



## Forming implementation intentions improves prospective memory in early psychosis



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### ABSTRACT

The study examined whether individuals with early psychosis are impaired in prospective memory (PM), that is, remembering to execute a planned intention in the future, and whether implementation intentions can improve their PM performance. Thirty participants with early psychosis and 33 healthy controls were randomly allocated to either an implementation intentions or control condition and completed a computerised event-based PM task. Participants were also administered two standardised tests of PM and an abbreviated IQ test. Results demonstrated that individuals with early psychosis showed PM deficits relative to healthy controls on the computerised PM task and on some standardised measures of PM. The PM performance of the early psychosis group benefited from forming implementation intentions. Implementation intentions was concluded to be an effective strategy for improving PM performance in individuals with early psychosis.

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### 1. Introduction

Prospective memory (PM) involves remembering to carry out a planned intention in the future, for example, taking medication at a particular time. The planned intention may be linked to a specific time (e.g., each morning at 7 am) or to the elapse of a particular time period (e.g., every four hours). In these cases, PM is described as time-based. Alternatively, the intention may be linked to a specific cue (e.g., post the letter at the first mail box), in which case it is termed event-based, or it may be linked to a specific activity (e.g., after breakfast), in which case it is described as activity-based. Although the intention has to be remembered, more than retrospective memory is involved in that the intended action has to be initiated at the appropriate time or in the presence of the appropriate cue, typically while engaged in other activities and without an external reminder.

Several tests of PM are now available. Some use self-report, such as the Brief Assessment of Prospective Memory (Man et al., 2011), which has test takers report their experience of memory lapses on PM tasks classified in terms of instrumental or everyday activities. Others, such as the Cambridge Prospective Memory Test (Wilson et al., 2005) have participants execute time-based and event-based tasks. PM can also be studied in the laboratory using a dual-task paradigm in which the participant has to complete an ongoing task within which the requirement for PM is embedded (Einstein and McDaniel, 1990; Einstein et al., 1995). The participant may be asked to respond, for example, to a sequence of stimuli presented via a computer screen and to execute an additional PM task when stimuli of a particular class are presented some time later.

PM is important because of its role in independent living. Without the capacity to self-initiate actions when intended, there is a loss of control over every-day functioning and with it the need for increased reliance on others. Deficits in PM have been found in older age individuals and in some patient groups. In one of the earliest studies of PM in patients with schizophrenia, Shum et al. (2004) employed a dual task paradigm to test for differences

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between patients and matched controls in time-based, event-based, and activity-based PM. Performance on all three PM measures was superior for control participants, but the difference was largest for the time-based measure. In a subsequent study that compared patients with schizophrenia, matched controls, and a non-clinical sample of individuals showing schizotypal personality features, Chan et al. (2008) replicated the differences between patients and controls found previously on time-, event-, and activity-based measures of PM, but with a different computer-based dual task. In addition to the objective measures of PM derived from the computer task, they tested for differences in subjective estimates of PM using the Prospective and Retrospective Memory Questionnaire (PRMQ; Smith et al., 2000). Contrary to the findings with the objective measures, there were no patient-control differences on the subjective PM measure, an effect that the authors attributed to the lack of awareness of their cognitive deficits. A meta-analysis of studies of PM in patients diagnosed with schizophrenia by Wang et al. (2009) found that deficits in PM performance were greater with time-based than event-based or activity based tasks. Aggregate PM performance across different types of PM was found to correlate negatively with duration of illness, medication dosage, general level of psychopathology, and age, and positively with education, and IQ. In other work, PM deficits were found to occur early in the course of the disorder (Lui et al., 2011; Zhou et al., 2012), and to be independent of general cognitive difficulties, executive function deficit, or problems with retrospective memory (Henry et al., 2007).

Deficits in PM in older age individuals were shown by Chasteen et al. (2001) to be remediable to some degree by having participants form implementation intentions. This strategy involved mentally rehearsing a plan of what they were to do when situational cues for action occurred at a later time. Implementation intentions specify if, when, and how a goal is to be achieved by mentally associating specific cues that may be encountered in the future with specific actions that, if taken, will ensure achievement of the goal (Gollwitzer, 1999). A meta-analysis by Gollwitzer and Sheeran (2006) showed the effectiveness of implementation intentions across a range of goals and situations. In the case of PM, they are assumed to work by replacing the need for top-down self-initiated action with automatic response to the situational cues when presented (Gilbert et al., 2009). Although both top-down and bottom-up processing are thought to be involved in PM, the latter has been shown to be of prime importance in dual-task paradigms where the PM cue forms part of the ongoing task (McDaniel et al., 2013).

