This study explored the proposition that persons high in “cognitive dysorganization,” as assessed by the Sense of Personal Disorganization Scale (SPDS), would show both poorer prospective memory and planning performance, especially in the absence of external memory cues. Cognitive dysorganization also was expected to affect planning performance above and beyond the effects of executive functioning, anxiety, and attentional deficits. As understood here, cognitive dysorganization refers to the extent that one’s overall cognitive functioning is deficient in the coherence, structure, and guidance essential to the achievement of intended aims and aspirations. Recruited from introductory psychology students in the upper and lower thirds of SPDS score distribution, 144 high and 158 low cognitive dysorganization participants, seen individually, were given rules for performing the Six Elements Task. Participants in the instruction only condition were asked to formulate a plan for task completion. Participants in the instruction plus cue condition were asked to formulate a plan and to use an outline of the plan during task completion. Participants in the no instruction condition were not told to formulate a plan. All participants then completed several behavioral measures of executive functioning, self-report questionnaires about anxiety and attentional deficits, and a personal information questionnaire. Participants were to
initiate the Six Elements Task at a certain cue and execute their plan, if they had formulated one. Results largely failed to support the proposition that cognitive dysorganization is associated with difficulties in prospective memory and planning, even in the absence of external prompting cues; however, cognitive dysorganization was found to be positively correlated with committing rule violations during plan execution. Results also failed to support the proposition that cognitive dysorganization contributed to planning performance above and beyond the effects of executive functioning, anxiety, and attentional deficits.
Dedicated to my family –

To my parents, who encourage me to strive for my dreams,

To my husband, who supports me as I reach my dreams,

To my sons, who are learning to strive for their own dreams,

And, to God, Who fulfills our dreams beyond our greatest expectations.
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Means of perceived task difficulty for CD groups and planning level
CHAPTER 1

INTRODUCTION

In negotiating the circumstances of our lives, we have to deal with an enormous number and variety of internal and external inputs. Because of the potential for competition and conflict among these inputs, with subsequent effects on our affect and behavior, a number of formulations have posited an executive system (Barkley, 1997a; Baddeley, 1995; Norman & Shallice, 1980, 1986; Baddeley & Hitch, 1974) which has both organizational and control functions. A primary goal of such an agency is to foster the achievement of intended aims. More specifically, the system is implicated in the selection of input, the attachment of meaning to inputs, the deployment of input for immediate or delayed processing, and the initiation and maintenance of relevant routines and action sequences.

1.1. The Executive System

Baddeley and Hitch (1974; Baddeley, 1995) developed a model that assumes a central executive and two subsystems. These subsystems receive verbal and visual material, which is then stored and manipulated. The subsystem information is connected to long-term memory via the central executive, which also controls attention and selects
and plans strategies of action. The executive system is assumed to have limited capacity, and therefore, needs to be efficiently organized in order to function properly, particularly when under high cognitive load or stress.

Norman and Shallice (1980, 1986) introduced an executive system model which assumes that action and thought processes are represented by schemas. Each distinct well-learned action sequence or thought has its own schema. For example, riding a bicycle is seen as having its own schema that enables the person to carry out this action. When a stimulus triggers the activation of a schema, a corresponding action or thought is carried out. When more than one schema are activated at once, an overlearned, highly routinized, automatic *contention-scheduling* takes effect. This contention-scheduling sorts through the activated schemas, selects the appropriate one for action, and inhibits the others. When this automatic, routinized process is not sufficient, a Supervisory System, a kind of central executive, intervenes and exercises control.

Shallice and Burgess (1993) have suggested that the Supervisory System would need to function in two general types of situations. First, executive intervention is necessary when contention-scheduling alone is likely to generate an incorrect response as when perceptual events strongly trigger a number of schemas that would lead to conflicting behaviors. If contention-scheduling cannot adequately resolve the conflict among the activated schemas by inhibiting the inappropriate ones, *stuck-in-set perseveration* of behavior tends to result. The Wisconsin Card Sorting Test performance of patients with frontal lobe damage has commonly been described as such stuck-in-set perseveration (Shallice & Burgess). During this task, a person is asked to match each card
in a deck to four target cards. There are various contingencies for matching, including matching by color, form, and number. However, the person is not told what the current matching rule is, and the experimenter shifts this rule periodically throughout the test period. On each trial, the patient is given feedback about whether each match is correct or incorrect. After ten consecutive correct answers, the rule is changed without warning (e.g., shape replaces color as the matching criterion). When this rule change occurs, those with frontal lobe damage continue to respond according to the initial rule, taking a long time to adapt to the new one. The patients’ perseverating behavior and error-making are believed to occur because the Supervisory System fails to compensate for impaired contention-scheduling, which cannot adequately select among the activated schema. That is, contention-scheduling fails both to inhibit behavior based on the now inappropriate rules and to choose behaviors that match the new rules. But, if functioning effectively, the Supervisory System is posited to prevent such perseveration by providing additional inhibition and activation and thereby permitting the selection of an appropriate response.

Second, the executive system is called upon in situations requiring novel, as opposed to well-learned, responses. When a novel response is required, internal and external triggers usually fail to activate task-relevant schemas. As a result, contention-scheduling is unable to select an appropriate schema, and the person forgets to perform the required response. For example, consider a woman who is asked to pick up a loaf of bread in a store that is not on her usual way home from work. If contention-scheduling is
operating alone as she drives home, she will not remember the bread, even though she had intended to do so. That schema, “pick up a loaf of bread”, is not activated by an external or internal cue, and she arrives at home empty-handed.

In such a case, because no relevant action-directing schema is activated, any non-relevant schema that happens to be activated will control behavior, with the result that the person will be distracted from the originally intended response. Thus, the same woman, who knows she was to do something after work, may stop at the dry cleaners, rather than the grocery store, because over time she has developed an association between driving home and stopping at the dry cleaners. In such a scenario, the role of the Supervisory System would be to provide guidance for an appropriate response, while inhibiting any schemas activated by distracting or non-relevant stimuli.

1.2. Behavioral Inhibition

Barkley (1997a) has proposed a model of executive functioning in which behavioral inhibition assumes a superordinate executive role in inhibiting erroneous prepotent responses, in stopping ongoing perseverating responses, and in controlling other interference. Thus, behavioral inhibition allows the executive functions to be performed effectively. Barkley identifies these functions as working memory, self-regulation, self-directed speech (i.e., reflection, problem-solving, and moral

---

1 Shallice and Burgess (1993) dismiss the characterization of the Supervisory System as a controlling homunculus by citing evidence from artificial intelligence studies, which supports the existence of mechanism that resolves such an “impasse” and selects novel action sequences.
reasoning), and behavior-regulation. These functions enable the control of appropriate goal-directed behaviors by the internal representation of rules, self-motivation, intentions, and plans.

