Review of Literature
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It is difficult to imagine life without memory. There would be no experience of joyful moments, any guilt or painful recollection without memory; life would be dull without past experiences and future plans; each moment would be a fresh one.

Literature suggest that from ancient times, memory has been a topic of research, discussion or dialogue, among the scholars of various disciplines. Although, the history of experimental studies began with the work of William James. Before his work, Plato a Greek philosopher has also quoted memory as marks on waxy material in the brain. Due to the dominance of behaviorism in the first half of the twentieth century, the topic of memory could not draw the attention of psychologists. But after the cognitive revolution of the 1960s, there was a heightened interest in memory research.

Research in memory has suggested various dichotomies such as short term/long term memory, semantic/episodic memory, declarative/procedural memory and explicit/implicit memory. A more recent one to be added to this list of dichotomies is the retrospective/prospective memory. Meacham and Singer (1977) are credited with coining the term ‘prospective memory’ (PM). They also distinguished between retrospective memory (RM) and PM.

One of the characteristics of human beings is that most of the behavior is future oriented. Many of our actions can be best understood as goal-directed and those goals are
to be realized in future. The realization of future goals and intentions create the need for understanding PM. Without remembering our goals, our behavior would lose its meaning. PM can be understood as the realization of delayed intention such as attending a meeting at a particular time.

Unlike PM, RM involves remembering of the past information such as remembering the events of the previous day. In the daily course of life, PM is required for future goals and plans whereas RM is required to recollect the past. It is thus clear that both are important in daily life.

Although a large amount of work has been done in RM, there is relatively less research that has investigated PM. Various aspects of PM need to be investigated. A gap exists in literature as little is known about PM (Baddeley & Wilkins, 1993; Ceci & Bronfenbrenner, 1985; Dobbs & Rule, 1987; Einstein & McDaniel, 1990; Harris, 1983; Meacham & Leimen, 1982).

The present chapter provides a review of the research pertaining to PM and various factors affecting PM.

### 2.1 Factors Affecting Prospective Memory

The factors influencing PM can be classified into two broad categories: *cognitive factors* and *non-cognitive factors*.

#### 2.1.2 Cognitive factors

Under this category may be included such factors as retrieval cues, content, familiarity, distinctiveness, conceptual processing, time of the day, cognitive resources,
divided attention, intention-superiority effect, working memory, the role of reminder, delay, time scale, enactment of PM task, metamemory, and transfer of appropriate processing.

2.1.2.1 Retrieval Cues

The first experimental studies of PM were conducted by Meacham and his associates (Mecham & Leiman, 1975; Mecham & Singer, 1977). Mecham and Leiman (1975) tried to examine the effect of retrieval cues on remembering of intention in a naturalistic setting. Subjects were required to send postcards to the experimenter on the stipulated day. The results showed that retrieval cues did not enhance PM performance. The study was plagued with several limitations. Being a naturalistic study, there was least control of experimenter over the whole process.

In another study, Mecham and Singer (1977) found that the cues significantly improved the PM performance and that a moderate level of incentive enhanced PM performance. Apart from this, they also reported that there was no relation between PM and RM.

2.1.2.2 Retrospective memory-

The relationship between PM and RM was studied by Wilkins and Baddeley (1978) in a naturalistic setting. The subjects who participated in the traditional free recall of unrelated words were also required to monitor their medicine taking action. A negative relationship between PM and RM was found.

However, one limitation of that study was that subjects knew in advance that they were participating in an experiment concerned with the study of PM. Due to this prior
knowledge subjects might have taken special care in responding to the intention related task.

Other studies (Huppert, Johnson, & Nickson, 2000; Wilson, Cockburn, Baddeley & Hiorns, 1989) found a positive relationship between prospective and retrospective memories.