In the study of Chasteen et al. (2001), participants in the implementation intentions condition imagined themselves performing the intended task (viz. writing the day of the week on the corner of a sheet of paper) and then said aloud that they intended to perform the task. Twice as many participants in this condition completed the intended task as those in conditions that had participants rehearse the intention or instructed participants to remember. Liu and Park (2004) further demonstrated the effectiveness of implementation intentions in an older age sample required to monitor their blood glucose levels. Participants in an implementation intentions condition were twice as likely to perform the self-care task as those in either of two control conditions. Implementation intentions has also shown to be an effective strategy for improving PM performance in individuals with schizotypal personality disorder (Chen et al., 2014).

In examining the effectiveness of implementation intentions, Smith et al. (2014) drew attention to an important distinction for PM as assessed with the dual task paradigm. The PM cue can be part of the ongoing task such that it is part of the processing required for accurate task completion, in which case it is described as focal, or it may not be highly integrated with the ongoing task,

in which case it is non-focal. Smith et al. (2014) noted that implementation intentions were more effective when the PM cue was focal and that when the PM cue was non-focal there was evidence of a cost to performance of the ongoing task. Chen et al. (2015) in their meta-analysis found no difference in the effectiveness of implementation intentions when PM cues were focal or non-focal, but some evidence for response cost to the ongoing task when PM performance is improved.

To date, the value of implementation intentions in remediating PM deficits has not been demonstrated with patients with psychosis. The present study addressed this using a sample of early psychosis patients. The term early psychosis refers to the stages of possible psychotic disorder when symptom profiles and durations are so mixed as to not warrant a diagnosis in terms of a particular DSM-IV or ICD-10 psychotic classification but indicate a need for clinical care (Addington et al., 2005). Employing such a group obviates problems of chronicity and long term medication and may assist in the development of early intervention strategies considered particularly important in the early stages of the disorder.

In the present study, a dual task paradigm was employed in which participants had to answer questions presented on a computer screen (ongoing task) and press the space bar whenever a word denoting a type of animal occurred (PM task). Patients and controls were allocated to an implementation intentions condition, in which they were asked to mentally rehearse what they were to do when an animal word appeared on the screen, or to a standard condition in which no special instructions were administered. In line with previous findings, it was hypothesised that (1) patients with early psychosis would perform significantly worse on PM than controls, (2) forming implementation intentions would increase the PM performance of control participants, and (3) forming implementation intentions would improve the PM performance of early psychosis participants over that in the standard condition. We made no hypothesis about whether the gain from implementation intentions would be greater in the control or early psychosis group, because we had no basis for any such hypothesis. Because PM in early psychosis has not been studied previously, we included a range of PM tests as well as the computer task. To check the earlier finding that there were no differences in PM performance between patient and control groups when the participants' subjective judgements were assessed, we used a different instrument to that used previously, in this case the Brief Assessment of Prospective Memory (BAPM; Man et al., 2011). Although showing the same capacity to discriminate patients with traumatic brain injury from controls, the BAPM consists of 16 items whereas the PRMQ includes only 8 directed to PM.

## 2. Method

### 2.1. Participants

The sample consisted of 30 participants (20 males) with early psychosis aged between 17 and 23 years ( $M=20.83$ ,  $SD=2.21$ ) and 33 control participants (15 males) within the same age range ( $M=20.70$ ,  $SD=2.68$ ). The former group was recruited from the Gold Coast Integrated Mental Health Early Psychosis Service and the latter group was recruited from Griffith University and the general community. Inclusion criteria for the early psychosis group were: (1) aged from 17 to 25 years; (2) able to speak, read and write English well enough to give informed consent and participate in cognitive testing; and (3) have a diagnosis of early psychosis. The diagnosis of early psychosis at the Gold Coast service required that the individual had not previously completed a

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