When inhibition is impaired, the performance of the executive functions is compromised, with the result that self-control and efficient goal-directed behavior become more difficult. Persons with such impairment are susceptible to the heightened influence of immediate external and situational pressures. Such persons also suffer from the diminished influence of the kinds of internally represented information that is consistent with their intentions and plans, the kind of information that often fosters long-term benefits. Barkley (1997a) posits that difficulties associated with deficiency in behavioral inhibition characterize Attention Deficit Hyperactivity Disorder (ADHD) (see also Ozonoff & Jensen, 1999). For example, children with an inhibitory deficit are likely to opt for a smaller, immediate reward rather than for a larger, delayed reward (e.g., see Rapport, Tucker, DuPaul, Merlo, & Stoner, 1986; see also Mischel, Shoda, & Rodriguez, 1989). Children with such an inhibitory deficit also have been found to perform particularly poorly in experimental tasks in which effective performance requires behavioral inhibition and novel responding (Milich, Hartung, Martin, & Haigler, 1994). In addition, such children, even when complying with a medication regimen, prefer a “planning-in-action approach” in solving complex problems (Papadopoulos, Parrila, & Das, 2001). That is, unlike their peers with normal inhibition who prefer to formulate a plan before taking action, these children would rather generate the plan in the moment, as they experience each stimulus in the problem-solving sequence.
Although Barkley’s (1997a) model was developed in an effort to account for the various and diverse features of ADHD in children\(^2\), it appears applicable to a more general understanding of executive functions\(^3\). For example, because behaviors associated with prefrontal lobe injuries or lesions (see Konrad, Gauggel, Manz, & Schoell, 2000) resemble those seen in ADHD (Barkley, 1997a), poor behavioral inhibition has been implicated in the executive functioning problems associated with brain injuries. More generally, while most formulations of executive functioning seem to imply a deficiency in some sort of central executive mechanism that inhibits and controls responding, Barkley’s (1997a) formulation explicitly specifies this mechanism as behavioral inhibition, and, in fact, proposes that it is the key function of the executive system.

1.3. Sub-optimal Functioning of the Central Executive System

As external demands on the central executive system increase, people would be expected to perform more poorly. For example, people tend to show impaired performance when they must pay attention to multiple activities. In order to study the effects of attentional demands on remembering to carry out intended actions (i.e., prospective memory), Einstein, Smith, McDaniel, and Shaw (1997) varied the

\(^{2}\) In a study to examine the overlap of executive functions and attention, Korkman (2000) concluded that poor inhibition does appear to underlie executive functions problems seen in those with ADHD, and that such difficulties may be identified and separated from deficits in attention.

\(^{3}\) Nigg (2001) raises concern with the generality of the term inhibition and argues that more specificity is needed in defining the types of inhibition related to various disorders.
background activity in a prospective memory task. Participants were asked to press a key on a computer keyboard whenever a certain word appeared on the monitor. When attentional demands were increased by adding a digit-monitoring background activity, participants performed more poorly⁴.

Such declines in performance under increased demands are likely to be particularly precipitous for those individuals with a deficiency in behavioral inhibition (Barkley, 1997a). Where the environment presents a large number of external cues, weak inhibition, leaving the person vulnerable to distraction, should lead to difficulty in selecting from among the many schemas, both relevant and non-relevant, that are activated simultaneously. Likewise, where the environment provides insufficient external guidance, the inhibitory deficit should fail to screen out inappropriate schemas and action sequences and/or fail to initiate appropriate ones. For example, with a deficit in behavioral inhibition, people would be expected to be more impulsive and to have difficulty keeping goal-directed thoughts in mind. This should increase the likelihood that they will forget appointments, lose track of important papers and information, have difficulty in sticking to their plans, and show other characteristics of ineffective responses. Barkley (1997a) notes that such a behavioral pattern is common in ADHD. Patients with prefrontal lobe damage display a similar disorganized behavioral pattern (Kimberg, D'Esposito, & Farah, 1997). In fact, in a study by Konrad et al. (2000), both children with traumatic brain injuries and children with ADHD showed poorer control in

⁴ Such increased attentional demands were more harmful during encoding than at retrieval, possibly because the latter is more automatic (see also Kidder, Park, Hertzog, & Morrell, 1997).
inhibiting both their pre-potent and on-going responses during experimental tasks than did a control group, despite the need to do so in order to perform well.

As might be expected, those, who, by virtue of weak inhibition, are prone to distraction, have difficulty in formulating well-organized plans about future actions. As mentioned earlier, children with poor inhibition (i.e., ADHD) prefer a “planning-in-action approach” to solving complex problems (Papadopoulos et al., 2001); whereas, their peers, without such inhibitory deficits, prefer to plan ahead. Difficulties in prior planning can also be seen in the performance of those with brain injuries and of those with ADHD on commonly used tests of executive functioning and planning. In adults, performance on the Tower of Hanoi and The Tower of London tests seems to be sensitive to frontal lobe damage or dysfunction (Glosser & Goodglass, 1990; Goel & Grafman, 1995; Owen, Downes, Sahakian, Polkey, & Robbins 1990). Children with traumatic brain injuries, as compared to same-aged controls, performed more poorly on more difficult versions of the Tower of London task, suggesting difficulties in planning in order to solve complex problems (Levin, Song, Scheibel, Fletcher, Harward, Lilly, & Goldstein, 1997; Shum, Short, Tunstall, O’Gorman, Wallace, Shephard, & Murray, 2000). And, in an attempt to develop the construct validity of a version of the Tower of London test (i.e., TOL-Super(Drexel)), children with ADHD were found to perform worse on this task than did their non-ADHD peers (Culbertson & Zillmer, 1998; see also Pennington, Groisser, & Welsh, 1993), with such performance loading most highly on a factor of Executive

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5 The efficacy of tasks, such as the Tower of London test, to adequately measure planning and problem-solving abilities has been questioned by a number of researchers (e.g., Kafer & Hunter, 1997).
Planning / Inhibition. This factor was found to be separate from factors of Executive Concept Formation / Flexibility, Psychometric Intelligence, and Memory.  