Kvavilashvili (1987) conducted a study to explore the relationship between remembering intention and remembering content, and the factors (sex, age, and retrieval cues) which influence the remembering of intention. The importance of intention and process of preservation were manipulated. Kvavilashvili (1987) defined perseveration as the involuntary rehearsal of intention in mind by the subjects. The probability of remembering intention at an appropriate time $P$ was then estimated as $P = (\text{Importance of intention}) \times (\text{number of perseverations}) + b$, where $b$ is a constant.

The study demonstrated no relationship between remembering of intention and remembering of content. The study indicated that the two kinds of memories dealt with separate memory systems. The intervening variable affected prospective memory only indirectly through preservation. The results also showed that the probability of preservation occurring during the intervening period depends on the character of the intervening period but not on the importance of intention.

### 2.1.2.3. Distinctiveness and Familiarity

Considering the noticing + search model where noticing is an automatic process, McDaniel and Einstein (1993) proposed that manipulating distinctiveness and familiarity of the target event should influence PM performance.
They defined distinctiveness as a target word’s familiarity relative to the majority of the items in the list. McDaniel and Einstein (1993) found support for their proposition by asking participants to learn and recall the items immediately and to press a key whenever a target word appeared on the screen.

In that experiment, short-term recall task was used to represent the ‘ongoing’ activity that embodied the prospective task. Pressing the key on keyboard represented PM task. It occurred only a few times throughout the experiment. Familiar and unfamiliar words were taken from category norms given by Battig and Montague (1969).

The study showed that prospective memory performance was better for unfamiliar and distinctive words than for familiar and non-distinctive words.

**2.1.2.4. Conceptual Processing**

The role of *conceptual processing* of the target event was studied by McDaniel, Robinson-Reigler, and Einstein, (1998). PM performance was better when the homographic words were the same between the formation of intention and later perception of the cue, as compared to a situation in which the target meaning was different at the retrieval time as compared to when the intention was formed.

A cognitive load effect was also demonstrated where performance was better when the target was studied semantically rather than non-semantically. Thus, the study showed that PM performance was influenced both by the quality of cue and cognitive load.
McGann, Ellis, and Milne (2000) extended these findings by conducting an experimental investigation using homophones as prospective cues that were embedded in sentences.

The results confirmed the earlier findings which state that Change in the meaning from planning to testing phase reduced the PM performance.

2.1.2.5. Conceptual Similarity

The role of conceptual similarity between ongoing task and PM task was investigated by Meier and Graf (2000). They assumed that if conceptual processing during ongoing task facilitates PM performance, then similar results may be obtained in the case of transfer appropriate processing (TAP), just like in RM test performance.

Transfer appropriate processing (TAP) is the assumption that RM test performance reflects the overlap between study and test phase processing. The experiment utilized both, perceptual processing of words as ongoing task and the conceptual processing as PM task.

Results were consistent with the TAP. The performance was higher when ongoing task and PM task matched (semantic vs. semantic or perceptual vs. perceptual) as compared to when they were different (semantic vs. perceptual processing).

2.1.2.6. Time of the day

Leirer, Decker, and Morrow (1994) studied the effect of time of the day and naturalistic PM of medication and appointment adherence. Unlike RM, performance on PM was better in the morning than midday and performance increased in the evening. The results can be explained on the basis of attentional capacity devoted to PM task.
Attentional capacity is negatively related to the activity level during different times of the day.

The results are consistent with the findings of McDaniel, Robinson-Reigler, and Einstein (1998) that cognitive loads are inversely related to the performance of PM.

2.1.2.7. Cognitive Resources

Goschke and Kuhl (1996) suggested that cognitive resources may or may not play a role in the realization of delayed intention. It depends on the demands of the particular task. When the intended action is simple, specified and the cue is well defined, then the realization of intention can entirely depend on the increased level of activation associated with the encoded intention and action schema.

This situation can be applied to both event-based and time-based PM tasks. Therefore, event-based and time-based prospective memories are not entirely separate entities. They seem to have a common thread.

Monitoring is not required in all the cases, particularly when cue and intended action are well specified and noticeable. When the cue is not easily noticeable then self-initiated retrieval of the PM cue is needed in order to carry out the intended action. PM cue is not noticeable in time-based task unless one looks at the clock.

