (2001) even stated that the former element is exclusive of prospective remembering. We can say that RM refers to something that already ended, it is in the past, whereas PM conveys the notion that something started in the past but it has not yet finished. Following these ideas, some investigations have been pursuing evidence that sustains the idea that PM and RM rely on distinct memory mechanisms (e.g., Kvavilashvili, 1987; Kvavilashvili, Kornbrot, Mash, Cockburn, & Milne, 2009) and on distinct neuroanatomical pathways (e.g., Cockburn, 1995; Schnitzspahn, Zeintl, Jäger, & Kliegel, 2011).

Another central point of inquiry involves the integration of PM concerning general memory frameworks and memory principles of functioning. Indeed, since the first empirical studies, it has been asked if remembering future intentions represents a special case in terms of memory processing. For instance, in a study of Loftus (1971), the author posed the question if forgetting to perform an intention is or not the same as forgetting a past information. In accordance, the author analyzed if well-established effects obtained in traditional RM paradigms, namely the recalling facilitation when retrieval cues are present and the recalling worsening when the number of activities during the delay interval is increased, can be found in a PM task. The results suggested that the effects obtained for RM tasks are also present in the context PM activities. Other examples of how PM functioning has been associated with distinct memory frameworks can be found across the literature, including the notion that, following the multisystem view (Schacter & Tulving, 1994; Tulving, 1985), PM belongs to the declarative system. The future intentions must be conscientiously formed and recollected at least once, even if there are occasions in which an intention is routinely repeated reaching a point of a less effortful retrieval (Graf & Uttl, 2001). Taking into account that the episodic memory refers to the acquisition of personal and daily experiences that allow to connect past, present and future (Eustache & Desgranges, 2008; Eustache, Viard, &

Desgranges, 2016; Tulving, 1985, 2002), PM can be integrated in this system since it involves the retrieval of daily-based intentions that depends upon the subject to be consummated. In parallel with the former multisystem approach, the study of levels of processing (Craik & Lockhart, 1972; Craik & Tulving, 1975) and how the type of processing during recall overlaps with the one used during encoding (Transfer Appropriate Processing) (Morris, Bransford, & Franks, 1977) have also been applied to PM research. More specifically, there is evidence showing that the type of processing required by the distracter task results in a better PM performance when it matches the processing needed to detect the environmental PM cues prompting the intention retrieval (e.g., Abney, McBride, & Petrella, 2013; McDaniel et al., 1998). Additionally, PM functioning has been also hypothesized to be supported by the Supervisory Attentional System (SAS), proposed by Norman and Shallice (1986), in the model of attention control associated with the prefrontal cortex functioning. According to these authors, this system comes into play when subjects need to select a new course of action when facing a situation in which the application of automatic and well-acquired cognitive responses is not satisfactory. They consider that SAS implicates deliberative attentional processes of activation and inhibition that grant control over the selection of potential schemas of action. Considering that PM activities might not involve well-learned responses, it is speculated that SAS provisions encoding and monitoring of target events associated with delayed intentions, and also inhibits ongoing responses in order to attend to PM implementation (Guynn, 2003). Interesting enough, the same idea is mirrored in the central executive component of the working memory model of Baddeley (1992) in the sense that it is responsible for the management and orientation of attentional resources to the task(s) at hand. In experiments that manipulated the demands on working memory, specifically targeting central executive resources, it was possible to observe a deleterious effect in the PM performance in the more attentional demanding conditions (Marsh & Hicks, 1998; McDaniel et al., 1998). These data seem to suggest that SAS and working memory processes may play a role in the realization of delayed intentions. Overall, as Roediger (1996) stressed, the same memory principles hypothesized in the field of RM seem to be easily mirrored in the context of PM.

Despite the former ideas, the notion of delayed intentions which is a central concept incorporated in the PM definition is barely analyzed in the literature. Pointing out this omission seems relevant since intentions have been a research topic with a long tradition in psychology. Indeed, intentions have been characterized as goal-oriented states towards specific outcomes (Gollwitzer, 1999; Heckhausen & Beckmann, 1990; Malle & Knobe, 2001). Thus, there is a plethora of intentions that may, perhaps, fall under the umbrella of PM, such as implementing New Year's resolutions, send happy birthday wishes, continuing to write an essay we started several days ago, or even return a borrowed book from the library. As we can see, some intentions can be solved in hypothetical single attempts while others are bound to different instrumental steps that pave the way to the ultimate goal. The question here is if PM embraces such a broad spectrum of intentional behaviors. Although this conceptual interrogation is mildly addressed in the literature, some authors such as Crowder (1996) and Roediger (1996) already highlighted that remember intentions is not the same as implementing them. We can remember our short-term and long-term intentions without performing any of them, so the memory of the action and the action *per se* do not fully overlap. This seems to be one of the reasons why the sort of examples commonly used to portray PM seem refer intentions that are intimately associated with restrict behavioral outcomes, which is in accordance with the proposal of Roediger (1996) of studying intentions that people are compelled to do. In other words, PM has been explored based on a specific set of everyday intentions that implicate a straight behavioral translation, consequently, more general and long-term goals (e.g., adopt a healthy diet; write an essay) are cut-out from the picture. Accordingly, the time/space window to execute such intentions is limited. As Ellis and Kvavilashvili (2000) pointed out, PM can contribute to enlighten the path between intention and action since it is one of the possible mechanisms that can operate between the design of a plan and its concretization. In accordance with the evidence presented so far, the conceptual foundations of PM seem to gravitate around different concepts, including goal-directed behavior, episodic memory, planning, and executive control. Two things seem to be consensual across the literature, the first is that PM is not only about memory as the designation may imply, it comprises different elements such as (a) the planning and codification of an intention to be performed in a specific context in the future, (b) the recognition of the appropriate context, (c) the intention retrieval, (d) the execution of the expected action, and (e) deactivation of the intention in order to avoid, for example, commission errors (Cockburn, 1995; Maylor, 1993). The second thing is that, although these complex requirements might be decisive to PM activities (see Graf & Uttl, 2001), this approach congregates naturally many confound elements. Accordingly, PM cannot be viewed as an exclusive form of memory. Instead it seems to be an integrative mechanism that requires the participation of different cognitive processes.

AN OVERVIEW OF THE METHODOLOGICAL FOUNDATIONS

The development of different ways of testing PM has been introducing relevant contributions for the conceptual discussion and delimitation, the proposal of different underlying mechanisms, the empirical testing of theoretical based predictions and, certainly, the development of assessment and intervention strategies to improve PM functioning. Indeed, distinct approaches may grant different perspectives over the phenomenon, as well as they can lead to different results and interpretations. When assessing a specific construct, even if using differentiated approaches, it is expected that the results fit together in a broader picture and, if not the case, it might be pertinent to inquiry if the same object is being tackled across methodologies. In this fashion, knowing the main advantages and caveats of the mainstream PM procedures can be a conspicuous resource of analysis. Generally speaking, the evaluation of PM can be categorized according to its objectiveness, hence, PM measures can be classified in objective or subjective. The objective ones comprise all the behavioral tasks that present a hypothetic scenario with specific demands, in which is possible to collect different indicators of performance. The subjective measures, as the designation may foresee, comprise all self-report measures that require the subjects (or significant others) to emit a personal judgment about everyday memory abilities and perceived frequency of memory lapses.

In the context of objective measures, the first laboratorial experiments were mainly semi-naturalistic single intentions tasks in which the subjects were required to follow a simple instruction, such as mail post cards to the experimenter in specific dates (Meacham & Singer, 1977), hang up a telephone receiver in 5 minutes (Kvavilashvili, 1987), complete a questionnaire at home without forgetting to write the date and time in a particular page corner (Dobbs & Rule, 1987), or tell the place of birth after concluding a survey (Loftus, 1971). These examples show how diverse PM activities can be and, accordingly, it has been hypothesized that they are associated with different needs, conscious experiences, and elaboration levels (Graf & Uttl, 2001). More specifically, PM tasks have been commonly distinguished in four types: the activity-based tasks in which the cue that signs the intention retrieval is associated to the end or to the beginning of another activity (e.g., remember to take some medication before lunch); the habitual tasks which are repetitive and routine type activities (e.g., taking some medication every morning); time-based tasks in which the intention retrieval relies on the passage of a specific interval of time (e.g., make a phone call in one hour); event-based tasks, the most used type, in which the intention is associated to some environmental cue that elicits the need to implement the PM task (e.g., buy milk on the way home). The semi-naturalistic tasks remain widely used as they can be easily incorporated in other experimental activities (e.g., Cuttler & Graf, 2007). Nonetheless, some disadvantages can be drawn, namely the lack of experimental control (McDaniel & Einstein, 2000, 2007), the susceptibility to ceiling effects (Kvavilashvili, 1992), and the narrow range of scores that might not be sensible to accommodate heterogeneous and diverse PM performances (Rendell & Henry, 2009; Shum, Fleming, & Neulinger, 2002). A more systematic and controlled study advent arrived in the 90's decade due to the laboratorial task developed by Einstein and McDaniel (1990), in which the participants are invited to perform a PM task (e.g., press "Q" when the word "animal" appears) embedded in an ongoing task (e.g., lexical decision task). This paradigm has been adapted in multiple ways, yet its prototypical structures is quite preserved across experiments. More specifically, laboratorial experimental tasks are characterized by (a) introducing a delay between the initial PM task instruction and the chance for retrieval, (b) assuring the absence of external prompts concerning the incoming opportunities for PM remembrance, and (c) maintaining the subjects involved in activities that must be interrupted to perform the intention (Ellis & Kvavilashvili, 2000; McDaniel & Einstein, 2000). Since its introduction, experimental laboratorial approaches have been assuming a leading role in boosting the field, even so there also some limitations that can be considered, such as the restricted temporal windows of retention, usually minutes, between the intention formation and the cue appearance (in everyday tasks the intervals can range from seconds to days and these longer intervals are less explored in the literature), the narrow windows of response (the intention must be retrieved and implemented concomitantly with the appropriate context which is not always the case in everyday situations), the difficulties encountered when trying to mimic in the laboratory the great diversity of ongoing activities found in everyday settings, and the study of alternative factors that can account for PM performance (e.g., planning strategies; memory aids).