1.4. Individual Differences in Executive Functioning

Wide individual differences are expected in the quality of executive system functioning, ranging from that likely to be characteristic of highly effective and efficient persons to that likely to be characteristic of persons with ADHD (Barkley, 1997a) or with prefrontal lobe injuries (Kimberg et al., 1997). In general, executive system functioning can be considered disorganized to the extent that it lacks the coherence, structure, and guidance essential to the achievement of intended aims and aspirations. Although the specific consequences of any given executive system impairment will depend on which of its processes and mechanisms are flawed, these are thought to be sufficiently interrelated so that an impairment in any of the system’s components is likely to be manifest, at least to some degree, in a variety of ways (see discussion in Kimberg et al., 1997).

1.5. Cognitive Dysorganization

Although the consequences of poor executive functioning may be most evident in children and adults with serious attentional problems and brain injuries, Mirels and Gordon (1996) have posited a continuum of executive function ineffectiveness in the

---

6 In a study using the Tower of London test with head-injured children, a five-factor solution was found – Conceptual-Productivity, Planning, Schema, Cluster, and Inhibition (Levin, Fletcher, Kufera, & Harward, 1996). Closed head injuries were associated with problems in Concept-Production and planning. Left frontal lesions also predicted problems in Schema.
general population (see Barkley, 1997a). They take this difference as reflecting the degree of cognitive dysorganization. According to Mirels, Dean, and Ponton (1998), a person’s degree of cognitive dysorganization will be reflected in the extent to which he or she is prone to the kinds of everyday cognitive and behavioral tendencies that have been associated with deficient executive system functioning. Such tendencies include misplacing important items, forgetting to do things, and feeling disorganized.

1.6. Sense of Personal Disorganization Scale (SPDS)

As a means of assessing cognitive dysorganization, Mirels, Dean, and Ponton (1998) developed the Sense of Personal Disorganization Scale (SPDS; see Appendix A). This self-report measure is based on the assumption that one’s degree of cognitive dysorganization is reflected in one’s avowal of the extent to which one is forgetful, absent-minded, inefficient, and suffering from a sense of general disorganization. Participants are asked to indicate the degree to which they agree with 12 items, such as “My life often seems very disorganized” and “Even when I write down what I have to do, I still often forget to do it”, on a seven-point Likert-type scale, ranging from –3 (strongly disagree) to +3 (strongly agree). The SPDS has good internal consistency (i.e., Cronbach’s alpha of 0.85-0.90 over three samples), and scores on the scale show anticipated relationships with a variety of other measures. For example, it relates positively to measures of anxiety and depression and negatively to measures of emotional stability and self-esteem (Mirels & Dean, 1997).

In addition, scores on the SPDS are related to self-reported attitudes about time usage and daily activities (Mirels & Dean, 2000, 2001). For example, compared with
persons scoring low on the SPDS, high scorers on the SPDS are more likely to report feeling little meaning and purpose in their daily activities. In addition, not only are they more likely to admit difficulty in persisting in and completing activities, but also they are more likely to report difficulties in both organizing and starting activities. In fact, as would be expected from Barkley’s (1997a) formulation, a post-hoc review of data from a pilot study by Mirels, Nygren, and Dean (1998) showed that a significantly greater number of participants, that is 9 out of 10 participants, who missed their experimental session without canceling were high scorers on the SPDS.

1.7. Prospective Memory

Individuals with inhibitory deficits tend to struggle when they have to remember to do something – whether that is keeping an appointment, picking up a loaf of bread after work, returning a phone call, or taking a medication. This type of memory, known as *prospective memory*, involves remembering to carry out intentions or fulfilling previously set goals (Marsh, Hicks, & Landau, 1998).

Prospective memory differs from retrospective memory in that the latter refers to memory for what was done or learned in the past. Winograd (1988) illustrates the difference by the contrast between remembering to tell one’s spouse that he or she received a phone call (i.e., prospective memory) and remembering the content of that phone message (i.e., retrospective memory). Available evidence suggests there is no relationship between prospective and retrospective memory abilities (Kliegel, McDaniel, & Einstein, 2000; Kvavilashvili, 1987; Maylor, 1990).
Prospective memory performance appears to be influenced by a number of variables. For example, performance is partially dependent on one’s motivation to carry out the task (Meacham & Singer, 1977), the importance of the intention (Kvavilashvili, 1987, 1992), one’s level of commitment (Marsh et al., 1998), and one’s comfort with the task (Meacham & Kushner, 1980). While the period of time over which one must remember an intention before carrying it out does not consistently influence subsequent performance (see Loftus, 1971; Wilkins, cited in Harris, 1980; Meacham & Leiman, 1982; Wilkins & Baddeley, 1978), the methods by which individuals attempt to remember their intentions over these time periods do matter (see Harris, 1984).

1.8. The Role of Attention and Executive Functioning in Prospective Memory

Demands on attention, as they consume cognitive resources, also have been implicated as an important influence on prospective memory. Ellis (1996) has proposed a multifaceted model of prospective memory that assigns a key role to attention. The model states that in order for a person to carry out an intended behavior, that behavior, together with the context in which it is to be carried out, needs to be stored in memory. In successful prospective memory performance, attentional activity monitors the context and activates appropriate action schemas. Ellis (1996) suggests that the integration of attention, memory, and action in prospective memory requires a supervisory or executive system (see also Marsh & Hicks, 1998). As already noted, such systems are believed to be responsible for both inhibiting normal contention-scheduling and activating appropriate schemas that normally would not be activated automatically by the task at hand. The importance of an executive system is readily apparent when one considers how
much more difficult it is to remember to do an infrequent new action than a more habitual and familiar one. Or, similarly, when one considers how much more difficult it is to remember to do a task without, rather than with, an external prompting cue.

Marsh and Hicks (1998), drawing upon Baddeley’s model of executive functioning (Baddeley & Hitch, 1974; Baddeley, 1995), proposed that prospective memory is importantly influenced by the number and type of active concurrent cognitive processes. Through management of these processes, the central executive works to allow appropriate direction of attention and selection of schemas. When the system becomes taxed by heavy cognitive demands, the central executive would be expected to function more poorly. The researchers, therefore, tested the effects of varying cognitive load on the central executive system and its subsystems. The results showed that, as expected, attention-demanding tasks, which draw more heavily upon the central executive, produced greater decrements in prospective memory performance.

Given the apparent importance of the central executive in prospective memory, individual differences in quality of executive functioning should influence prospective memory performance. Suggestive evidence of such influence was presented by Marsh, Hicks, and Landau (1998) in connection with a procedure in which participants reported on the extent to which they had been successful in carrying out activities that they had set for themselves the previous week. The researchers found that participants who showed signs of deficiencies in attention and memory were “natural recorders,” persons who use memory aids such as daily planners in an apparent effort to compensate for their deficits.
Older persons have also been found to be especially likely to rely on external prospective memory aids in order to compensate for their memory deficits (Moscovitch, 1982).