In this task, monitoring of the clock as target time approaches is a better predictor of successful PM performance (Einstein, McDaniel, Smith, & Shaw, 1998). Adopting the same logic of monitoring and PM performance in a time-based task,
Einstein et al. (1998) stipulated that event-based task also benefits from monitoring of the target event, particularly when target cue is not easily noticeable and well defined.

### 2.1.2.8. Divided-Attention

It has been demonstrated that divided attention during the retrieval phase of PM task decreases the performance (Marsh, & Hicks, 1998a; McDaniel, Robison-Riegler, & Einstein, 1998). These studies clearly indicated that some sort of attentional capacity was necessary for the successful PM performance at least at the time of retrieval irrespective of the task being event-based or time-based.

PM task is stored in declarative memory (Goschke & Kuhl, 1993). The declarative intention is represented at a heightened level of activation. In their experiment, Goschke and Kuhl (1993) made subjects to learn pairs of actions in a script such as ‘clearing messy desk’.

After the scripts were learned, subjects were divided into two groups. One group was told that they would have to perform one of the two scripts. The other group was instructed that they would have to simply observe the experimenter perform one of the two scripts.

It was found that those subjects who were under prospective script were faster and more accurate than those who were under neutral script. The experiment clearly demonstrated the intention-superiority effect, and that it heightens the activation of declarative representation.
The intention-superiority effect is the finding that response latencies are faster for items related to an incomplete intention as compared with materials that have no associated intentionality (Marsh, Hicks, and Bink, 1998). The results are consistent with Anderson’s (1983) ACT* model of memory.

2.1.2.9. Intention-superiority effect

The intention-superiority effect in terms of Anderson’s (1983) ACT* network model of memory has got some additional empirical support. Mantyla (1993) found that priming increased later PM remembering. Primed items were better recalled than non-primed items. The intention-superiority effect was replicated by Marsh, Hicks, and Bink (1998).

2.1.2.10. Working-memory

The role of working memory in the realization of event-based intended action was investigated using different cognitive loads in a study by Marsh and Hicks (1998). PM performance declined when the cognitive load was higher for executive control. But different cognitive loads of articulatory suppression did not produce any decrement in PM.

A high cognitive load on visuospatial component requires high task monitoring. This resulted in a decline in the performance of PM. The low load of the visuospatial task does not require active monitoring and therefore does not affect PM negatively.

2.1.2.11. Role of reminder

PM is high in self-initiated processes. The question arises how reminders affect prospective memory performance. The role of reminder in PM performance was investigated by Guynn, McDaniel, and Einstein (1998).
There were two groups of subjects. In one group, subjects were reminded about the PM task during the retrieval interval, whereas no reminders were given to the other group. Though the reminders to do certain activity in the future increased the likelihood that the task will be performed, the most effective reminders were those which reminded of both the PM target event and the intended activity compared to no reminder at all.

The reminders that referred only to the target events did not facilitate PM. On the other hand, reminders that referred to the intended activity improved the PM performance but not to the level of reminders that referred to both the target event and intended activity.

2.1.2.12. Time Scale

Maylor, Chater, and Brown (2001) tried to investigate how memory retrieval depends on time scale. Subjects were given four minutes to recall what they did yesterday, last week and last year under retrospective condition.

Similarly, under prospective condition subjects were asked to recall within four minutes what they intended to do tomorrow, next week, or next year. The results were consistent with scale invariance. There was no significant difference across both the memories. There was a better recall on a PM task than RM task.

The study conducted by Maylor et al. (2001) again proved the intention superiority effect.

2.1.2.13. Cognitive Load, Delay, and Phonological Rehearsal

Stone, Dismukes, and Remington (2001) studied the effect of cognitive load, delay and phonological rehearsal on prospective memory. They developed a new paradigm that allows repeated measure of PM.
The results showed that high workload increased the errors in PM performance but increasing delay between the formation of intention and realization of intention had no effect. The short retention interval (3 to 5 minutes) employed by Stone et al. (2001) may be the reason for such a result.