The principles presented so far have been also applied to the development of systematic PM assessment tools with explicit preoccupations with ecological validity. These instruments tend to mimic specific everyday tasks and demands with a purpose of capturing a performance proximal to the one assumed in real-life situations. An innovative example is the Rivermead Behavioral Memory Test (RBMT) (Wilson, Cockburn, & Baddeley, 1985) which was the first clinical instrument to integrate three PM items, such as the belonging task in which the subjects are required to ask for the returning of a personal object kept by the professional in the beginning of the session. Currently, there are several instruments with a similar philosophy that encompass different strategies, including video-based and virtual reality approaches (see Table S1 in the Supplementary Material Section). These measures englobe mainly event-based and time-based PM intentions to be implemented while engaging in other activities such as neuropsychological tests. In addition, and circumventing some of the limitations pointed to the laboratorial approaches, these measures allow the simulation of other PM features including activity-based and regular/irregular activities (habitual versus punctual tasks), the introduction of flexible adaptations according to specific needs (e.g., measuring the PM retrieval after a 24h interval), and the usage of opportune strategies such as notes and time checks. Nevertheless, it is important to note that the number of reports with theoretical oriented PM tools and associated psychometric properties is fairly restricted, which means that the majority of these measures are not ready to be applied straightforward in clinical settings and that more investigation is needed to enlighten their potentialities.

As aforementioned, PM has also been explored by means of self-report measures (see Table S1 in the Supplementary Material Section). Two of the most used surveys are the Prospective Memory Questionnaire (PMQ) (Hannon, Adams, Harrington, Fries-Dias, & Gipson, 1995) which was the first questionnaire devised to explore the frequency of daily PM lapses, and the Prospective and Retrospective Memory Questionnaire (PRMQ) (Crawford, Smith, Maylor, Della Sala, & Logie, 2003; Smith, Della Sala, Logie, & Maylor, 2000) which stands as the most used self-rating measure. Although the majority of these measures are composed of items that assess the frequency of memory lapses in Likert-type scales (e.g., "How often do you forget to buy something you planned to buy, like a birthday card, even when you see the shop"), some of them contain items intended to explore different processes, such as the relative importance attributed to the failures and the common compensatory strategies used to prevent forgetting. In comparison with the objective measures with ecological preoccupations, there are more studies exploring psychometric characteristics in self-report questionnaires. This pattern is somehow expected since questionnaires have the competitive advantage of being less resource and time consuming, allowing a less burdening data collection with a significant amount of information gathered in a short time span. Nonetheless, self-report measures may not reflect the actual PM performance in daily activities, since we are dealing with personal representations that warrant a careful interpretation (Rönnlund Vestergren, Mäntylä, & Nilsson, 2011; Zeintl, Kliegel, Rast, & Zimprich, 2006). For instance, Uttl and Kibreab (2011) tried to address this matter and found that different subjective instruments tend to reveal reasonable reliability but lower convergent validity with objective PM tasks; a similar pattern has been found in other investigations (e.g., Clune-Ryberg et al., 2011; Fleming et al., 2009; Hannon et al., 1995). Objective measures can provide a more reliable approximation to the PM functioning, whereas subjective instruments enable to examine other factors, such as memory self-efficacy and linkages with mood (Roche, Fleming, & Shum, 2002; Rönnlund et al., 2011). More specifically, self-report measures make possible to access the beliefs underlying personal abilities, including the reasons behind lapses and the perceived impact of these alterations in everyday functioning (Roche, Moody, Szabo, Fleming, & Shum, 2007). Indeed, when persons are aware of their personal memory abilities, they tend to implement distinct strategies to prevent possible failures, and they are more prone to perform memory tasks with success (McDonal-Miszczak, Gould, & Tychynski, 1999; Meeks, Hicks, & Marsh, 2007). Thus, the information extracted from objective and subjective measures is diverse and, more importantly, it can complement each other, paving different opportunities of approaching PM mechanisms.

THEORETICAL DEVELOPMENTS: UNITARY PROCESS APPROACH VERSUS MULTIPROCESS FRAMEWORK

A central issue discussed in the PM field concerns how cognitive systems promote the remembrance of an intention in the expected moment. More specifically, the study of processes and of variables of influence that operate between the intention establishment and its recuperation has been particularly explored for event-based PM, and the debate over these mechanisms have been fueling distinct theoretical predictions and proposals, including the Preparatory Attentional and Memory (PAM) (Smith, 2003) processes theory and the Multiprocess View (MPV) (Einstein et al., 2005). The first considers that successful PM is intimately associated with the involvement of non-automatic resource-demanding monitoring mechanisms that search the environment for retrieval opportunities. This includes hence the allocation of (limited) cognitive resources that prepare the subject to implement the previous planned intention when the circumstances are due. Taking into account that the distribution of resources between activities results in fewer resources available for each specific task, PAM claims that the introduction of a PM task can lead to indirect costs at the ongoing task performance level (Smith, 2003; Smith & Bayen, 2004, 2005, 2006). This prediction has been tested and supported by several studies (e.g., Cohen, Jaudas, Hirschhorn, Sobin, & Gollwitzer, 2012; Marsh, Hancock, & Hicks, 2002; Marsh & Hicks, 1998; McDaniel, Shelton, Breneiser, Moynan, & Balota, 2011; Smith, Hunt, McVay, & McConnell, 2007). In the same vein, when there is an increase of the resources demanded by the ongoing task, it has been also hypothesized that fewer resources are available for the maintenance of the monitoring processes and, as a consequence, the PM performance can be affected (e.g., Marsh et al., 2002; Marsh & Hicks, 1998). Overall, the notion that the PM retrieval is only possible by means of preparatory attentional monitoring processes is the hallmark of the PAM approach. Even so, it is important to note that the intervention of such preparatory processes does not mean that the subject is always monitoring for PM cues in an explicit manner (Smith & Bayen, 2005). Smith (2010) even emphasizes that cost measures are merely indirect indicators of PM performance, and that other factors such as speed-accuracy trade-offs and increased difficulties in target/non-target judgments must be considered when gauging ongoing task costs. Nonetheless, some authors (McDaniel & Einstein, 2007) argue that PAM is not clear about the nature and the extent of such costs, because even if the functioning of preparatory attentional processes results in overall costs, this does not mean that the former processes are ubiquitous and responsible for all PM retrievals. Indeed, the cost results obtained in laboratorial settings might be explained by a more attentive response delivered by subjects in such contexts (e.g., Boywitt & Rummel, 2012). Moreover, PAM does not accommodate the interference of other mechanisms that, apart from monitoring, can play a role in PM failures, such as RM slips, metamemory, and planning strategies.

The MPV deems also the role of monitoring processes in prospective remembering but, concomitantly, it accepts the idea that delayed intention retrieval can take place without the action of executive and resource demanding processes particularly devoted to it (Einstein et al., 2005). In other words, the multiprocess framework predicts the consumption of attentional resources when active monitoring is required (top-down attentional control), yet it also contemplates the possibility of a more spontaneous/automatic retrieving mechanism (bottom-up retrieval) which does not rely on preparatory attentional processes (Einstein et al., 2005; McDaniel, Umanath, Einstein, & Waldum, 2015). In accordance, the detection of relevant environmental cues can occur in a more automatic fashion and, in these conditions, no cost in the ongoing task performance is expected. Indeed, some studies do not find significant ongoing task costs when a PM activity is present (e.g., Einstein et al., 2005; Harrinson & Einstein, 2010; Scullin, McDaniel, & Einstein, 2010). To explain how this spontaneous retrieval can occur, McDaniel and Einstein (2007) advanced some hypothesis based in other phenomenon well-studied in the memory field, such as context-free recognition (priming mechanism), reflexive associative memory (similar to pair associate recall in which there are associations between cues and targets, and in the case of PM the association is between a specific event and the intended action) and familiarity (the target can generate the feeling of previous occurrence). Moreover, there are several assumptions embraced by the multiprocess view, namely: **(a)** The cognitive processes involved in a particular situation are specified by the nature of the context; **(b)** Different mechanisms, including spontaneous and strategic monitoring processes, can support PM remembering. Indeed, in a recent update of the MPV framework, Scullin, McDaniel and Shelton (2013) clarified that the interplay between monitoring and automatic processes is fundamental for PM functioning by showing that participants can engage or disengage in active monitoring depending if the PM cues are expected or not; **(c)** The strategies and mechanisms used by the subjects will vary according to the interaction between different factors, such as the demands of the ongoing task and the individual characteristics (e.g., Cuttler & Graf, 2007; Foster, McDaniel, Repovš, & Hershey, 2009; Rose, Rendell, McDaniel, Aberle, & Kliegel, 2010; Scullin et al., 2010; Smith, Persyn, & Butler, 2011). For instance, by assessing the relevant properties of each situation, subjects are able to perceive if spontaneous retrieval mechanisms are likely to assure or not PM retrieval. If not, strategic monitoring represents a more adaptive mechanism of response. Some studies even show that a more intensive monitoring response can emerge for previous planned moments (e.g., Guynn, 2003; Lourenço, White, & Mayor, 2013). **(d)** People commonly rely on spontaneous retrieval processes, hence, they show a bias towards less demanding and more automatic ways of response. In this regard, McDaniel and Einstein (2007) advocated that although monitoring strategies are engaged in some laboratorial contexts increasing the probability of PM success, it is not plausible to assume that, in everyday settings, resource demanding processes are always needed for PM retrieval. If we take in consideration that our day-by-day lives are impregnated with diverse ongoing and PM activities and, in top of that, we add the notion that our performance is continuously dependent upon active monitoring processes, the expected result would be an overwhelming and weary experience.

Overall, a central postulation of MPV is that PM retrieval is a multifaceted process in which various factors can participate, including the PM task importance, salience of target cues, nature of the ongoing tasks, and individual features (McDaniel & Einstein, 2000). However, such a broad and complex theoretical framework galvanizes several difficulties to the experimental research enterprise since it is almost impossible to disentangle all the possible interactions between different players. In fact, the aforementioned assumptions are really hard to test in experimental contexts. Even so, some efforts have been made to focus in specific corollaries that can be extracted from this general dynamic approach, leading researchers to explore the influence of specific parameters in terms of PM target cue and ongoing task. A popular example includes the investigations on focal/non-focal processing, which is intimately associated with the notion of transfer-appropriate processing, revealing that target cues that require the same processing as the one needed during the ongoing task – focal cues – are better detected than non-focal ones (Einstein et al., 2005; McDaniel & Einstein, 2000; Scullin et al., 2010). Other examples comprise studies on the saliency and distinctiveness of PM cues (e.g., Cona, Kliegel, & Bisiacchi, 2015), the length of the delay interval between encoding and recuperation (e.g., Hicks, Marsh, & Russel, 2000), the ongoing task demands (e.g., Marsh & Hicks, 1998), and the influence of individual factors such as working memory capacity (e.g., Brewer, Knight, Marsh, & Unsworth, 2010) and personality (e.g., Uttl, White, Gonzalez, McDouall, & Leonard, 2013).