More recently, several studies, using a variety of prospective memory tasks, have found that performance on such tasks is strongly related to working memory capacity (e.g., Cherry & LeCompte, 1999; Kliegel et al., 2000). Although measures of working memory capacity, like those used in prospective memory studies, have been shown to include assessment of both brief retrospective memory and executive functions (Engle, Tuholski, Laughlin, & Conway, 1999), Kliegel and his colleagues (2000) argue that the latter, executive functioning, is the more important component. This relationship between prospective memory and executive functioning (see Banville & Nolin, 2000) has also been supported by studies of people with brain injuries, particularly with those with frontal lobe injuries (see Palmer & McDonald, 2000), who have been found to perform poorly on prospective memory tasks (e.g., Hannon, Adams, Harrington, Fries-Dias, & Gipson, 1995; Kinsella, Murtagh, Landry, & Homfray, 1996; Shum, Valentine, & Cutmore, 1999; Wiseman, Ratcliff, Chase, Laporte, Robertson, & Colantonio, 2000).

1.9. Importance of External Memory Supports in Prospective Memory

The presence of external memory supports, particularly in the context of heavy attentional demands, seems to be helpful for prospective memory performance because such cues serve to attract and direct attention. The presence or absence of such external prompting supports is the key difference between two types of prospective memory tasks (Einstein & McDaniel, 1996). Event-based prospective memory requires remembering to do something upon the occurrence of a certain prompting cue (e.g., relaying a message to
a person when that person appears or making a phone call after seeing a reminder note).

Time-based prospective memory, in contrast, requires remembering to do something at a designated time (e.g., keeping an appointment or removing a cake from the oven).

Prospective memory performance typically is poorer in time-based tasks than in event-based ones (Harris, 1984), presumably because the former involves fewer environmental supports and relies more heavily on self-initiated retrieval of intentions (Craik, 1986; Einstein & McDaniel, 1996; Marsh & Hicks, 1998).

In self-initiated cueing, or the act of reminding oneself, people must remember to cue themselves without any external help or suggestion from the environment. In their noticing plus search model of prospective memory, Einstein and McDaniel (1996) have proposed that, in event-based memory, environmental prompting cues automatically elicit feelings of familiarity which often lead to a conscious search of memory in order to identify the significance of the cue. Time-based prospective memory, as it lacks this elicitation of a sense of familiarity that initiates the retrieval process, is likely to be more difficult. Most of us, in fact, seem to be aware that environmental cues are helpful in bringing our intentions to mind (Dobbs & Reeves, 1996). And, when these environmental prompting cues are unlikely to be present, we often will set up our own external reminders, such as posting notes or placing objects in odd places (see Marsh & Hicks, 1998).

In general, as the number of external memory supports decreases, or the level of attentional demands increases, prospective memory tasks tend to become more difficult. Both of these conditions seem to require the central executive to work more strenuously
in focusing attention on and selecting appropriate schemas. When the functioning of the central executive system has trouble adapting to these situations, especially if it fails, poor prospective memory is likely to result.

1.10. Simple Versus Complex Prospective Memory

Although prospective memory has received increasing research attention over the past two decades (Ceci, Baker, & Bronfenbrenner, 1988; cf. Ellis & Kvavilashvili, 2000), adequate research paradigms have been difficult to develop. Because of the obstacles in establishing sound experimental control, few researchers have attempted to examine how prospective memory operates in daily functioning. In some of the few “real life” tasks, several experimenters have asked participants to return postcards at specified times (Maylor, 1990; Wilkins, cited in Harris, 1980), to phone the experimenter (Levy & Claravall, 1977), and to keep appointments (Levy & Loftus, 1984). Most researchers have opted to examine prospective memory in less naturalistic tasks. In such tasks, researchers typically ask participants to remember to carry out some activity, such as raising a card after specified time intervals while watching a movie in the laboratory (Harris & Wilkins, 1982). Unfortunately, as Kliegel, McDaniel, and Einstein (2000) noted, these prospective memory tasks tend to focus on a person’s ability to remember to carry out a single intention at a specified time. These simple tasks tend to be impoverished in both the number and complexity of intentions and memory cues that are important in everyday activities (Marsh et al., 1998; Rabbit, 1996). In addition, these tasks tend to be rather automatic, not requiring the thoughtfulness and planning that
would be needed in more naturalistic and complex prospective memory tasks (Guynn, McDaniel, & Einstein, 1998; McDaniel, Robinson-Riegler, & Einstein, 1998).

In a study by Marsh, Hicks, and Landau (1998), participants reported that their natural daily prospective memory activities involved a type of planning. In order to reach their goals, participants indicated that they would form a plan, hold that plan in mind, and carry out the steps of the plan consecutively. Usually, in such plans, there are several subtasks that must be completed to achieve the overall goal, with some delay between the subtasks (see Kliegel et al., 2000). Examples of such activities that have been investigated are cooking a three-course meal (Byrne, 1977) and following a daily schedule or activity plan (Ellis, 1996). Although most theoretical descriptions of prospective memory (see Burgess & Shallice, 1997; Dobbs & Reeves, 1996; Ellis, 1996) describe such a complex and naturalistic planning and acting process, prospective memory tasks studied in the laboratory typically focus on the execution of the intention, but not on the formation of the intention (see Kliegel, Martin, McDaniel, & Einstein, 2002). Interestingly, Bisiacchi (1996), using only the execution of an intended action as the measure of prospective memory, found no correlation between simple prospective memory performance and planning performance. However, when more complex models of prospective memory are used, a relationship between simple and complex prospective memory is found, suggesting that executive functioning may be related to particular phases of the prospective memory process (see Kliegel et al., 2000).
1.11. Complex Prospective Memory: Planning

Planning is a part of our daily lives. Most of us will consider the day’s schedule the evening or morning before the day begins, and often, we will schedule things for a particular day several days, weeks, or months in advance. Many of us also plan how we will accomplish a task or reach a goal by devising a series of steps, or subtasks, that must be completed in sequential order. In general, planning is a mental strategy used to prepare us for future action and to facilitate our performance toward the goal at hand (Gollwitzer, 1996). It also serves to keep us on track when distractions or difficulties arise that may lead us astray from our goals (Gollwitzer, 1996).