There is a possibility that using long interval may give a different result. When the auditory variable was manipulated in the experiment, the performance on PM was reduced.

The reason could be that it prevented verbal rehearsal of the PM. The performance on background task was negatively affected only when there was a high workload and not by the opportunity of the rehearsal.

2.1.2.14. Effect of delay between formation of intention and realization of intention

Using the long retention interval Nigro and Cologne (2000) explored the effect of delay between the formation of intention and realization of intention in an experiment in which subjects performed in a two-phase event-based PM task.

The retention interval was varied as 10 minutes, 2 days, and 2 weeks. The results revealed following points:

(1) No effect of delay either on the occurrence of remembering or its accuracy, and

(2) a significant effect of task importance on the performance of prospective memory.

The results were later replicated by Stone et al. (2001) and Maylor et al. (2001).
In a study, Schaefer, Kazak, and Sagness (1998) investigated the effect of enactment on PM performance. Subjects were asked to remember to perform a task that they initially enacted, watched the experimenter performing the task, or had the task described to them.

They were required to perform the task in future. The results showed that self-enactment produced poorest PM performance. Schaefer et al. (1998) explained their findings on the basis of Lewin’s persistent tension system where it is assumed that the persisting tension system enhances recall of to-be-completed tasks.

2.1.2.15. Metamemory

PM clearly relies on a multidimensional set of cognitive processes. PM outside laboratory depends on to a large extent on metamemory. It refers to knowledge of people of how good or bad their memories are. What is their level of motivation, and what the completion of an intention requires?

As a consequence, people take steps to adopt strategies that will compensate for their own shortcomings. Marsh and Hicks (1998) found that people who use external aids like calendars and diaries to record forthcoming events rated themselves as having worse memory abilities, worse attentional capabilities and actually performed more poorly on objective measures of attention and memory as compared to those who do not use external aid and think themselves as having good memory and good attentional capacities (McDonald-Miszczak., Gould, & Tychynski, 1999. Similar results have been reported by Khan and Sharma (2005).
2.1.2.16. Priming

*Priming* refers to the presentation of a pre-stimulus event/cue that either facilitates or inhibits the processing of subsequent stimulus. Mantlya (1993) found that in an event-based PM task priming prospective response increased later prospective remembering. However, the effect of priming on time-based prospective memory has not been explored.

The above-mentioned literature review highlights the importance of cognitive variables in the performance of PM. Though the same variables are also important in RM, they do not play a similar role.

2.1.3 Non-cognitive and Clinical factors

This brief section on the non-cognitive factors and clinical factors is included to indicate the way researchers are getting interested in understanding PM. As compared to non-cognitive factors, clinical and pathological conditions have received more attention by researchers.

Researchers are trying to understand PM in pathological conditions such as: dementia (Maylor, Smith, Sala, & Logie, 2002), traumatic brain injury (Kopp & Thone-Otto, 2003; Shun, Valentine, & Cutmore, 1999), depression (Rude, Hertel, Jarrold, Covich, & Hedlund, 1999), acquired brain damage (Cockburn, 1996), Parkinson’s disease (Katai, Maruyama, & Lkeda, 2003), anxiety (Harris & Menzies, 1999), Alzheimer’s disease (McKitrick Camp, & Black, 1999); neurological disturbances (West, Herndon, & Ross-Munroe, 2001), Schizophrenia (Shum, Leung, Ungvari, & Tang, 2001).
Non-cognitive factors such as personality (Winograd, 1988; Meacham, 1988) and aging (Brooks & Gardiner, 1994; Einstein & McDaniel, 1990; Messer, Kyle, & Kvavlishavilli, 2000; Rendell, & Thomson, 1999) have also been studied.

Since the present dissertation focused on exploring the correlates of PM, the following is a description of the research objectives of this dissertation.