PM IN THE LIGHT OF DEVELOPMENT: INVERTED U PERFORMANCE AND AGING PARADOX

The study of how PM functioning varies across different developmental stages, ranging from childhood to late adulthood, has been one of the most productive avenues of research in the area. As a matter of fact, researchers have been particularly interested in what factors can contribute to age related differences in PM performance, and how aging can impact or not PM. The inverted U-shape performance and the aging paradox are considered relevant epitomes of the crossing roads featuring PM and development (McDaniel & Einstein, 2007). More specifically, it has been commonly reported that PM performance follows an inverted U-shape function across development, in other words, from childhood to young adulthood there is an increase in PM performance, while from adulthood to late adulthood is observed a decline (Zimmermann & Meier, 2006; Zöllig, West, Martin, Altgassen, Lemke, & Kliegel, 2007). This pattern suggests that PM performance follows a similar trajectory, as other cognitive domains, such as episodic RM, executive functions, and information processing speed (e.g., Deary et al., 2009; Salthouse, 2009). Likewise, during childhood, the normative development of executive resources such as planning, task switching, inhibitory control and working memory seems to play an important role in PM performance pattern (e.g., Kliegel et al., 2013; Mackinlay, Kliegel, & Mäntylä, 2009; Mahy, Moses, & Kliegel, 2014; Mattli, Zöllig, & West, 2011; Voigt et al., 2014).

The adoption of strategic monitoring strategies has been used to explain how children (between preschool and 12 years old) improve PM performance (Mackinlay et al., 2009; Voigt et al., 2014), and how elderly might display some difficulties regarding PM tasks in which monitoring is useful. Interestingly, the multiprocess framework predicts that self-initiated strategic monitoring is acquired at a certain level of development, and that this monitoring might be altered by aging whereas spontaneous retrieval processes remain somehow preserved (McDaniel & Einstein, 2007). In the beginning of laboratorial-based PM studies, it was even tested if PM could be quite resilient to age-related differences (e.g., Einstein & McDaniel, 1990), particularly in less demanding conditions regarding ongoing exigencies and self-initiated processes that are more prone to the use of spontaneous strategies (e.g., Einstein, McDaniel, Richardson, Guynn, & Cunfer, 1995; Einstein, Smith, McDaniel, & Shaw, 1997). Moreover, it has been observed that older adults seem to fail more often in the detection of environmental PM cues (Mattli et al., 2011; West, Jakubek, & Wymbs, 2002; Zöllig et al., 2007), and reveal more difficulties in the deactivation of intentions that are no longer needed (Scullin, Bugg, & McDaniel, 2012; Scullin, Bugg, McDaniel, & Einstein, 2011). Although the former results show that strategic monitoring is an important factor to be considered in aging, different meta-analysis (Henry, MacLeod, Phillips, & Crawford, 2004; Uttl, 2008, 2011) have been pointing that the MPV is not totally accurate in its predictions, especially because older adults display, in a consistent manner, more difficulties in PM laboratory tasks regardless of type of task (event- or time-based) and focal/non-focal processing.

In contrast with the extensive body of research indicating PM declines in the elderly, numerous investigations have been showing that older adults can show a similar or even better PM performance than their younger counterparts in naturalistic settings (Bailey, Henry, Rendell, Phillips, & Kliegel, 2010; Henry et al., 2004; Kvavilashvili, Cockburn, & Kornbrot, 2013; Niedźwieńska & Barzykowski, 2012; Rendell & Craik, 2000; Schnitzspahn, Ihle, Henry, Rendell, & Kliegel, 2011; Uttl, 2008).This performance inconsistency has been disseminated as the "aging paradox". Following the MPV framework, McDaniel and Einstein (2007) clarify that the mixed results can be explained by different dynamic factors, such as: **(a)** age-related cognitive alterations; **(b)** requirements in terms of self-initiation preparatory processes; **(c)** the ongoing task demands. Regarding the first point, it has been well established that several cognitive domains including executive functions and information processing speed are affected by aging (Bisiacchi, Borella, Bergamaschi, Carretti, & Mondini, 2008; Burgess & Shallice, 1996; Deary et al., 2009). In this fashion, it has been showed that elderly adults with executive functions difficulties are more prone to show a weakened PM performance in comparison with older adults with a better executive performance

(McFarland & Glisky, 2009). Moreover, PM tasks that require higher degree of executive functions, such as activities involving active monitoring and planning, are hypothesized to reveal greater age-related differences (McDaniel & Einstein, 2011). Also in this context, it is important to reminisce that laboratorial paradigms exert their own rhythm to the participants and, as a result, older adults are in disadvantage as they naturally need more time to give a response (Gao, Cheung, Chan, Chu, & Lee, 2013; West & Craik, 1999). In the case of the second point, it has been observed that age effects are more pronounced when there is not a match between the processes required by the ongoing task and the ones needed to detect the cue target (Henry et al., 2004; Kliegel, Jäger, & Phillips, 2008). In other words, older adults detect better focal PM cues than non-focal ones. Concerning the last point and as an effect of the cognitive alterations which can occur with aging, it is expected that older adults reveal more difficulties during the management of ongoing tasks, especially if there is an uprising in the level of demands, such in the case of laboratorial tasks (Einstein et al., 1997; Kvavilashvili et al., 2013).

Overall, there seems to exist flexible circumstances in which older adults are more prone to take advantage of their previous experiences to deal with the tasks at hand, as it happens in more naturalistic settings but less in laboratorial contexts. PM task features such as ongoing task load, motivation, response flexibility and strategy implementation assume a relevant role in the understanding of age-related differences (e.g., Aberle, Rendell, Rose, McDaniel, & Kliegel, 2010; Kvavilashvili et al., 2013; Schnitzspahn, Ihle, et al., 2011). Thus, the results obtained from laboratory-based tasks cannot be applied in a straightforward manner to everyday settings due to the complex interplay between distinct variables.

CONTRIBUTIONS FROM NEURAL CORRELATES AND CLINICAL-BASED INVESTIGATIONS

Functional techniques, such as neuroimaging and Event-Related Potentials (ERPs), have been contributing to distinct theoretical predictions concerning PM functioning. Due to their high temporal resolution, ERPs have been fairly productive in showing different component-dependent modulations in agreement with expected PM processes, such as target cue detection (N300), switching between ongoing and PM trials (frontal positivity), intention retrieval (recognition old-new effect), and strategic monitoring (Cona, Bisiacchi, & Moscovitch, 2014; West, 2007, 2011). Moreover, it has been hypothesized that distinct regions support PM functioning, namely prefrontal, hippocampal structures, and other temporal lobe structures (McDaniel & Einstein, 2007). Precisely, from neuropsychological investigations with clinical populations with frontal lesions and elderly populations with executive functions problems, the results tend to reveal significant PM impairments, lending evidence to the idea that frontal lobe structures play a relevant role in PM processes (Cheng, Wang, Xi, Niu, & Fu, 2008; Cockburn, 1995; McDaniel et al., 1999; McFarland & Glisky, 2009; Umeda, Kurosaki, Terasawa, Kato, & Miyahara, 2011). Regarding the involvement of hippocampal and temporal lobe structures, the neuropsychological evidence is scarce, even so a study with individuals with epilepsy associated with mesial temporal sclerosis suggested that mesial temporal lobe structures, including hippocampus, are conspicuous players in PM processes (Adda, Castro, Além-Mar e Silva, Manreza, & Kashiara, 2008).

A clearer picture concerning the neuroanatomical areas recruited during PM activities emerges from neuroimaging studies, in which the activation of prefrontal areas, especially the anterior prefrontal cortex (Broadmann's area 10 - BA 10), is a consistent finding reported in several studies (e.g., Burgess, Quayle, & Frith, 2001; Cona, Scarpazza, Sartori, Moscovitch, & Bisiacchi, 2015; Okuda et al., 1998; Okuda et al., 2007; Simons, Schölvinck, Gilbert, Frith, & Burgess, 2006). More specifically, when contrasting experimental conditions with or without an embedded PM task, there are two frontal areas which seem to work in a complementary way: lateral BA 10 activation is observed during PM tasks and, concomitantly, there is a deactivation of the medial BA 10; in addition, when considering ongoing tasks only, some regions of the medial BA 10 are more activated (e.g., Burgess, Gonen-Yaacovi, & Volle, 2011; Cona, Scarpazza et al., 2015; Simons et al., 2006). These effects can be exacerbated by extra demanding conditions and might highlight that the anterior prefrontal cortex is essential in different stages of PM, including planning, maintenance, and target cue orientation (Burgess et al., 2011; Simons et al., 2006). Nevertheless, it is important to note that although anterior prefrontal areas are consistently activated during PM activities, they are also activated across other paradigms and conditions (Burgess et al., 2011; Cabeza & Nyberg, 2000). In this sense, the involvement of prefrontal and temporal medial regions cannot be restricted to PM since other episodic memory processes for past and future events count also with the participation of these areas (Schacter et al., 2007; Shallice et al., 1994).

Once again, the conceptualization of PM as a broader concept that coalesce different cognitive functions dovetails with these data. Even so, it is important to question how the data from neuroimaging studies can inform the discussion of theoretical models. Accordingly, the existence of both automatic and active monitoring mechanisms underlying PM retrieval seems to be supported by different neural basis (Cona, Bisiacchi, Sartori, & Scarpazza, 2016; McDaniel, LaMontagne, Beck, Scullin, & Braver, 2013;

Oksanen, Waldum, McDaniel, & Braver, 2014): anterior prefrontal cortex activity seems to be associated with active monitoring and top-down attention control, whereas parietal and ventral brain regions have been related with more bottom-up and automatic PM retrieval.