While carrying out our plans, the feedback we receive from the environment helps us to evaluate the effectiveness of our actions, the appropriateness of our plans, and the status of our goal achievement (Frese, Stewart, & Hannover, 1987). The structure and organization of both plans and goals vary widely as does their relation to each other. Many goals and the associated plans for realizing them are arranged hierarchically, with the achievement of lower level aims essential to the achievement of higher level aims. Plans vary in the extent to how sharply they focus on a goal, the extent to which they are specific to a particular goal, and the extent to which they contain details about how to act (Frese et al., 1987). These features of plans influence their effectiveness in achieving intended aims.

Scholnick, Friedman, and Wallner-Allen (1997) suggest that there is much about planning that we do not yet know. For example, it is uncertain whether all forms of planning involve the same general processes or if some types of planning require one
ability or several coordinated abilities. Nevertheless, the constituent subtasks involved in most planning can be described. Generally, planning involves representing a problem, setting goals, deciding to plan, evaluating available resources and limitations, creating a plan, implementing and monitoring the plan, and finally reviewing the outcome (Friedman, Scholnick, & Cocking, 1987; Scholnick & Friedman, 1987, 1993). Given this characterization of planning, any purposeful behavior, or any strategy constructed in relation to a future action, would count as planning (Scholnick, 1994).

1.12. Individual Differences in Planning

Some people are much better at planning than are others. Some seem to struggle with planning, while some seem to avoid making plans altogether. Such differences have led a number of investigators to argue that planfulness is a personality trait (Scholnick et al., 1997). For example, in a factor analysis of the Jackson Personality Inventory, Jackson, Paunonen, Fraboni, and Goffin (1996) found that a conscientiousness factor actually comprises two correlated subfactors – Achievement (i.e., ambition, achievement orientation, and perseverance) and Methodicalness (i.e., planfulness, organization, and the need to maintain an orderly environment). Frese and colleagues (1987) have described planfulness, and goal orientation, as action styles, which are hypothesized to be fairly stable person-specific approaches to action. These authors found that lower levels of planfulness, as assessed by a self-report measure, tend to be correlated with higher rates of depression, increased work-related stress, and decreased college performance.
(Frese et al., 1987). In addition, poor planning is related to inefficient, non-goal-oriented behaviors (see also Schonpflug, 1985; Semmer & Frese, 1985) and to coronary-prone Type A behavior (Jenkins, Zyzanski, & Rosenman, 1971).7

Others, however, have argued that planfulness is more profitably construed as a cognitive ability than as a personality trait. For example, Wachter, Ullrich, Nebe, and Klarius (1997) concluded that planfulness and modes of goal implementation were not explained by personality, intelligence, or memory characteristics, and, in fact, were themselves better predictors of the quality of performance in real activities than were these characteristics. In another study, Tucker and Warr (1996) examined the differences between cognitive styles, or the “consistent individual differences in the ways of organizing and processing information and experience (Messick, 1984, p. 61),” and cognitive abilities, or the “content and level of what a person can maximally achieve (Messick, 1984, p. 61).” They concluded that the cognitive styles of planfulness, tempo, and complexity were not helpful in predicting complex task performance beyond the predictive power of elementary cognitive abilities, such as processing speed and working memory. Even those suggesting that planfulness is a personality trait (Scholnick et al., 1997) have acknowledged that planning may be disrupted by limited working memory or by skill level.

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7 Frese and his colleagues (1987) developed a scale to assess action styles, which yielded three factors – goal orientation, planfulness, and social orientation (i.e., using help from others to set one’s own plans). The items of the planfulness factor do not overlap with SPDS in content but may be related. This scale appears to focus more on the extent to which people think about their plans, rather than on the discomfort and difficulties they experience because of their disorganization, as the SPDS does.
Scholnick and her colleagues (1997) have adopted an information-processing paradigm with which to understand planning. They prefer this model because it allows for new plans to be created during the course of problem-solving rather than the mere reliance on adapting old strategies to new situations. This information-processing model also allows the researchers to investigate problem representation, plan creation, and monitoring by a system that includes an executive function which allocates attentional resources and schedules operations during problem-solving. They, therefore, describe the central executive as the master planner, which functions in a number of activities, including goal attainment and problem solving (Scholnick, 1994; Scholnick et al., 1997). Theoretically, then, as people’s master planners vary in efficiency and effectiveness, people are likely to vary in their abilities to solve problems, manage multiple activities, and work toward goals.

1.13. Prospective Memory and Planning

As already noted, planning and prospective memory appear to be related in a number of ways (Kliegel et al., 2000; Marsh et al., 1998; Rabbit, 1996). Participants report that their natural daily intentions involve a type of planning (Marsh et al., 1998). Both seem to involve the representation of a situation, the establishment of the intended outcome, a decision to plan or act, the evaluation of available resources and limitations, the creation of a plan, the implementation and monitoring the plan, and, finally, a review of the outcome (Friedman et al., 1987; Scholnick & Friedman, 1987, 1993). In addition,
both seem to rely on the functioning of the central executive system in order to allow the person to respond in novel ways that are appropriate to the intended outcome, but inconsistent with the usual actions associated with the situation.

In an effort to delineate the relationship between planning and prospective memory, Kliegel and his colleagues (2000) reviewed five experiments in which participants’ planning was evaluated in terms of their performance on tasks, each of which, required multiple actions in order to accomplish a goal. Unfortunately, four of these tasks were inadequate to the assessment of prospective memory because the experimenter reminded participants to begin each action (Kvavilashvili & Chitashvili, 1991; Somerville, Wellmann, & Cultice, 1983; Wilson, Cockburn, & Baddeley, 1985). In the fifth study (Shallice & Burgess, 1991), participants were asked to complete the Six Elements Task, a set of six subtasks which must be performed sequentially according to a set of rules and within a limited time period. Although this study did allow for the examination of some planning processes, Kliegel et al. (2000) argued that complex prospective memory could not be studied because participants completed the task immediately after instruction and plan formation, rather than waiting for a period of time to elapse before initiating the plan at the prescribed moment.

In an attempt to study the phases of planning, including the prospective memory components of plan initiation and plan execution, Kliegel and his colleagues (2000) modified the Six Elements Task of Shallice and Burgess (1991). As in the original version of the procedure, participants were asked to formulate a plan that would allow them to work on the six subtasks within the given constraints in a way that would
maximize their total earned points. In addition, Kliegel et al. (2000) asked participants to initiate the task on their own at a particular point in the study. During the time between plan formation and plan initiation, participants were assessed on measures of working memory, inhibition, and retrospective memory in order to evaluate the effects of these cognitive abilities on performance and to keep participants occupied so that the prospective memory task for which they planned would not stay in their working memory.