**Objectives of the Present Research:**

**Exploring the Correlates of Prospective Memory**

Against this backdrop and understanding of PM processes, the researcher aimed to identify and explore the correlates of PM. This would assist in gaining insight of more functionaries of PM.

1. **Depressive symptoms:** This research explored the effect of depressive symptoms on PM. Therefore it is important to understand the concept of affect as well. Affect refers to the experience of feeling or emotion. Affect is a key part of the process of an organism’s interaction with stimuli.

   The word also refers sometimes to affect display, which is "a facial, vocal, or gestural behavior that serves as an indicator of affect" (APA 2006). The term "affect" can be taken to indicate an instinctual reaction to stimulation occurring before the typical cognitive processes considered necessary for the formation of a more complex emotion.

   Zajonc (1980) asserts this reaction to stimuli is primary for human beings, and that it is the dominant reaction for lower organisms. Zajonc suggests affective reactions can occur without extensive perceptual and cognitive encoding and can be made sooner and with greater confidence than cognitive judgments (Zajonc, 1980).
Many theorists (e.g., Lazarus, 1982) consider affect to be post-cognitive. That is, affect is thought to be elicited only after a certain amount of cognitive processing of information has been accomplished. In this view, an affective reaction, such as liking, disliking, evaluation, or the experience of pleasure or displeasure, is based on a prior cognitive process in which a variety of content discriminations are made and features are identified, examined for their value, and weighted for their contributions (Brewin, 1989).

A divergence from a narrow reinforcement model for emotion allows for other perspectives on how affect influences emotional development. Thus, temperament, cognitive development, socialization patterns, and the idiosyncrasies of one's family or subculture are mutually interactive in non-linear ways.

As an example, the temperament of a highly reactive/low self-soothing infant may “disproportionately” affect the process of emotion regulation in the early months of life (Griffiths, 1997).

**Prospective Memory and Affect:**

Some theorists have researched on the affect and PM like Meacham and Kushner (1980) provided the earliest investigation that was concerned about the influence of unspecific emotion variables on prospective remembering.

These authors contrasted two competing hypotheses regarding the influence of emotional appraisal of an intended action on the probability of its execution. Meacham and Kushner’s (1980) study provided that the first evidence that the emotional valence of an intended action seems to exhibit effects on the likelihood that the task is remembered.
and carried out. For uncomfortable intentions, it seems that they are remembered very accurately, perhaps as a result of greater activation and/or rehearsal processes in memory.

However, such aversive intentions may have a relatively high probability of remaining unperformed.

To add on to this Investigation of the influence of unspecific negative emotions on prospective remembering is the questionnaire study by Schmidt (2004). Schmidt’s findings provided evidence that states of highly negative emotions may impair prospective remembering in everyday life.

Cockburn and Smith (1994) published the first study which investigated the impact of inner states of experienced anxiety on prospective memory performance in a sample of 119 adults. The findings by Cockburn and Smith indicated that high levels of anxiety might favor success in some PM tasks (rather than being deleterious for good performance, as could be expected from an intuitive standpoint).

Nigro and Cicogna (1999) applied both a time-based and an event-based PM task to a sample of 40 undergraduate students. Nigro and Cicogna (1999) interpreted the better performance of the highly anxious participants as evidence that anxiety leads people to monitor the environment and the passage of time more frequently, which might lead to better PM performance.

Harris and Menzies (1999) investigated the influence of the mood states of anxiety and depression on both PM and RM performance. Harris and Menzies (1999) provided evidence that negative emotional states might interfere with the accurate
remembering to carry out future intentions, but not with the accurate remembering of past information.

In a clinical study, Rude, Hertel, Jarrold, Covich, and Hedlund (1999) investigated whether patients suffering from major depression have deficits in the ability to perform intended actions. The results of Rude and colleagues (1999) conformed with their hypothesis that depression results in impairments in prospective memory tasks that require a high degree of controlled, self-initiated processing, a pattern that had already been found within the realm of retrospective memory (e.g., Hertel & Hardin, 1990; Hertel & Milan, 1994).