IMPROVING PM REMEMBERING

The theoretical discussions about PM contemplate the idea that PM can have an impact in the ongoing task performance and, at the same time, the notion that the nature of the ongoing task can also interfere with PM remembering (Einstein et al., 2005; McDaniel & Einstein, 2007; Smith, 2003). In this sense, an important question is how can we evade possible difficulties and failures regarding PM remembering. The study of ways to improve memory can shed light on specific underlying mechanisms and encourage the development of compensatory approaches that can be used in distinct applied contexts. In this sense, the investigation of the impact of compensatory approaches, including internal (e.g., mnemonics) and external strategies (e.g., use of external/environmental aiding cues such as alarms and written reminders), represent a fruitful avenue of research. Nevertheless, these concepts have been explored in a minor extent in the field of PM. Interesting enough, one of the most studied strategies is the implementation intentions, which has been developed in the domain of motivational and goal-directed behavior research - something we already discussed in conceptual section when presenting the notion of intention - aiming to support a more effective self-regulatory functioning. According to Gollwitzer (1993, 1999), implementation intention endorses the idea that when persons compel themselves to initiate a specific behavior in previous planned conditions, they are more likely to accomplish their intentions. More specifically, it is argued that when there is a meticulous planning of when, where and how the intention is supposed to take place, these situational linkages gain an easy access status in memory (heightened accessibility), functioning as reliable prompts of action. Due to this status, the recognition of the previous planned conditions can take place even if people are completely absorbed in other activities. Likewise, the detection of the expected environmental conditions is hypothesized to be an automatic triggering mechanism that consumes few cognitive resources. Although the former assumptions require further examination, it is possible to establish a parallel with PM: firstly, we are referring to delayed intentions which are supposed to be performed in a particular situation; secondly and following the multiprocess approach, the detection of PM targets can rely on spontaneous retrieval mechanisms. Thus, implementation intention has a straightforward application to PM and that is why this is the most explored technique to enhance PM functioning. Specifically, several studies have been showing that when participants have the opportunity to plan in detail where a specific action will take place by means of verbal and/or visual formulation, such as "When situation X appears, I have to perform action Y", the PM performance is enhanced (e.g., Burkard et al., 2014; Chasteen, Park, & Schwarz, 2001; Chen et al., 2015; Khoyratty et al., 2015; McDaniel & Scullin, 2010; McFarland & Glisky, 2011, 2012; Mioni, Rendell, Terrett, & Stablum, 2015; Rummel, Einstein, & Rampey, 2012; Schnitzspahn & Kliegel, 2009; Smith, Rogers, McVay, Lopez, & Loft, 2014; Zimmermann & Meier, 2010).

In fact, the study of enhancement strategies has been providing the opportunity to study deeper planning and encoding mechanisms and how they can influence retrieval, and this is can be particularly relevant since the investigation of PM has been mainly focused in retrieval processes. Besides implementation intentions, external compensatory strategies such as written reminders, note-taking, organizers and electronic aids tend to reveal good results (e.g., Fleming, Shum, Strong, & Lightbody, 2005; Shum, Fleming, Gill, Gullo, & Strong, 2011; Thöne-Otto & Walther, 2003; van den Broek, Downes, Johnson, Dayus, & Hilton, 2000; Waldron, Grimson, Carton, & Blanco-Campal, 2012). More importantly, there are other internal strategies showing also positive evidence, specifically: episodic future thinking, where the subjects are asked to imagine in a detailed and sequential manner the events that will occur before, during and after a certain period/event of the day (e.g., Altgassen et al., 2015; Neroni, Gamboz, & Brandimonte, 2014; Nigro, Brandimonte, Cicogna, & Cosenza, 2014); self-imagination which a mnemonic that requires the subjects to imagine a specific to remember event from their own personal perspective (e.g., Grilli & McFarland, 2011); visual imagery in which the subjects are invited to imagine (visual projection) a particular situation (e.g., McFarland & Glisky, 2012; Potvin, Rouleau, Sénéchal, & Giguère, 2011). Although all these strategies imply different procedures, it is possible to observe a common denominator that is introducing somehow a self-referential context specifically associated with a future intention. Following the levels of processing approach (Craik & Lockhart, 1972; Craik & Tulving, 1975), self-referential processing conditions are widely known to foster deeper levels of encoding and, thus, information recall is powerfully boosted (e.g., Rogers, Kuiper, & Kirker, 1977; Symons & Johnson, 1997).

So far it is not clear how the former strategies particularly contribute to PM enhancement. The procedures may be distinct, but perhaps they work through similar processing mechanisms such as self-referential and imagery processes. Thus, future research needs to enlighten the distinct properties ascribed (or not) to each technique, and how they can intervene in terms of PM processing. For instance, do they lead the subject to engage in less effortful monitoring and to rely more on automatic retrieval mechanisms? The studies conducted so far regarding implementation intentions show that, although implementation intentions foster a better PM performance possibly due to a stronger association between cue and action, the use of this strategy is not enough to assure a good performance in more demanding conditions (McDaniel & Scullin, 2010). This associative strength can even lead to more difficulties in the deactivation of no longer needed intentions (Bugg, Scullin, & McDaniel, 2013). Moreover, the role of this strategy in the promotion of a more automatic and spontaneous retrieval mechanism stills under debate, because some studies support this view (Rummel et al., 2012), while others do not find compelling evidence (McDaniel & Scullin, 2010; Smith et al., 2014). Besides these interrogations, it is important to note that whereas external strategies used in PM comply with the traditional views applied in general memory research, some of the internal strategies presented here seem to be intrinsically attached to PM, being implementation intentions a sound example. In this sense, the study of enhancing strategies can be a productive road to further explore PM underlying mechanisms.

FINAL CONSIDERATIONS

In this work we aimed to provide a comprehensive overview of the PM research enterprise having in mind some particular questions such as: Is the concept of PM really necessary or is it a result of an abiding tendency to generate concepts based on methodologies and experimental results? What are the unique features of PM that fuel its conceptual and search individualization? As Roediger (1996) pinpointed, how the memory for a list of things we have already done differs from the memory for a list of things we intend to accomplish in the future? We were not expecting to address directly these conundrums, but we intended to understand the strengths and limitations ascribed to the field. In this regard, we would like to highlight some ideas. First, the emergence of the study of PM was inspired by the fact that people commonly report memory lapses associated with forgetting future intentions (e.g., Terry, 1988). So, the interest for PM did not appear due to experimental effects found in other studies about human memory, but due to the idea that retrieving and forgetting intentions have somehow different properties when compared to remembering and forgetting past events (e.g., Crowder, 1996; Loftus, 1971). In order to pursue this idea, researchers have been trying to operationalize PM through different manners, including single semi-naturalistic tasks proxy to what a person would do in everyday settings, more complex behavioral simulations of everyday tasks, self-report measures, and laboratory experimental paradigms. Interestingly, it is based on the PM task requirements that different authors, including McDaniel and Einstein (2007), discuss the unique features of PM by setting contrasts with other tasks frequently used to test memory. It is understandable that researchers use methodological examples to demonstrate how distinct processes can be recruited during PM since the tasks contemplate different characteristics, such as self-initiated retrieval and switching between different task sets. Even so, this tendency shows that the conceptual analysis of PM requires further exploration, especially because establishing an appraisal rooted solely in methodological dissimilarities represents a constrained view to the everyday phenomenon. Indeed, this is one of the main critiques that we can point to the PM research enterprise.

The unclear definition of PM lead us to the second point of discussion that is in which conditions make sense then to investigate this construct. An indirect answer could be rendering that PM is not an isolated form of memory as it requires a dynamic interplay between different cognitive capacities, including attentional resources, executive functions (e.g., inhibitory control; switching), working memory, information processing speed, and episodic RM (e.g., Brewer et al., 2010; Foster et al., 2009; Kliegel, Mackinlay, & Jäger, 2008; McDaniel et al., 1998; Salthouse, Berish, & Siedlecki, 2004; Schnitzspahn, Stahl, Zeintl, Kaller, & Kliegel, 2013; Scullin et al., 2011). Even so, it is important to note that some investigations have been fruitful in finding some partial dissociations between PM and other cognitive processes (e.g., Cockburn, 1995; Zeintl, Kliegel, & Hofer, 2007). These interdependences and the complexity ascribed to PM make somehow understandable the motivations underlying the development of the MPV (McDaniel & Einstein, 2000). As explained earlier in this review, a central assumption of the MPV is that the mechanisms used by the subject will vary in accordance to distinct external and internal variables, including the features of the ongoing task and individual characteristics. PM performance can be modulated by specific manipulations such as the type of processing required by the ongoing activity and PM cues, the load of the ongoing task, the distinctiveness of the PM cue, different retention intervals and so on (see McDaniel & Einstein, 2007). Other variables, although not addressed in this review, can also be considered, such as time of the day (e.g., Leirer, Tanke, & Morrow, 1994), subjective importance attributed to intention to be retrieved (e.g., Aberle et al., 2010; Kliegel, Martin, McDaniel, & Einstein, 2001; Kvavilashvili, 1987; Walter & Meier, 2014), mood (e.g., Schnitzspahn et al., 2014), and individual characteristics including differences in the working memory and attentional abilities, planning, and personality (e.g., Heffernan & Ling, 2001; Marsh, Hicks, & Landau, 1998; Smith et al., 2011). Following the MVP, we can expect, for example, that different personality and metamemory features modulate the subjective evaluation of each situation, prompting the individuals to engage in active monitoring according to their own judgment of the situation.

Even so, the assessment of such complex interactions between variables poses serious difficulties to the PM research enterprise. As such, taking into account that the majority of the PM studies are laboratorial in nature, it is possible to realize that the experimental appraisal of PM is currently struggling with several challenges. More specifically, in laboratorial tasks is not possible to mimic all possible variations endorsed by everyday PM tasks, including flexible retrieval opportunities, extensive delay intervals populated by distinct ongoing activities with different levels of demand, numerous interruptions, self-generated intentions, overlapping between intentions with various subjective values, and the possibility of lunching new courses of action when the initial plans are not met. Despite these limitations, well controlled experimental manipulations have been generating relevant insights about how PM works. Thus, in order to overcome some of the limitations faced by laboratory-based paradigms, McDaniel and Einstein (2007) suggested the adaption of some experimental parameters such as implementing self-paced procedures and a better integration between laboratorial and naturalistic features. The idea here is to devise more complex experimental environments amenable to the evaluation of different stages of PM processing, namely planning and encoding, retention and execution of multiple intentions. Concrete examples are the complex PM task in which participants are required to accomplish serial intentions aiming to mimic a daily situation where persons have to manage multiple actions (Kliegel, McDaniel, & Einstein, 2000), and the “home-like” task where there is a simulation of two rooms, a living room, a kitchen, and where the participant is requested to plan and accomplish different tasks (Shum, Cahill, Hohaus, O'Gorman, & Chan, 2013). Indeed, the combinations across diverse methodologies can be viewed as an important challenge for future research, mainly because some of the attempts already preconized between objective and subjective measures of PM reveal lower convergent validity (Clune-Ryberg et al., 2011; Fleming et al., 2009; Uttl & Kibreab, 2011). Although the final goal is to gather converging evidence concerning PM functioning, it is important to take into account that distinct methodological approaches can appeal to different PM processes and, as a result, the data can be mixed.

