Personality and Individual Differences 56 (2014) 40–44

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Trait impulsivity and prospective memory abilities: An exploratory study

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ARTICLE INFO

Article history:
Received 19 March 2013
Received in revised form 19 July 2013
Accepted 12 August 2013
Available online 6 September 2013

Keywords:
Impulsivity
Prospective memory
Individual differences
Personality traits

ABSTRACT

Both impulsivity and prospective memory may be related to executive functioning. This study was the first to examine if prospective memory is related to trait impulsivity. Seventy-eight undergraduate students completed one self-report and two laboratory measures of prospective memory, as well as the Barratt Impulsiveness Scale-11. Higher levels of trait impulsivity were not significantly associated with prospective memory task performance; however, impulsivity was related to self-report of prospective memory problems. Individuals with relatively worse prospective memory appeared to rely on a clock-checking tactic to improve task performance. Such compensatory behaviors may be effectively deployed over short periods by people with chronic prospective memory problems when such memory abilities are made salient, but may be difficult to maintain in day-to-day life.

1. Introduction

Prospective memory is a cognitive function that allows individuals to form intentions to act and then implement them in some future context (Ellis & Kvavilashvili, 2000; Graf, 2005; Graf & Uttl, 2001). It enables people to succeed in goal-directed behavior in everyday life (Kliegel, Ropeter, & Mackinlay, 2006). Despite prospective memory's close relation to acting purposefully toward future goals, there is a lack of research looking at the prospective memory abilities of individuals differing in personality traits related to acting without consideration of future consequences. Individuals high in trait impulsivity, in particular, tend to act immediately and recklessly, and may display executive dysfunctions, such as poor inhibitory control needed for task-planning (e.g. Congdon & Canli, 2008). Limitations on the formation of intentions for future action, as well as problems using prospective memory to act appropriately on these plans, arguably could contribute to individual differences in impulsivity. For this reason, the present study investigates a potential cognitive limitation related to prospective memory in individuals varying in trait impulsivity.

Impulsivity is identified as a prominent trait in personality psychology and is commonly manifested as a problematic feature in psychopathology (Flory et al., 2006). An inclusive definition was provided by Daruna and Barnes (1993), who reflected on impulsivity as a pattern of maladaptive behavior that encompasses "actions that are poorly conceived, prematurely expressed, unduly risky, or inappropriate to the situation and that often result in undesirable consequences" (p. 23). Impulsivity is a multifaceted construct that may reflect different traits related to reduced effortful control, overactive reward, and underactive punishment sensitivity (e.g. Cross, Copping, & Campbell, 2011). Although somewhat mixed, recent research suggests that the aspects of trait impulsivity related to reduced effortful control are associated with limitations on cognitive executive functions important for behavioral inhibition and control (e.g. Congdon & Canli, 2008), and possibly working memory as well (Hinson & Whitney, 2006; Whitney, Jameson, & Hinson, 2004). It is possible that problems with prospective memory are related to this type of impulsivity, indexing limitations on effortful control.

Prospective memory has typically been classified into two major subtypes: *event-based* and *time-based* (Einstein & McDaniel, 1996; Kliegel et al., 2006). A major distinction between the two types of prospective memory lies within the cues involved to signal the optimal moment to perform the action. Event-based prospective memory involves the initiation and execution of a previously-formulated action in response to an external stimulus (e.g. seeing a supermarket and remembering to buy milk), while time-based prospective memory involves initiation of the action in response to an internal cue at a specific time (e.g. remembering to mail a letter at 1 o'clock) or within a specific time frame (e.g.

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http://dx.doi.org/10.1016/j.paid.2013.08.016

remembering to call a friend back in 30 min). Recent theories regarding prospective memory suggest that there is a further distinction between the two memory types in terms of their executive demands. For example, time-based memory may depend more on executive control processes than event-based prospective memory (Einstein & McDaniel, 1990). One contention is that unlike event-based tasks, which are triggered by external cues, time-based prospective memory tasks require more mental effort because they rely on a self-initiated response when external cues may be absent (Einstein & McDaniel, 1990; Khan, Sharma, & Dixit, 2008; Nater et al., 2006). However, others have claimed that this distinction may not be useful in the natural settings where external chronometers are available to serve as event-based cues (e.g. Graf & Grondin, 2006). It is proposed that prospective memory cues offer different information about the predictability of imminent situations in which it is appropriate to execute the plan. This may be a sort of proximity calculation (Graf & Grondin, 2006), with an estimate of greater proximity indicating the appropriateness of action, be it within a relative time frame or in the presence of the target cue. From this perspective, the core distinction between time-based and event-based prospective memory is suggested to be the extent to which one is able to estimate how close the approaching cue is, and the features that make such calculations possible (e.g. how close is the cue in terms of time and/or spatial location to the point of appropriate retrieval; Graf & Grondin, 2006). Although an alternative view has been suggested regarding the underlying attention mechanisms and the level of cognitive demands the two types of prospective memory require (e.g. see Park, Hertzog, Kidder, Morrell, & Mayhorn, 1997), overall, there seems to be consensus regarding the requirement of central executive resources and this does not seem to differ regardless of the approach one takes in construing prospective memory classifications.