The above-mentioned studies show that there is some relationship between Affect and PM. PM challenges are universal in everyday life, and the practical import of frequent failures is likely to be significant for people who are also experiencing affective and other cognitive difficulties. The theoretical importance of such failures is also substantial, given the evidence for certain kinds of cognitive impairments in depression (Got lib, Roberts, & Gilboa, 1996).

Performance on time-based prospective task appears to rely on controlled, self-initiated processes (cf. Craik, 1986), and controlled, self-initiated processes are implicated in depression-related deficits on RM tasks (e.g., Hertel & Hardin, 1990).

Thus, the researcher is keen to investigate further the effect of depressive symptoms on prospective memory.

2. Gender: Gender is a significant main factor for PM. Females have performed significantly better than males on almost all subscales of PM. It is possible that females
were accurate about the upcoming tasks that needed to be executed, were keeping track of the time, solving word search puzzles without getting too involved in it, and thus managed to perform better on the PM tasks.

Studies related to gender asymmetries in PM are few. For instance, a study by Tan and Kvavilashvili (2003) that aimed to assess gender differences in event and time PM found that females performed significantly better at event-based PM (for both distinctive and non-distinctive embedded cues) than males. They supported these findings by proposing that females tended to depend more on metamemory processes and might have unconsciously processed for the presence of the environmental stimuli. However, within the same study, they did not find a gender difference for time-based PM task.

Thus, the researcher aimed to investigate the effect of gender on PM and RM in terms of cues and retention interval.

3. Nature and Importance of task: some researchers have observed that the perceived importance of the PM task (e.g. important appointments) seems to increase the likelihood of prospective remembering (Andrzejewski et.al., 1991; Kvavilashvili, 1987).

The few studies conducted on this issue do tend to show a positive relationship between perceived importance of the task and levels of prospective remembering (Kliegal et.al. in press). However, Winograd (1988) speculated that people make social attributions about how important another individual considers a PM task based on how successfully that individual remembers to do the task.

Thereby, the researcher focuses here on investigating the importance and nature of task as correlates of PM using a naturalistic paradigm.
4. Effects of substance use on prospective memory: It is now fairly well established that many substance-abusing populations report experiencing higher levels of PM failures in their daily lives, including heavy users of alcohol (e.g., Heffernan, Moss, & Ling, 2002), marijuana (e.g., McHale & Hunt, 2008), nicotine (e.g., Heffernan et al., 2005), and “ecstasy” (e.g., Heffernan, Jarvis, Rodgers, Scholey, & Ling, 2001).

However, only a handful of studies to date have used performance-based laboratory paradigms to examine the effects of substances abuse on PM ability.

In non-clinical samples, cigarette smoking (e.g., Heffernan, Clark, Bartholomew, Ling, & Stephens, 2010) and acute administration of alcohol (e.g., Leitz, Morgan, Bisby, Rendell, & Curran, 2009) and benzodiazepines (Rich, Svoboda, & Brown, 2006) are associated with lower PM.

Among young adults, binge-drinking (Heffernan et al., 2010) and use of cannabis (Bartholomew, Holroyd, & Heffernan, 2010) and ecstasy (Bedi & Redman, 2008a; cf. Montgomery, Hatton, Fisk, Ogden, & Jansari, 2010; Rendell, Gray, Henry, Tolan, 2007) have been linked to worse performance on naturalistic tasks of PM.

Finally, two recent clinical studies have shown evidence of deficits in both time- (Iudicello et al., 2011) and event-based (Rendell, Mazur, & Henry, 2009) PM in methamphetamine-dependent individuals, which may be driven by errors of cue detection and executive dyscontrol.

The current study aimed to investigate the nature of PM among the patients of substance abuse.

In this scientific endeavor of exploring the major correlates of PM the researcher will thus try to answer the following questions:
• How depressive symptoms influence prospective memory?

• How does gender correspond with a difference in prospective memory task performance?

• What is the relationship between task characteristics (nature and importance of task) & prospective memory?

• How does habit of substance abuse affect prospective memory?