As a final remark, we would like to travel back to the beginning of the review where we mentioned that memory is not only about revisiting the past, since it also supports future oriented processes. Like Burgess and colleagues (2011) denoted, it seems plausible to assume that the current designated PM processes belong somehow to a broader conceptualization of “prospection” activities. Indeed, as we exemplified through the review section dedicated to enhancement strategies, some recent investigations are already connecting PM with other future oriented processes, namely episodic future thinking (Altgassen et al., 2015; Neroni et al., 2014; Nigro et al., 2014). Therefore, we consider that these linkages constitute a promising avenue for future research that can shed some light in our understating of PM functioning.

REFERENCES

Aberle, I., Rendell, P. G., Rose, N. S., McDaniel, M. A., & Kliegel, M. (2010). The age prospective memory paradox: Young adults may not give their best outside of the lab. *Developmental Psychology, 46*(6), 1444-1453. http://dx.doi.org/10.1037/a0020718

Abney, D. H., McBride, D. M., & Petrella, S. N. (2013). Interactive effects in transfer-appropriate processing for event-based prospective memory: The roles of effort, ongoing task, and PM cue properties. *Memory & Cognition, 41*(4), 1032-1045. http://dx.doi.org/10.3758/s13421-013-0324-7

Adda, C. C., Castro, L. H., Além-Mar e Silva, L. C., Manreza M., L., & Kashiara, R. (2008). Prospective memory and mesial temporal epilepsy associated with hippocampal sclerosis. *Neuropsychologia, 46*(7), 1954-1964. http://dx.doi.org/ 10.1016/j.neuropsychologia.2008.01.016

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. *The Quarterly Journal of Experimental Psychology, 68*(1), 192-204. http://dx.doi.org/10.1080/17470218.2014.956127

Atance, C. M., & O’Neill, D. K. (2001). Episodic future thinking. *Trends in Cognitive Sciences, 5*(12), 533-539. http://dx.doi.org/10.1016/S1364-6613(00)01804-0.

Baddeley, A. (1992). Working memory. *Science, 255*(5044), 556-559. http://dx.doi.org/10.1126/science.1736359

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.

Quarterly Journal of Experimental Psychology, 63(4), 646-652. http://dx.doi.org/10.1080/17470210903521797

Bisiacchi, P. S., Borella, E., Bergamaschi, S., Carretti, B., & Mondini, S. (2008). Interplay between memory and executive functions in normal and pathological aging. *Journal of Clinical and Experimental Neuropsychology, 30*(6), 723-733. http://dx.doi.org/10.1080/13803390701689587

Boywitt, C. D., & Rummel, J. (2012). A diffusion model analysis of task interference effects in prospective memory. *Memory & Cognition, 40*(1), 70-82. http://dx.doi.org/10.3758/s13421-011-0128-6

Brewer, G. A., Knight, J. B., Marsh, R. L., & Unsworth, N. (2010). Individual differences in event-based prospective memory: Evidence for multiple processes supporting cue detection. *Memory & Cognition, 38*(3), 304-311. http://dx.doi.org/10.3758/MC.38.3.304

Bugg, J. M., Scullin, M. K., & McDaniel, M. A. (2013). Strengthening encoding via implementation intention formation increases prospective memory commission errors. *Psychonomic Bulletin and Review, 20*(3), 522-527. http://dx.doi.org/10.3758/s13423-013-0378-3

Burgess, P. W., & Shallice, T. (1996). Bizarre responses, rule detection and frontal lobe lesions. *Cortex, 32*(2), 241-260. http://dx.doi.org/10.1016/S0010-9452(96)80049-9

Burgess, P. W., Gonen-Yaacovi, G., & Volle, E. (2011). Functional neuroimaging studies of prospective memory: What have we learnt so far? *Neuropsychologia, 49*(8), 2246–2257. http://dx.doi.org/10.1016/j.neuropsychologia.2011.02.014.

Burgess, P. W., Quayle, A., & Frith, C. D. (2001). Brain regions involved in prospective memory as determined by positron emission tomography. *Neuropsychologia, 39*(6), 545-555. http://dx.doi.org/10.1016/S0028-3932(00)00149-4

Burkard, C., Rochat, L., Blum, A., Emmenegger, J., Van der Linden, J., & Van der Linden, M. (2014). A daily-life-oriented intervention to improve prospective memory and goal-directed behaviour in ageing: a pilot study. *Neuropsychological Rehabilitation, 24*(2), 266-295. http://dx.doi.org/10.1080/09602011.2014.887023

Cabeza, R., & Nyberg, L. (2000). Imaging cognition II: An empirical review of 275 PET and fMRI studies. *Journal of Cognitive Neuroscience, 12*(1), 1-47. http://dx.doi.org/10.1162/08989290051137585

Chasteen, A. L., Park, D. C., & Schawarz, N. (2001). Implementation intentions and facilitation of prospective memory. *Psychological Science, 12*(6), 457-461. http://dx.doi.org/10.1111/1467-9280.00385

Chen, X., Wang, Y., Liu, L., Cui, J., Gan, M., Shum, D. H. K., & Raymond C. K. (2015). The effect of implementation intention on prospective memory: A systematic and meta-analytic review. *Psychiatry Research, 226*(1), 14-22. http://dx.doi.org/10.1016/j.psychres.2015.01.011

Cheng, H., Wang, K., Xi, C., Niu, C., & Fu, X. (2008). Prefrontal cortex involvement in the event-based prospective memory: Evidence from patients with lesions in the prefrontal cortex. *Brain Injury, 22*(9), 697-704. http://dx.doi.org/10.1080/02699050802263035

Clune-Ryberg, M., Blanco-Campal, A., Carton, S., Pender, N., O'Brien, D., Phillips, J., …Burke, T. (2011). The contribution of retrospective memory, attention and executive functions to the prospective and retrospective components of prospective memory following TBI. *Brain Injury*, *25*(9), 819-831. http://dx.doi.org/10.3109/02699052.2011.589790

Cockburn, J. (1995). Task interruption in prospective memory: A frontal lobe function? *Cortex, 31*(1), 87-97. http://dx.doi.org/10.1016/S0010-9452(13)80107-4

Cohen, A. L., Jaudas, A., Hirschhorn, E., Sobin, Y., & Gollwitzer, P. M. (2012). The specificity of prospective memory costs. *Memory, 20*(8), 848-864. http://dx.doi.org/10.1080/09658211.2012.710637

Cona, G., Bisiacchi, P. S., & Moscovitch, M. (2014). The effects of focal and nonfocal cues on the neural correlates of prospective memory: Insights from ERPs. *Cerebral Cortex, 24*(10), 2630-2646. http://dx.doi.org/10.1093/cercor/bht116

Cona, G., Bisiacchi, P. S., Sartori, G., & Scarpazza, C. (2016). Effects of cue focality on the neural mechanisms of prospective memory: A meta-analysis of neuroimaging studies. *Scientific Reports, 6*, 25983. http://dx.doi.org/10.1038/srep25983

Cona, G., Kliegel, M., & Bisiacchi, P. S. (2015). Differential effects of emotional cues on components of prospective memory: An ERP study. *Frontiers in Human Neuroscience, 9*, 10. http://dx.doi.org/10.3389/fnhum.2015.00010

Cona, G., Scarpazza, C., Sartori, G., Moscovitch, M., & Bisiacchi, P. S. (2015). Neural bases of prospective memory: A meta-analysis and the "Attention to Delayed Intention" (AtoDI) model. *Neuroscience & Biobehavioral Reviews, 52*, 21-47. http://dx.doi.org/10.1016/j.neubiorev.2015.02.007

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*(6), 671-684. http://dx.doi.org/10.1016/S0022-5371(72)80001-X

Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General, 104*(3), 268-294. http://dx.doi.org/10.1037/0096-3445.104.3.268

Crawford, J. R., Smith, G., Maylor, E. A., Della Sala, S., & Logie, R. H. (2003). The Prospective and Retrospective Memory Questionnaire (PRMQ): Normative data and latent structure in a large non-clinical sample. *Memory, 11*(3), 261-275. http://dx.doi.org/10.1080/09658210244000027

Crowder, R. E. (1996). Commentary: The trouble with prospective memory: A provocation. In M. Brandimonte, G. O. Einstein, & M. A. McDaniel (Eds.), *Prospective memory: Theory and applications* (pp. 143-147). Mahwah, NJ: Erlbaum.

Cuttler, C., & Graf, P. (2007). Sub-clinical compulsive checkers' prospective memory is impaired. *Journal of Anxiety Disorders, 21*(3), 338-352. http://dx.doi.org/10.1016/j.janxdis.2006.06.001

Deary, I. J., Corley, J., Gow, A. J., Harris, S. E., Houlihan, L. M., Marioni, R. E., …Starr, J. M. (2009). Age-associated cognitive decline. *British Medical Bulletin, 92*(1), 135-152. http://dx.doi.org/10.1093/bmb/ldp033

Dobbs, A. R., & Rule, B. G. (1987). Prospective memory and self-reports of memory abilities in older adults. *Canadian Journal of Psychology, 41*(2), 209-222. http://dx.doi.org/10.1037/h0084152

Einstein, G. O., & McDaniel, M. A. (1990). Normal aging and prospective memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 16*(4), 717-726. http://dx.doi.org/10.1037//0278-7393.16.4.717

Einstein, G. O., & McDaniel, M. A. (2005). Prospective memory: Multiple retrieval processes. *Current Directions in Psychological Science, 14*(6), 286-291. http://dx.doi.org/10.1111/j.0963-7214.2005.00382.x

Einstein, G. O., McDaniel, M. A, Thomas, R., Mayfield, S., Shank, H., Morrisette, N., & Breneiser, J. (2005). Multiple processes in prospective memory retrieval: Factors determining monitoring versus spontaneous retrieval. *Journal of Experimental Psychology: General, 134*(3), 327-342. http://dx.doi.org/10.1037/0096-3445.134.3.327

Einstein, G. O., McDaniel, M. A., Richardson, S. L., Guynn, M. J., & Cunfer, A. R. (1995). Aging and prospective memory: Examining the influences of self-initiated retrieval processes. *Journal of Experimental Psychology: Learning, Memory and Cognition, 21*(4), 996-1007. http://dx.doi.org/10.1037/0278-7393.21.4.996