1.14. The Role of Executive Functioning in Planning

Frequently used laboratory measures of planning include the Tower of Hanoi, the Tower of London, and errand planning tasks. In the Tower tasks, people are asked to move rings stacked in size order on one peg to another peg without violating size order (i.e., rings cannot be placed on top of rings smaller in size). In errand planning tasks, people are asked to complete a number of errands within geographic and temporal constraints. In both, people must identify the inherent order in the tasks and create a sequence that fits both this order and the given constraints; the tasks may vary in the number of constraints and in the number of sequences possible (Scholnick et al., 1997). Because these tasks require people to plan, execute, monitor, and revise a sequence of moves within a set of constraints, Welsh, Satterlee-Cartmell, and Stine (1999) have argued that working memory and inhibition for prepotent responses must be involved in such performance (see also Goel & Grafman, 1995; Goldman-Rakic, 1987; Roberts & Pennington, 1996).
A similar understanding of the cognitive processes in planning has led Barkley (1997a) to hypothesize that children with ADHD, who have deficits in inhibition and working memory, should exhibit impairments in planning. In fact, Perchet, Revel, Fourneret, Mauguiere, and Garcia-Larrea (2001) found that children with ADHD had more difficulty with planfulness and planning behaviors than children without attentional deficits. Similarly, such planning impairments have been found in those with poor executive functioning due to brain injury (see van den Broek, 1999, for review). In a study of the effects of traumatic brain injury on performance of the tasks in the Cognitive Assessment System, Gutentag, Naglieri, and Yeates (1998) found that children with brain injuries, as compared to children without such injuries, earned significantly lower scores in the domains of attention and planning (executive functioning measures), but similar scores in the other domains. Problems in problem solving, cognitive flexibility, and executive functioning also have been found in patients with traumatic brain injuries both before and after neurosurgery interventions (Leon-Carrion, Alarcon, Revuelta, Murillo-Cabezas, Dominguez-Roldan, Dominguez-Morales, Machuca-Murga, & Forastero, 1998).

The components of the planning process may be differentially impaired by damage to various parts of the brain. In one study, participants were asked to perform a problem-solving task on a photocopy machine in which four stages of planning – analysis of the problem, formulation of a solution, planning, and monitoring – were measured (Crepeau, Scherzer, Belleville, & Desmarais, 1997). Participants also completed several neuropsychological tests. Those participants with traumatic brain injuries performed
significantly worse on both the problem-solving task and the neuropsychological tests as compared to their non-injured peers. Moreover, the patterns of deficits seen in the participants’ performance suggested partial independence of the various problem-solving components. In another study (Carlin, Bonerba, Phipps, Alexander, Shapiro, & Grafman, 2000), researchers were able to show that two groups with different types of frontal lobe damage exhibited equally poor performance on the Tower of London, a traditional planning task, but differential performance across the stages of planning. One group showed more impairment in plan development and execution, while the other group showed more impairment in execution-related processes.

Even those with relatively mild brain injuries show deficits in planning. Malec, Machulda, and Smigielski (1993) conducted a cluster analysis of neuropsychological test results among patients with traumatic brain injuries and found that one cluster of patients, those with mild initial injuries, very mild neuropsychological impairment, and mild disabilities, showed difficulties with planning and irritability. Another cluster of patients, despite showing normal performance on traditional tests of executive functioning, exhibited disorganization, absentmindedness, poor prospective memory, and deficits in planning and decision-making (Burgess, 2000b; Burgess, Veitch, de Lacy Costello, & Shallice, 2000). The primary impairment for all of these patients has been described as one in multitasking, or in the ability to perform concurrent tasks or jobs simultaneously by interleaving, or alternating between the subtasks of one and the subtasks of the other
(cited in Burgess, 2000b, p. 281). This condition has been called “strategy application disorder” (see Burgess, 2000b; Levine, Stuss, Milberg, Alexander, Schwartz, & Macdonald, 1998; Shallice & Burgess, 1991).

Burgess (2000b) further proposes that strategy application disorder will be most evident in complex real-life situations in which people must organize and structure their behavior according to their goals and external constraints. Even mild executive dysfunctions, which do not disrupt performance on traditional neuropsychological tests, do appear to undermine multitasking, “an activity which is at the very heart of competency in everyday life (Burgess, 2000b, p. 279).” Frequently some of the tasks involved in our everyday multitasking have to be delayed and completed at a later time. Meanwhile, interruptions and unexpected outcomes arise while we are attempting to complete these tasks (Burgess, 2000a, 2000b). As such, our daily multitasking does utilize, to some degree, those executive functions measured by standard neuropsychological tests, including inhibition, cognitive flexibility, retrospective memory, and prospective memory (Burgess et al., 2000; Kliegel et al., 2002). The demands of such multitasking also seem to draw upon an additional set of cognitive processes (Burgess, 2000b; Duncan, Johnson, Swales, & Freer, 1997).

1.15. Six Elements Task

One test that appears to assess processes involved in multitasking is the Six Elements Test (Shallice & Burgess, 1991). As explained above, in this measure of planning performance, participants are asked to complete six different subtasks in a specified time period, which, in fact, is not long enough for all subtasks to be completed.
In addition, participants are given some sequence constraints to guide their work. Adequate performance thus relies on planning, or on development of a plan for the sequencing of subtasks and the completion of as many items as possible within the time limit, in order to maximize one’s total number of earned points. Overall performance on this test is correlated with deficits in multitasking and active planning processes in everyday life (Burgess, 2000b; Kliegel et al., 2000; Burgess, Alderman, Ernslie, Evans, & Wilson, 1998), but not with performance on other neuropsychological instruments (Burgess, 2000b; Duncan et al., 1997).

Poor performance on a planning task, however, may derive from deficits in one or more components of the planning process (Kotovsky, Hayes, & Simon, 1985; Scholnick et al., 1997) that may be associated with impairment of one or more of the executive functions. In an effort to better elucidate the relationship among planning and executive functions, Kliegel and his colleagues (in press) had participants complete a modified version of the Six Elements Test (Shallice & Burgess, 1991; Kliegel et al., 2000). Again, as discussed above, in this modification, participants developed a plan for completing the six subtasks. They then worked on various measures until a certain point in the experiment at which they were to execute their earlier formulated plans. In this way, the researchers could isolate the various stages of the planning process, which they call complex prospective memory. Using this procedure, Kliegel and his colleagues (2002) were able to formulate a process model of planning, or complex prospective memory, that implicates various executive functions in each phase. Performance in the first phase, the intention formation phase in which people must create a plan for action and encode it,
was highly correlated with a planning measure, a task in which people had to complete several errands in a fictitious setting given sequencing and time constraints. Retention, the second phase in which people must remember what they intended to do, was not significantly related to any of the measured executive functions. Initiation of the intention, the third phase, was related to performance on the Tower of London and the Wisconsin Card Sorting Test, indicating plan initiation is linked to reliance upon cognitive flexibility and problem solving. Finally, execution of the intention was strongly linked to measures of cognitive flexibility, planning, and non-verbal fluency. Thus, while it has been demonstrated that deficits in planning ability are generally related to poor executive functioning, it may now be possible, using Kliegel’s process model, to link specific executive functioning deficits to a variety of disabilities which result in limited planning abilities.