Although trait impulsivity and prospective memory have not been previously examined together, there are reasons to suspect that prospective memory function may vary with individual differences in impulsivity. As mentioned previously, individuals high in impulsivity may have poorer working memory and executive abilities, both of which are suggested to be central to prospective memory function (e.g. Heffernan, Jarvis, Rodgers, Scholey, & Ling, 2001; Martin, Kliegal, & McDaniel, 2003). It has been suggested that working memory plays an important role because it allows the individual to hold a representation of the intended action online, schedule an appropriate response, and monitor the performance of those responses (e.g. Basso, Ferrari, & Palladino, 2010; Einstein, Smith, McDaniel, & Shaw, 1997).

If executive functions are related to trait impulsivity, and if some of these functions are critical for prospective memory, it is reasonable to hypothesize that impulsivity will be related to measures of prospective memory. Poor prospective memory may be related to problems with planning for and conceptualizing the future which are central to some views of impulsivity (e.g. Keough, Zimbardo, & Boyd, 1999).

In the present study, undergraduate students completed multiple measures of prospective memory, including a self-report, a time-based task and an event-based task. Trait impulsivity was assessed with the Barratt Impulsiveness Scale-11 (BIS-11; Patton, Stanford, & Barratt, 1995), a measure previously related to problems with effortful control (e.g. Goya-Maldonado et al., 2010; Kam, Dominelli, & Carlson, 2012). We hypothesized that higher levels of impulsivity would be related to worse prospective memory and that this would be relatively more pronounced on time-based rather than event-based tasks because of the putatively greater demands on executive functions which are thought to be limited in impulsive individuals.

2. Method

2.1. Participants and procedure

The participants were 78 students (24 male; 54 female) recruited through a subject pool at a large university in British Columbia. All participants were undergraduates taking psychology courses offering extra credit for study participation. Only those between the ages 17–22 years (M = 19.46 years, SD = 1.44) who denied neurological problems, had normal range vision (with or without correction), and had been speaking English for at least five years, were allowed to participate.

Upon arrival to the laboratory, participants provided informed consent and were given instructions for both a time- and an event-based prospective memory task. As part of an approximately 30-min retention interval for the instructions, participants completed a set of questionnaires. The questionnaire order was counterbalanced to prevent order effects. Next, the participants engaged in computer-administered tasks, with the first being the time-based prospective memory task followed by two Event-Related Potential tasks not reported on here. After these tasks, participants were asked to move from the chair in front of the computer back to the one in which they completed the questionnaires. It was during this period that event-based task performance would be recorded. The entire duration of the study was two hours.

2.2. Measures

2.2.1. Barratt Impulsiveness Scale-11 (BIS-11)

The BIS-11 (Patton et al., 1995) is one of the most widely-used scales for measuring impulsivity (Stanford et al., 2009). It consists of 30 questions rated on a 4-point Likert scale. It has three subscales: Motor Impulsiveness (e.g. "I do things without thinking"), Attentional Impulsiveness (e.g. "I get easily bored when solving thought problems"), and Non-Planning Impulsiveness (e.g. "I am more interested in the present than the future"). Cronbach's alpha for the total score was .81 in the present sample. Internal consistencies for each of the subscales were: .69 for Motor Impulsiveness, .55 for Attentional Impulsiveness, and .68 for Non-Planning Impulsiveness. These values are somewhat low, but within the range reported in other studies (Stanford et al., 2009).

2.2.2. Prospective Memory Questionnaire (PMQ)

The PMQ is a self-report questionnaire developed by Hannon, Adams, Harrington, Fries-Dias, and Gibson (1995) requiring participants to recount the frequency of various prospective memory failures as well as how often they use strategies to help their prospective memory performance. Fifty-two statements are rated with a 9-point scale with items differing in the range (i.e. a week to up to a year) which the participants used to assess how frequently they experienced the situation. The PMQ has four 14-item subscales. Three probe different prospective memory failures, including Long-Term Episodic, Short-Term Habitual, and Internally-Cued Prospective Memory. The Long-Term Episodic subscale describes memory for tasks with no regular schedules and which are completed a length of time after a cue has appeared (e.g. "I forgot to make an important phone call"). The Short-Term Habitual subscale relates to memory for tasks that occur on a regular basis and which have to be performed shortly after the appearance of the relevant cue (e.g. "I forgot to turn my alarm clock off when I got up this morning"). The Internally Cued subscale addresses memory for tasks with no distinct external cue, making them self-initiated (e.g. "I forgot to bring something I meant to take with me when leaving the house"). The last subscale is related to techniques used to assist recall (e.g. "I lay things I need to take with me