Einstein, G. O., Smith, R. E., McDaniel, M. A., & Shaw, P. (1997). Aging and prospective memory: The influence of increased task demands at encoding and retrieval. *Psychology and Aging, 12*(3), 479-488. http://dx.doi.org/10.1037/0882-7974.12.3.479

Ellis, J. A, & Kvavilashvili, L. (2000). Prospective memory in 2000: Past, present, and future directions. *Applied Cognitive Psychology, 14*(7), S1-S9. http://dx.doi.org/10.1002/acp.767.abs

Eustache, F., & Desgranges, B. (2008). MNESIS: Towards the integration of current multisystem models of memory. *Neuropsychology Review, 18*(1), 53-69. http://dx.doi.org/10.1007/s11065-008-9052-3

Eustache, F., Viard, A., & Desgranges, B. (2016). The MNESIS model: Memory systems and processes, identity and future thinking. *Neuropsychologia, 87*, 96-109. http://dx.doi.org/10.1016/j.neuropsychologia.2016.05.006

Fleming, J., Kennedy, S., Fisher, R., Gill, H., Gullo, M., & Shum, D. (2009). Validity of the Comprehensive Assessment of Prospective Memory (CAPM) for use with adults with traumatic brain injury. *Brain Impairment, 10*(1), 34-44. http://dx.doi.org/10.1375/brim.10.1.34

Fleming, J., Shum, D., Strong, J., & Lightbody, S. (2005). Prospective memory rehabilitation for adults with traumatic brain injury: A compensatory training programme. *Brain Injury, 19*(1), 1-10. http://dx.doi.org/10.1080/02699050410001720059

Foster, E. R., McDaniel, M. A., Repovš, G., & Hershey, T. (2009). Prospective memory in Parkinson disease across laboratory and self-reported everyday performance. *Brain Injury, 23*(3), 347-358. http://dx.doi.org/10.1037/a0014692.Prospective

Gao, J. L., Cheung, R. T. F., Chan, Y. S., Chu, L. W., Lee, & T. M. C. (2013). Increased prospective memory interference in normal and pathological aging: Different roles of motor and verbal processing speed. *Aging, Neuropsychology, and Cognition, 20*(1), 80-100. http://dx.doi.org/10.1080/13825585.2012.672948

Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology, 4*(1), 141-185. http://dx.doi.org/10.1080/14792779343000059

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*(7), 493-503. http://dx.doi.org/10.1037/0003-066X.54.7.493

Graf, P., & Uttl, B. (2001). Prospective memory: A new focus for research. *Consciousness and Cognition, 10*(4), 437-450. http://dx.doi.org/10.1006/ccog.2001.0504

Grilli, M. D., & McFarland, C. P. (2011). Imagine that: Self-imagination improves prospective memory in memory-impaired individuals with neurological damage. *Neuropsychological Rehabilitation, 21*(6), 847-859. http://dx.doi.org/10.1080/09602011.2011.627263.

Guynn, M. J. (2003). A two-process model of strategic monitoring in event-based prospective memory: Activation/retrieval mode and checking. *International Journal of Psychology, 38*(4), 245-256. http://dx.doi.org/10.1080/00207590344000178

Hannon, R., Adams, P., Harrington, S., Fries-Dias, C., & Gipson, M. T. (1995). Effects of brain injury and age on prospective memory self-rating and performance. *Rehabilitation Psychology, 40*(4), 289-298. http://dx.doi.org/10.1037/0090-5550.40.4.289

Harrinson, T. L., & Einstein, G. O. (2010). Prospective memory: are preparatory attentional processes necessary for a single focal cue? *Memory & Cognition, 38*(7), 860-867. http://dx.doi.org/10.3758/MC.38.7.860

Heckhausen, H., & Beckmann, J. (1990). Intentional action and action slips. *Psychological Review, 97*(1), 36-48. http://dx.doi.org/10.1037/0033-295X.97.1.36

Heffernan, T., & Ling, J. (2001). The impact of Eysenck's extraversion-introversion personality dimension on prospective memory. *Scandinavian Journal of Psychology, 42*(4), 321-325. http://dx.doi.org/10.1111/1467-9450.00243

Henry, J. D., MacLeod, M. S., Phillips, L. H., & Crawford, J. R. (2004). A meta-analytic review of prospective memory and aging. *Psychology and Aging, 19*(1), 27-39. http://dx.doi.org/10.1037/0882-7974.19.1.27

Hicks, J. L., Marsh, R. L., & Russel, E. J. (2000). The properties of retention interval and their effect on retaining prospective memories. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*(5), 1160-1169. http://dx.doi.org/10.1037/0278-7393.26.5.1160

Khoyratty N. B., Wang, Y., O'Gorman, Lloyd, C., Williams, P. L., Chan, R. C., & Shum, D. (2015). Forming implementation intentions improves prospective memory in early psychosis. *Psychiatric Research, 228*(3), 265-271. http://dx.doi.org/10.1016/j.psychres.2015.05.101.

Kliegel, M., Jäger, T., & Phillips, L. (2008). Adult age differences in event-based prospective memory: A meta-analysis on the role of focal versus nonfocal cues. *Psychology and Aging, 23*(1), 203-208. http://dx.doi.org/10.1037/0882-7974.23.1.203

Kliegel, M., Mackinlay, R., & Jäger, T. (2008). Complex prospective memory: Development across the lifespan and the role of task interruption. *Developmental Psychology*, *44*(2), 612-617. http://dx.doi.org/10.1037/0012-1649.44.2.612

Kliegel, M., Mahy, C. E. V., Voigt, B., Henry, J. D., Rendell, P. G., & Aberle, I. (2013). The development of prospective memory in young school children: The impact of ongoing task absorption, cue salience, and cue centrality. *Journal of Experimental Child Psychology, 116*(4), 792–810. http://dx.doi.org/10.1016/j.jecp.2013.07.012

Kliegel, M., Martin, M., McDaniel, M. A., & Einstein, G. O. (2001). Varying the importance of a prospective memory task: differential effects across time- and event-based prospective memory. *Memory, 9*(1), 1-11. http://dx.doi.org/10.1080/09658210042000003

Kliegel, M., McDaniel, M. A., & Einstein, G. O. (2000). Plan formation, retention, and execution in prospective memory: A new approach and age-related effects. *Memory & Cognition, 28*(6), 1041-1049. http://dx.doi.org/10.3758/BF03209352

Kopp, U. A., & Thöne-Otto, A. I. T. (2003). Disentangling executive functions and memory processes in event-based prospective remembering after brain damage: A neuropsychological study. *International Journal of Psychology, 38*(4), 229-235. http://dx.doi.org/10.1080/00207590244000205

Kvavilashvili, L. (1987). Remembering intention as a distinct form of memory. *British Journal of Psychology*, *78*(4), 507-518. http://dx.doi.org/10.1111/j.2044-8295.1987.tb02265.x

Kvavilashvili, L. (1992). Remembering intentions: A critical review of existing experimental paradigms. *Applied Cognitive Psychology*, *6*(6), 507-524. http://dx.doi.org/10.1002/acp.2350060605

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*(5), 864-875. http://dx.doi.org/10.1080/17470218.2012.721379

Kvavilashvili, L., Kornbrot, D. E., Mash, V., Cockburn, J., & Milne, A. (2009). Differential effects of age on prospective and retrospective memory tasks in young, young-old, and old-old adults. *Memory*, *17*(2), 180-196. http://dx.doi.org/10.1080/09658210802194366

Leirer, V. O., Tanke, E. D., & Morrow, D. G. (1994). Time of day and naturalistic prospective memory. *Experimental Aging Research, 20*(2), 127-134. http://dx.doi.org/10.1080/03610739408253958

Loftus, E. F. (1971). Memory for intentions: The effect of presence of a cue and interpolated activity. *Psychonomic Science, 23*(4), 315-316. http://dx.doi.org/10.3758/BF03336128

Lourenço J. S., White K., & Maylor E. A. (2013). Target context specification can reduce costs in nonfocal prospective memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 39*(6), 1757–1764. http://dx.doi.org/10.1037/a0033702

Mackinlay, R. J., Kliegel, M., & Mäntylä, T. (2009). Predictors of time-based prospective memory in children. *Journal of Experimental Child Psychology, 102*(3), 251-264. http://dx.doi.org/10.1016/j.jecp.2008.08.006

Mahy, C. E. V., Moses, L. J., & Kliegel, M. (2014). The development of prospective memory in children: An executive framework. *Developmental Review, 34*(4), 305-326. http://dx.doi.org/10.1016/j.dr.2014.08.001

Malle, B. F., & Knobe, J. (2001). The distinction between desire and intention: A folk-conceptual analysis. In B. F. Malle, L. J. Moses, & D. A. Baldwin (Eds.), *Intentions and intentionality: Foundations of social cognition* (pp. 45-67). Cambridge, MA, US: The MIT Press.

Marsh, R. L., & Hicks, J. L. (1998). Event-based prospective memory and executive control of working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 24*(2), 336-349. http://dx.doi.org/10.1037/0278-7393.24.2.336

Marsh, R. L., Hancock, T. W., & Hicks, J. L. (2002). The demands of an ongoing activity influence the success of event-based prospective memory. *Psychonomic Bulletin & Review, 9*(3), 604-610. http://dx.doi.org/10.3758/BF03196319

Marsh, R. L., Hicks, J. L., & Landau, J. D. (1998). An investigation of everyday prospective memory. *Memory & Cognition, 26*(4), 633-643. http://dx.doi.org/10.3758/BF03211383

Mattli, F., Zöllig, J., & West, R. (2011). Age-related differences in the temporal dynamics of prospective memory retrieval: A lifespan approach. *Neuropsychologia, 49*(12), 3494-3504. http://dx.doi.org/10.1016/j.neuropsychologia.2011.08.026

Maylor, E. A. (1993). Aging and forgetting in prospective and retrospective memory tasks. *Psychology and Aging, 8*(3), 420-428. http://dx.doi.org/10.1037/0882-7974.8.3.420

McDaniel, M. A, & Einstein, G. O. (2000). Strategic and automatic processes in prospective memory retrieval: A multiprocess framework. *Applied Cognitive Psychology, 14*(7), S127-S144. http://dx.doi.org/10.1002/acp.775

McDaniel, M. A., & Einstein, G. O. (2007). *Prospective memory: An overview and synthesis of an emerging field*. Thousand Oaks, CA, US: SAGE Publications.