1.16. Individual Differences and the Six Elements Task

Interestingly, in an attempt to study the effects of aging on active planning, Kliegel and his colleagues (2000) used their modified version of the Six Elements Task. Both young and old participants completed this task in addition to responding to a number of measures, including those of working memory, inhibition, and retrospective memory. These measures, serving as a distractor between plan formation and initiation, also were used to evaluate the effects of these age-sensitive cognitive abilities on the planning process. In general, the findings suggested that younger adults performed better on the cognitive abilities measures and showed better plan formulation and plan initiation than did older adults. Such differences in planning were partially due to age alone,
controlling for any differences in cognitive abilities. In contrast, there were no age-related
differences in plan retention and plan fidelity (i.e., extent to which the participants
followed their own plans). The development of a plan and its initiation seemed to be
related to each other, but these early phases did not appear to be related to the actual
execution of the plan.

1.17. Cognitive Dysorganization, Prospective Memory, and Planning

As discussed above, there is evidence to suggest that difficulties in prospective
memory and planning, as well as in self-control and efficient goal-directed behavior (see
Barkley, 1997a), may result from impaired executive functions. Thus, to the extent to
which cognitive dysorganization, as assessed by the SPDS, reflects impaired executive
functioning, it should be negatively related to the quality of prospective memory and
planning performance. More specifically, high SPDS scorers, compared with their low
scoring counterparts, should have more difficulty in planning and in remembering to
carry out their intended plans.

1.18. Cognitive Dysorganization, Planning, and Environmental Memory Supports

Dean (2001), in fact, has provided evidence consistent with the expectation that
those high in cognitive dysorganization would perform more poorly on prospective
memory tasks than those low in cognitive dysorganization. In her study, participants were
to remember to knock on a table periodically while watching a film about a submarine
disaster. Participants in the event-based condition were given an external cue;
specifically, these participants were asked to knock on a table whenever any male
character’s first name was spoken. Participants in a time-based condition were not given
an external cue; instead, they were asked to knock every three minutes, without the aid of a timepiece. After watching the film, participants were given a postcard containing questions about the film, which they were to return in either one or seven days. Although there was no difference in prospective memory performance in the lab task by the two cognitive dysorganization groups in the event-based condition, their performance did differ in the time-based condition. More specifically, high cognitive dysorganization participants, as compared to their low cognitive dysorganization peers, showed significantly poorer performance in the absence of prompting cues. High cognitive dysorganization participants also performed more poorly in the more naturalistic task, that is, they were less likely to return postcards than were the low cognitive dysorganization participants, with this difference being greater in the seven-day condition than in the one-day interval condition.

Research by Mirels and his colleagues (Mirels & Gordon, 1996; Mirels & Dean, 2001) provides additional evidence of difficulties in planning. For example, they found that scores on the SPDS were related to self-reported attitudes about time usage and daily activities. More specifically, high, as compared with low, cognitive dysorganization participants were more likely to report that they have difficulty organizing, starting, persisting in, and completing activities (Mirels & Gordon, 1996). These difficulties are reflective of the phases of planning as delineated by Kliegel and colleagues (2000), including plan formation, plan initiation, and plan execution. Although the fourth phase, that of plan retention, was not explicitly included in the above studies, those high in
cognitive dysorganization gave no indication that it was problematic for them.
Interestingly, no executive function has been found to be associated with plan retention
(Kliegel, Martin, McDaniel, & Einstein, 2002).

1.19. The Present Study

The current study explores the proposed relationship between cognitive
dysorganization, prospective memory, and planning, and the ways in which executive
functioning may mediate these relationships. First, the present study examines the
differences in prospective memory and planning associated with cognitive
dysorganization and external environmental supports. The presence of such differences is
evaluated with respect to prospective memory and each phase of the planning process.
Second, the present study attempts to determine the executive processes associated with
each of the planning phases and whether cognitive dysorganization contributes to these
planning phases beyond the contributions of the executive functions. The specific
executive functions considered include working memory, inhibition, cognitive fluency,
and divided attention.

Higher reported levels of cognitive dysorganization are expected to be associated
with poorer prospective memory and poorer planning. Given their poor prospective
memory performance and their self-reported difficulties in planning and task
performance, persons high in cognitive dysorganization are expected to show deficits in
planning performance, parallel to those seen in patients with impaired executive system
functions due to brain injury, ADHD, or aging (Barkley, 1997a; Burgess, 2000b; Burgess
et al., 2000; Kliegel et al., 2000). Thus, high, as compared to low, cognitive
dysorganization participants would be expected to exhibit absentmindedness, poor
prospective memory, planning and decision-making deficits, and poor multitasking
(Burgess, 2000b; Burgess et al., 2000). Moreover, these deficits due to cognitive
dysorganization are likely to be particularly pronounced when attentional demands are
high. That is, when faced with numerous, competing stimuli, any weakness in the
executive system is likely to lead to ineffective balancing and interleaving of the
simultaneous tasks, resulting in impaired performance.

Moreover, the use of external cues to assist in the various phases of planning is
expected to moderate the relationship between cognitive dysorganization and planning
performance. As discussed above, Dean (2001) found that high, as compared to low,
cognitive dysorganization participants were less likely to carry out the tasks in the
absence of external prompting cues. This difference in performance between the two
cognitive dysorganization groups did not appear when external prompting cues were
provided. Thus, high, as compared to low, cognitive dysorganization participants are
expected to show more problems when such external prompting cues are absent, with
such differential performance decreasing as more external memory support is provided.

