



Variation in cognitive failures: An individual differences investigation of everyday attention and memory failures

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ABSTRACT

The present study examined individual differences in everyday cognitive failures assessed by diaries. A large sample of participants completed various cognitive ability measures in the laboratory. Furthermore, a subset of these participants also recorded everyday cognitive failures (attention, retrospective memory, and prospective memory failures) in a diary over the course of a week. Using latent variable techniques the results suggested that individual differences in cognitive abilities (i.e., working memory, attention control, retrospective memory, and prospective memory) were related to individual differences in everyday cognitive failures. Furthermore, everyday cognitive failures predicted SAT scores and partially accounted for the relation between cognitive abilities and SAT scores. These results provide important evidence for individual differences in everyday cognitive failures as well as important evidence for the ecological validity of laboratory cognitive ability measures.

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Introduction

We owe our ability to effectively focus and sustain attention on a task, to retrieve information accurately from memory, and to carry out planned intentions in the future to a well functioning cognitive system. Without question, this system allows us to carry out the myriad of important and mundane tasks set before us daily. Despite the effectiveness of our overall cognitive system, sometimes we make mistakes resulting in generalized cognitive failures. For instance, have you ever caught yourself daydreaming during an important meeting? Have you ever forgotten the name of a person you were just introduced to? Have you ever forgotten to add an attachment to an email before sending it? Most people will answer yes to these questions, although the frequency of these cognitive failures likely varies across people. Thus, although we carry out many of our day-to-day tasks successfully, every once in awhile we experience a cognitive failure. Such failures have long been considered an important topic of research in a num-

ber of domains including cognitive psychology, cognitive aging, developmental psychology, clinical psychology, educational psychology, neuropsychology, and neuroimaging.

An important reason for examining cognitive failures is that not only does the frequency of such errors likely vary as a function of individual differences, neuropsychological disorders, and age, but these failures also have real world consequences. For example, students who are more likely to daydream or mind-wander during lectures may perform more poorly on tests than students who are less likely to mind wander. Furthermore, forgetting to carry out an intention, such as putting the landing gear down before landing, will also have obvious real world consequences (see Reason (1990) for a review). Thus, examining cognitive failures will not only allow for a better understanding of the underlying mechanisms that give rise to such errors but also allow for a better understanding of who is likely to commit such errors.

Everyday attention and memory failures

Broadly construed, cognitive failures refer to all of the possible different types of failures within the cognitive

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system (i.e., memorial, attentive, or otherwise) that could conceivably occur. These include lapses of attention, mind wandering, failures of memory, action failures, etc. (e.g., Broadbent, Cooper, FitzGerald, & Parkes, 1982). Theoretically, these errors can be conveniently grouped into three classes of failures: attention failures, retrospective memory failures, and prospective memory failures (see Heckhausen and Beckman (1990), Norman (1981), and Reason (1984a) for similar taxonomies of action slips). In the current study attention failures refer to situations in which attention could not be maintained and sustained on a task leading to a momentary lapse. Such failures could arise from distracting external stimuli (e.g., a loud noise) or from internal thoughts and distractions (e.g., daydreaming). Thus, these attentional lapses could arise from distractions, from mind wandering, or from absent-mindedness (similar to action slips). Retrospective memory failures refer to situations in which information cannot be properly retrieved from the memory system even though that information is likely stored. Retrospective memory failures could include failures over the short-term (e.g., forgetting the name of a person you were just introduced to), failures of autobiographical/personal memory (e.g., forgetting your email password), or failures of more fact-based semantic memory (e.g., forgetting the name of the person who was the President of the United States during the Civil War). Prospective memory failures refer to situations in which an individual forgets to carry out some intention in the future. For example forgetting to carry out an activity (e.g., forgetting to add an attachment to an email), forgetting to do something at a particular time (e.g., forgetting to go to a meeting at 10:15 am), and forgetting to attend an event (e.g., forgetting to go to your sister's wedding) would all be considered prospective memory failures. Clearly there are a number of different ways that the cognitive system can fail and some of these errors can be relatively harmless, whereas other errors could have life-threatening consequences. Understanding these cognitive failure as well as possible sub-classifications of failures is important in order to not only understand how the cognitive system operates, but it is also for determining who is likely to demonstrate these different failures and in what situations these failures are most likely. That is, an examination of cognitive failures should provide us with more information regarding the underlying cognitive systems that give rise to such errors (attentional and memorial systems) as well as giving some indication of how these systems and their resulting errors are interrelated.

An important method for examining everyday attention and memory failures is through diary studies. As the name suggests, in these studies individuals are required to carry a diary for some amount of time and record their attention and memory failures. These studies provide important information about the different types of cognitive failures as well as the relative frequencies with which these cognitive failures occur in everyday life. For example, Reason (1984a) had 63 undergraduates record their action slips in the course of a week. Reason found that many of attentional failures occurred because participants were either preoccupied by internal thoughts or distracted by external stimuli. Furthermore, Reason

found that most of these errors occurred during the late afternoon and early evening.

Crovitz and Daniel (1984) had 47 participants record their memory failures. Crovitz and Daniel found that the most frequently occurring memory error was a retrospective memory error (forgetting someone's name) followed by a prospective memory (forgetting to make a phone call). Likewise, Terry (1988) examining memory failures in 50 individuals found that prospective memory errors were the most common followed by retrospective memory failures. These results suggest that diary studies provide important information on everyday attention and memory failures. However, little work has examined the relation between cognitive failures assessed with diaries and performance on laboratory tasks. Thus, it is not known whether everyday attention and memory failures reflect breakdowns in the same cognitive mechanisms assessed via laboratory tasks and it is not known whether variations in performance on laboratory tasks will be able to predict who is likely to experience everyday attention and memory failures.

Individual differences in working memory capacity and cognitive control

Theoretically, cognitive failures likely result from general failures in cognitive control. Cognitive control refers to the ability to guide processing and behavior in the service of task goals and this ability is a fundamental aspect of the cognitive system that is thought to be important for a number of higher-level functions. Important components of cognitive control include actively maintaining task goals, selectively and dynamically updating task goals, detecting and monitoring conflict, and making adequate control adjustments in the presence of conflict (Cohen, Ashton-Jones, & Gilzenrat, 2004). These components are thought to influence processing in a wide range of tasks and situations. As such, the ability to effectively utilize cognitive control and various executive functions (such as updating, switching and inhibition; Miyake et al., 2000) should be an important determinant of an individual's performance in such situations. Early work by Norman (1981) and Reason (1984a, 1984b) suggested that cognitive failures arise, in part, due to failures of cognitive control. For example, when attention is disengaged from the current task and focused on other external distracting stimuli or internal thoughts (e.g., daydreaming), cognitive failures are likely to occur. Along this line, Reason (1984b) suggested that "susceptibility to cognitive failures appears to be determined by some *general* control factor that exerts its influence over all aspects of mental function" (p. 115). Theoretically the absence of cognitive control can lead to an increase in the frequency of cognitive failures and this general lack of cognitive control leads to overall increases in all different types of failures rather than specific failures being due to failures of specific processing components (i.e., retrospective memory failures as a result of failures in retrospective memory processes). This notion of failures being due to general vs. specific factors will be examined more thoroughly later.

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