McDaniel, M. A., & Einstein, G. A. (2011). The neuropsychology of prospective memory in normal aging: A componential approach. *Neuropsychologia, 49*(8), 2147-2155. http://dx.doi.org/10.1016/j.neuropsychologia.2010.12.029

McDaniel, M. A., & Scullin, M. K. (2010). Implementation intention encoding does not automatize prospective memory. *Memory & Cognition, 38*(2), 221-232. http://dx.doi.org/10.3758/MC.38.2.221

McDaniel, M. A., Glisky, E. L., Rubin, S. R., Guynn, M. J., & Routhieaux, B. C. (1999). Prospective memory: A neuropsychological study. *Neuropsychology, 13*(1), 103-110. http://dx.doi.org/10.1037/0894-4105.13.1.103

McDaniel, M. A., LaMontagne, P., Beck, S. M., Scullin, M. K., & Braver, T. S. (2013). Dissociable neural routes to successful prospective memory. *Psychological Science, 24*(9), 1791-1800. http://dx.doi.org/10.1177/0956797613481233

McDaniel, M. A., Robinson-Riegler, B., & Einstein, G. O. (1998). Prospective remembering: Perceptually driven or conceptually driven processes? *Memory & Cognition, 26*(1), 121-134. http://dx.doi.org/10.3758/BF03211375

McDaniel, M. A., Shelton, J. T., Breneiser, J. E., Moynan, S., & Balota, D. A. (2011). Focal and non-focal prospective memory performance in very mild dementia: A signature decline. *Neuropsychology*, *25*(3), 387-396. http://dx.doi.org/10.1037/a0021682.

McDaniel, M. A., Umanath, S., Einstein, G. O., & Waldum, E. R. (2015). Dual pathways to prospective remembering. *Frontiers in Human Neuroscience, 9*, 392. http://dx.doi.org/10.3389/fnhum.2015.00392

McDonal-Miszczak, L., Gould, O. N., & Tychynski, D. (1999). Metamemory predictors of prospective and restrospective memory performance. *The Journal of General Psychology, 126*(1), 37–52. http://dx.doi.org/10.1080/00221309909595350

McFarland, C, & Glisky, E. (2012). Implementation intentions and imagery: Individual and combined effects on prospective memory among young adults. *Memory & Cognition, 40*(1), 62-69. http://dx.doi.org/10.3758/s13421-011-0126-8.

McFarland, C. P., & Glisky, E. L. (2009). Frontal lobe involvement in a task of time-based prospective memory. *Neuropsychologia, 57*(7), 1660-1669. http://dx.doi.org/10.1016/j.neuropsychologia.2009.02.023
McFarland, C., & Glisky, E. (2011). Implementation intentions and prospective memory among older adults: An investigation of the role of frontal lobe function. *Aging, Neuropsychology, and Cognition, 18*(6),633-652. http://dx.doi.org/10.1080/13825585.2011.613449
Meacham, J. A., & Singer, J. (1977). Incentive effects in prospective remembering. *Journal of Psychology, 97*(2), 191-197. http://dx.doi.org/10.1080/00223980.1977.9923962
Meeks, T. J., Hicks, J. L., & Marsh, R. L. (2007). Metacognitive awareness of event-based prospective memory. *Consciousness and Cognition, 16*(4), 997–1004. http://dx.doi.org/10.1016/j.concog.2006.09.005
Mioni, G., Rendell, P. G., Terrett, G., & Stablum, F. (2015) Prospective memory performance in traumatic brain injury patients: a study of implementation intentions. *Journal of International Neuropsychological Society, 21*(4), 305-313. http://dx.doi.org/10.1017/S1355617715000211
Morris, C. D., Bransford, J. D., & Franks, J. J. (1977). Levels of processing versus transfer appropriate processing. *Journal of Verbal Learning and Verbal Behavior, 16*(5), 519-533. http://dx.doi.org/10.1016/s0022-5371(77)80016-9
Neroni,, M. A., Gamboz, N., & Brandimonte, M. A. (2014). Does episodic future thinking improve prospective remembering? *Consciousness and Cognition, 23*(1), 53-62. http://dx.doi.org/10.1016/j.concog.2013.12.001
Niedźwieńska, 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*(1-2), 58-83. http://dx.doi.org/10.1080/13825585.2011.628374
Nigro, G., Brandimonte, M. A., Cicogna, P., & Cosenza, M. (2014). Episodic future thinking as a predictor of children's prospective memory. *Journal of Experimental Child Psychology, 127*, 82-94. http://dx.doi.org/10.1016/j.jecp.2013.10.013
Norman, D., & Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. In R. J. Davidson, G. E. Schwarts, & D. Shapiro (Eds.), *Consciousness and self-regulation: Advances in research and theory* (Vol. 4, pp. 1-18). New York: Plenum Press.
Oksanen, K. M., Waldum, E. R., McDaniel, M. A., & Braver, T. S. (2014). Neural mechanisms of time-based prospective memory: Evidence for transient monitoring. *PloS ONE, 9*(3), e92123. http://dx.doi.org/10.1371/journal.pone.0092123
Okuda, J., Fujii, T., Ohtake, H., Tsukiura, T., Yamadori, A., Frith, C. D., & Burgess, P. W. (2007). Differential involvement of regions of rostral prefrontal cortex (Brodmann area 10) in time- and event-based prospective memory. *International Journal of Psychophysiology, 64*(3), 233-246. http://dx.doi.org/10.1016/j.ijpsycho.2006.09.009
Okuda, J., Fujii, T., Yamadori, A., Kawashima, R., Tsukiura, T., Fukatsu, R., …Fukuda, H. (1998). Participation of the prefrontal cortices in prospective memory: Evidence from a PET study in humans. *Neuroscience Letters, 253*(2), 127-130. http://dx.doi.org/10.1016/S0304-3940(98)00628-4
Potvin, M. J., Rouleau, I., Audy, J., Charbonneau, S., & Giguère, J. F. (2011). Ecological prospective memory assessment in patients with traumatic brain injury. *Brain Injury, 25*(2), 192–205. http://dx.doi.org/10.3109/02699052.2010.541896
Rendell, P. G., & Craik, F. I. M. (2000). Virtual and actual week: Age-related differences in prospective memory. *Applied Cognitive Psychology, 14*(7), S43–S62. http://dx.doi.org/10.1002/acp.770
Rendell, P. G., & Henry, J. D. (2009). A review of virtual week for prospective memory assessment: Clinical implications. *Brain Impairment, 10*(1), 14–22. http://dx.doi.org/10.1375/brim.10.1.14
Roche, N. L., Fleming, J. M., & Shum, D. H. K. (2002). Self-awareness of prospective memory failure in adults with traumatic brain injury. *Brain Injury, 16*(11), 931-945. http://dx.doi.org/10.1080/02699050210138581
Roche, N. L., Moody, A., Szabo, K., Fleming, J. M., & Shum, D. H. K. (2007). Prospective memory in adults with traumatic brain injury: An analysis of perceived reasons for remembering and forgetting. *Neuropsychological Rehabilitation, 17*(3), 314–34. http://dx.doi.org/10.1080/09602010600831004
Roediger, H. L. (1996). Commentary: Prospective memory and episodic memory. In M. Brandimonte, G. O. Einstein, & M. A. McDaniel (Eds.), *Prospective memory: Theory and applications* (pp. 149-155). Mahwah, NJ: Erlbaum.

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology, 35*(9), 677-688. http://dx.doi.org/10.1037/0022-3514.35.9.677

Rönnlund, M., Vestergren, P., Mäntylä, T., & Nilsson, L. G. (2011). Predictors of self-reported prospective and retrospective memory in a population-based sample of older adults. *The Journal of Genetic Psychology, 172*(3), 266-284. http://dx.doi.org/10.1080/00221325.2010.538450

Rose, N., Rendell, P. G., McDaniel, M. A., Aberle, I., & Kliegel, M. (2010). Age and individual differences in prospective memory during a "virtual week": The roles of working memory, vigilance, cue focality, and task habituation. *Psychology and Aging, 25*(3), 595-605. http://dx.doi.org/10.1037/a0019771

Rummel, J., Einstein, G. O., & Rampey, H. (2012). Implementation-intention encoding in a prospective memory task enhances spontaneous retrieval of intentions. *Memory, 20*(8), 803-817. http://dx.doi.org/10.1080/09658211.2012.707214

Salthouse, T. A. (2009). When does age-related cognitive decline begin? *Neurobiology of Aging, 30*(4), 507-514. http://dx.doi.org/10.1016/j.neurobiolaging.2008.09.023

Salthouse, T.A., Berish, D.E., & Siedlecki, K.L. (2004). Construct validity and age sensitivity of prospective memory. *Memory & Cognition, 32*(7),1133-1148. http://dx.doi.org/10.3758/BF03196887

Schacter, D. L., & Tulving, E. (1994). What are the memory systems of 1994? In D. L. Schacter & E. Tulving (Eds.), *Memory systems* (pp. 1-38). Cambridge, MA: MIT Press.

Schacter, D. L., Addis, D. R., & Buckner, R. L. (2007). Remembering the past to imagine the future: The prospective brain. *Nature Reviews Neuroscience, 8*(9), 657-661. http://dx.doi.org/10.1038/nrn2213

Schnitzspahn, K. M., & Kliegel, M. (2009). Age effects in prospective memory performance within older adults: The paradoxical impact of implementation intentions. *European Journal of Ageing, 6*(2), 147-155. http://dx.doi.org/10.1007/s10433-009-0116-x

Schnitzspahn, K. M., Ihle, A., Henry, J. D., Rendell, P. G., & Kliegel, M. (2011). The age prospective memory-paradox: An exploration of possible mechanisms. *International Psychogeriatrics, 23*(4), 583-592. http://dx.doi.org/10.1017/S1041610210001651

Schnitzspahn, K. M., Stahl, C., Zeintl, M., Kaller, C.P., & Kliegel, M. (2013). The role of shifting, updating, and inhibition in prospective memory performance in young and older adults. *Developmental Psychology, 49*(8), 1544-1553. http://dx.doi.org/10.1037/a0030579

Schnitzspahn, K. M., Thorley, C., Phillips, L. E., Voigt, B., Threadgold, E., Hammond, E. R., …Kliegel, M. (2014). Mood impairs time-based prospective memory in young but not older adults: The mediating role of attentional control. *Psychology and Aging, 29*(2), 264-270. http://dx.doi.org/10.1037/a0036389

Schnitzspahn, K. M., Zeintl, M., Jäger, T. & Kliegel, M. (2011). Metacognition in prospective memory: Are performance predictions accurate? *Canadian Journal of Experimental Psychology, 65*(1), 19-26. http://dx.doi.org/10.1037/a0022842

Scullin, M. K., Bugg, J. M., & McDaniel, M. A. (2012). Whoops, i did it again: Commission errors in prospective memory. *Psychology and Aging, 27*(1), 46-53. http://dx.doi.org/10.1037/a0026112

Scullin, M. K., Bugg, J. M., McDaniel, M. A., & Einstein, G. O. (2011). Prospective memory and aging: Preserved spontaneous retrieval, but impaired deactivation, in older adults. *Memory & Cognition*, *39*(7), 1232-1240. http://dx.doi.org/10.3758/s13421-011-0106-z

Scullin, M. K., McDaniel, M. A, & Einstein, G. O. (2010). Control of cost in prospective memory: Evidence for spontaneous retrieval processes. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *36*(1), 190-203. http://dx.doi.org/10.1037/a0017732

Scullin, M. K., McDaniel, M. A, & Shelton, J. T. (2013). The Dynamic Multiprocess Framework: Evidence from prospective memory with contextual variability. *Cognitive Psychology, 67*(1-2), 55-71. http://dx.doi.org/10.1016/j.cogpsych.2013.07.001

Shallice, T., Fletcher, P., Frith, C. D., Grasby, P., Frackowiak, R. S., & Dolan, R. J. (1994). Brain regions associated with acquisition and retrieval of verbal episodic memory. *Nature, 368*(6472), 633-635. http://dx.doi.org/10.1038/368633a0

Shum, D., Cahill, A., Hohaus, L. C., O'Gorman, J. G., & Chan, R. C. K. (2013). Effects of aging, planning, and interruption on complex prospective memory. *Neuropsychological Rehabilitation*, *23*(1), 1-19. http://dx.doi.org/10.1080/09602011.2012.716761

Shum, D., Fleming, J., & Neulinger, K. (2002). Prospective memory and traumatic brain injury: A review. *Brain Impairment, 3*(1), 1–16. http://dx.doi.org/10.1375/brim.3.1.1

Shum, D., Fleming, J., Gill, H., Gullo, M. J., & Strong, J. (2011). A randomized controlled trial of prospective memory rehabilitation in adults with traumatic brain injury. *Journal of Rehabilitation Medicine, 43*(3), 216-223. http://dx.doi.org/10.2340/16501977-0647

Simons, J. S., Schölvinck, M. L., Gilbert, S. J., Frith, C. D., & Burgess, P. W. (2006). Differential components of prospective memory? Evidence from fMRI. *Neuropsychologia, 44*(8), 1388-1397. http://dx.doi.org/10.1016/j.neuropsychologia.2006.01.005

Smith, G., Della Sala, S. D., Logie, R. H., & Maylor, E. A. (2000). Prospective and retrospective memory in normal ageing and dementia: A questionnaire study. *Memory, 8*(5), 311–321. http://dx.doi.org/10.1080/09658210050117735

Smith, R. E. (2003). The cost of remembering to remember in event-based prospective memory: Investigating the capacity demands of delayed intention performance. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *29*(3), 347-361. http://dx.doi.org/10.1037/0278-7393.29.3.347

Smith, R. E. (2010). What costs do reveal and moving beyond the cost debate: Reply to Einstein and McDaniel. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 36*(4), 1089-1095. http://dx.doi.org/10.1037/a0019183

Smith, R. E., & Bayen, U. J. (2004). A multinomial model of event-based prospective memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*(4), 756-777. http://dx.doi.org/10.1037/0278-7393.30.4.756

Smith, R. E., & Bayen, U. J. (2005). The effects of working memory resource availability on prospective memory: A formal modeling approach. *Experimental Psychology, 52*(4), 243-256. http://dx.doi.org/10.1027/1618-3169.52.4.243

Smith, R. E., & Bayen, U. J. (2006). The source of adult age differences in event-based prospective memory: A multinomial modeling approach. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *32*(3), 623-635. http://dx.doi.org/10.1037/0278-7393.32.3.623

Smith, R. E., Hunt, R. R., McVay, J. C., & McConnell, M. D. (2007). The cost of event-based prospective memory: salient target events. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*(4), 734-746. http://dx.doi.org/10.1037/0278-7393.33.4.734

Smith, R. E., Persyn, D., & Butler, P. (2011). Prospective memory, personality, and working memory. *Zeitschrift Für Psychologie, 219*(2), 108-116. http://dx.doi.org/10.1027/2151-2604/a000055

Smith, R. E., Rogers, M. D., McVay, J. C., Lopez, J. A., & Loft, S. (2014). Investigating how implementation intentions improve non-focal prospective memory tasks. *Consciousness and Cognition, 27*, 213-230. http://dx.doi.org/10.1016/j.concog.2014.05.003

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin, 121*(3), 371-394. http://dx.doi.org/10.1037/0033-2909.121.3.371

Terry, W. S., (1988). Everyday forgetting: Data from a diary study. *Psychological Reports, 62*(1), 299-303. http://dx.doi.org/10.2466/pr0.1988.62.1.299

Thöne-Otto, A. I., & Walther, K. (2003). How to design an electronic memory aid for brain-injured patients: Considerations on the basis of a model of prospective memory. *International Journal of Psychology, 38*(4), 236-244. http://dx.doi.org/10.1080/00207590344000169

Tulving, E. (1985). How many memory systems are there? *American Psychologist, 40*(4), 385-398. http://dx.doi.org/10.1037/0003-066X.40.4.385

Tulving, E. (2002). Episodic memory: From mind to brain. *Annual Review of Psychology, 53*(1), 1-25. http://dx.doi.org/10.1146/annurev.psych.53.100901.135114

Umeda, S., Kurosaki, Y., Terasawa, Y., Kato, M., & Miyahara, Y. (2011). Deficits in prospective memory following damage to the prefrontal cortex. *Neuropsychologia, 49*(8), 2178-2184. http://dx.doi.org/10.1016/j.neuropsychologia.2011.03.036

Uttl, B. (2008). Transparent meta-analysis of prospective memory and aging. *PLoS ONE, 3*(2): e1568. http://dx.doi.org/10.1371/journal.pone.0001568

Uttl, B. (2011). Transparent meta-analysis: Does aging spare prospective memory with focal vs. non-focal cues? *PLoS ONE, 6*(2): e16618. http://dx.doi.org/10.1371/journal.pone.0016618.

Uttl, B., & Kibreab, M. (2011). Self-report measures of prospective memory are reliable but not valid. *Canadian Journal of Experimental Psychology*, *65*(1), 57-68. http://dx.doi.org/10.1037/a0022843

Uttl, B., White, C. A., Gonzalez, D. W., McDouall, J., & Leonard, C. A. (2013). Prospective memory, personality, and individual differences. *Frontiers in Psychology, 4*, 130. http://dx.doi.org/10.3389/fpsyg.2013.00130

van den Broek, M., Downes, J., Johnson, Z., Dayus, B., & Hilton, N. (2000). Evaluation of an electronic memory aid in the neuropsychological rehabilitation of prospective memory deficits. *Brain Injury, 14*(5), 455-462.

Voigt, B., Mahy, C. E., Ellis, J., Schnitzspahn, K., Krause, I., Altgassen, M., & Kliegel, M. (2014). The development of time-based prospective memory in childhood: The role of working memory updating. *Developmental Psychology, 50*(10), 2392-2404. http://dx.doi.org/10.1037/a0037491

Waldron, B., Grimson, J., Carton, S., & Blanco-Campal, A. (2012). Effectiveness of an unmodified personal digital assistant as a compensatory strategy for prospective memory failures in adults with an ABI. *Irish Journal of Psychology, 33*(1), 29-42. http://dx.doi.org/10.1080/03033910.2012.659044

Walter, S., & Meier, B. (2014). How important is importance for prospective memory? A review. *Frontiers in Psychology, 5*, 657. http://dx.doi.org/10.3389/fpsyg.2014.00657

West, R. (2007). The influence of strategic monitoring on the neural correlates of prospective memory. *Memory & Cognition, 35*(5),1034-1046. http://dx.doi.org/10.3758/BF03193476

West, R. (2011). The temporal dynamics of prospective memory: A review of the ERP and prospective memory literature. *Neuropsychologia, 49*(8), 2233-2245. http://dx.doi.org/10.1016/j.neuropsychologia.2010.12.028

West, R., & Craik, F. I. M. (1999). Age-related decline in prospective memory: The roles of cue accessibility and cue sensitivity. *Psychology and Aging, 14*(2), 264-272. http://dx.doi.org/10.1037//0882-7974.14.2.264

West, R., Jakubek, K., & Wymbs, N. (2002). Age-related declines in prospective memory: Behavioral and electrophysiological evidence. *Neuroscience & Biobehavioral Reviews, 26*(7), 827-833. http://dx.doi.org/10.1016/S0149-7634(02)00069-6

Wilson, B. A., Cockburn, J. M., & Baddeley, A. D. (1985). *The Rivermead Behavioral Memory Test. Reading*, England/Gaylord, MI: Thames Valley Test Company/National Rehabilitation Services.

Zeintl, M., Kliegel, M., & Hofer, S. M. (2007). The role of processing resources in age-related prospective and retrospective memory within old age. *Psychology and Aging, 22*(4), 826-834. http://dx.doi.org/10.1037/0882-7974.22.4.826

Zeintl, M., Kliegel, M., Rast, P., & Zimprich, D. (2006). Prospective memory complaints can be predicted by prospective memory performance in older adults. *Dementia and Geriatric Cognitive Disorders, 22*(3), 209–215. http://dx.doi.org/10.1159/000094915

Zimmermann, T. D., & Meier, B. (2006). The rise and decline of prospective memory across the lifespan. *The Quarterly Journal of Experimental Psychology, 59*(12), 2040-2046. http://dx.doi.org/10.1080/17470210600917835

Zimmermann, T. D., & Meier, B. (2010). The effect of implementation intentions on prospective memory performance across the lifespan. *Applied Cognitive Psychology, 24*(5), 645-658. http://dx.doi.org/10.1002/acp.1576

Zöllig J., West R., Martin M., Altgassen M., Lemke U., & Kliegel M. (2007). Neural correlates of prospective memory across the lifespan. *Neuropsychologia, 45*(14), 3299-3314. http://dx.doi.org/10.1016/j.neuropsychologia.2007.06

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