Also, the executive functions themselves, when measured behaviorally, are
expected to be differentially associated with each of the phases of planning process. In

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8 These difficulties also would be expected in those with impaired behavioral
inhibition, as hypothesized by Barkley (1997a). No studies, however, have
directly examined the relationship between poor inhibition, as defined by
Barkley, and planning ability (see discussion in Barkley, 1997a).
fact, in two separate studies utilizing the Six Elements Test, Kliegel and his colleagues (2000, 2002) have presented evidence that the various phases of planning may involve specific executive functions. For example, these authors found that, during plan formation, elaboration of a plan is positively associated with non-verbal cognitive fluency. Also, timely initiation of a plan seems to become more likely as working memory, inhibition, and cognitive flexibility increase. And, in addition to depending on performance in the earlier phases of planning, plan execution draws upon working memory, cognitive flexibility, inhibition, and verbal fluency. In fact, plan retention is the only phase that has not associated with one or more executive functions. Thus, working memory is anticipated to contribute to plan formation, initiation, and execution; whereas, cognitive fluency is anticipated to contribute only to plan formation and execution. Inhibition and divided attention are expected to be related to plan initiation and execution. Plan retention is not expected to relate to any of the executive functions.

Over and above the influence of several components of executive functioning, cognitive dysorganization is expected to account for variance in planning. Similar to this, Kliegel and his colleagues (in press) found that younger adults performed better on the cognitive abilities measures and showed better plan elaboration and plan initiation than did older adults. Such differences in planning were partially due to age alone, controlling for any differences in executive functions. Cognitive dysorganization is expected to show effects parallel to those of age.

To test these hypotheses of the relationships concerning cognitive dysorganization, executive functioning, prospective memory, and planning, the current
The study employs a modified version of the Six Elements Task (Shallice and Burgess, 1991; see also Kliegel et al., 2000). As elaborated earlier, participants completing this task are asked to develop a plan to work on six subtasks within given constraints in order to maximize their total number of points. Participants then complete a number of other measures until it is time to initiate the earlier formulated plan. In the present study, two major modifications of the Kliegel et al. procedure are made. First, whereas Kliegel and his colleagues measured age and its effects on planning, cognitive dysorganization is included in the present study as an important individual differences measure that is expected to contribute to planning performance. Second, in order to measure the effectiveness of external memory cues in the planning process, the degree of such external support is varied. In the plan formation condition, only some of the participants receive verbal directions to formulate a plan for later performance; the other participants do not have this external cue. In addition, in the plan execution phase, half of those who developed a plan in the first component of planning have an outline of that plan to follow as they execute this task.

The Six Elements Task is most appropriate for testing the hypotheses of the current study because it allows for the examination of performance during each phase of planning (Burgess, 1996; Kliegel et al., 2000; Kliegel et al., 2002). This is important because those with high levels of cognitive dysorganization, who are likely to perform more poorly, may not suffer from an overall incapacity to plan (Kotovsky et al., 1985; Scholnick et al., 1997). Rather, it may be that they have difficulties in one or more of the phases of planning, and that this impairment leads to poor, or failed, plan execution.
1.20. Conclusion

In summary, the current study explores the proposed relationships among cognitive dysorganization, planning, and simple prospective memory, as well as several executive functions which may underlie these relationships. Although cognitive dysorganization is expected to be associated with some difficulties in executive functioning, attentional problems, and trait anxiety, it also is expected to contribute to differences in planning ability beyond those due to these factors alone. Moreover, the use of external cues to assist in the various phases of planning is expected to moderate this relationship. More specifically, the increasing presence of such cues are expected to narrow the differences in performance between those with low and high levels of cognitive dysorganization.
CHAPTER 2

METHOD

2.1. Participants

Participants selected from four pools of introductory psychology students (N₁ = 699, N₂ = 282, N₃ = 133, and N₄ = 654) completed the Sense of Personal Disorganization Scale (SPDS; Mirels, Dean, & Ponton, 1998) as part of large-scale data collections undertaken at the beginning of four consecutive academic terms at Ohio State University. SPDS scores for the four samples were similar (M₁ = 40.92, SD₁ = 14.89; M₂ = 41.95, SD₂ = 15.33; M₃ = 40.14, SD₃ = 16.19; M₄ = 40.56, SD₄ = 15.05). Criteria for the selection of participants were based on the scores defining the upper and lower thirds of SPDS score distribution of the first sample. Students scoring 47 or higher on the SPDS were designated as high in cognitive dysorganization; those scoring 33 or lower were designated as low in cognitive dysorganization. Within each level of cognitive dysorganization, participants were be selected randomly, then contacted by email with a solicitation for participation in the present study and instructions for enrolling in the experiment via the research web page (see Appendix B for email message). The final sample consisted of 160 female students and 142 male students (N = 302), ranging in age
from 18 to 51 years (M = 19.67, SD = 3.09). The 158 low cognitive dysorganization participants had a mean score of 24.99 (SD = 6.12) on the SPDS; the 144 high cognitive dysorganization participants had a mean score of 57.63 (SD = 7.96).

2.2. Instruments

2.2.1. Sense of Personal Disorganization Scale (SPDS). As noted earlier, the SPDS (Mirels, Dean, & Ponton, 1998; see Appendix A) is a 12-item self-report measure developed on the assumption that one’s degree of cognitive dysorganization would be reflected in a person’s avowal of the extent to which he or she is absent-minded, inefficient, forgetful, and prone to a generalized sense of disorganization. Respondents are asked to indicate the degree to which they agree or disagree with such items as “My life often seems very disorganized,” and “I almost never misplace bills or important papers.” The response format is a seven-point Likert scale ranging from –3 (strongly disagree) to +3 (strongly agree). The scale has a Cronbach’s alpha of 0.85 (Mirels et al., 1998), and it appears to be unifactorial (Mirels et al., 1998). It relates in expected ways to a wide range of other dispositions including anxiety, self-esteem, and several aspects of self-reported time usage (Mirels et al., 1998; Mirels & Dean, 2000).

2.2.2. Working Memory Test (WMT). The working memory task used in the current study was developed by Turner and Engle (1989; see Appendix C for example) as a measure of working memory capacity, or “the ability to use controlled processing to maintain information in an active, quickly retrievable state” (Engle, 2001, p. 301). Participants are presented with a “mathematical operation – word string”, such as “(10 / 2) + 4 = 3? tool” in the center of a computer monitor. They are asked to read the math
problem aloud, solve it, and state “yes” or “no”, depending on whether the answer on the
screen is correct or incorrect. They are further instructed to read aloud the word at the end
of the math problem. After the participants say each word, the experimenter presses a
key, and the next string is presented. Although the participants are given adequate time to
process each string, they are not given time to rehearse the words. Once a set of two to
six strings is presented, the program pauses, and the participants are asked to write down,
in order, the words that were shown to them in the most recent set. A working memory
capacity score is computed as the sum of the number of words recalled correctly across
the trials, divided by the number of trials. Scores on this measure have been found to be
related to other measures of working memory, including reading span and counting span
(Engle, Tuholski, Laughlin, & Conway, 1999; see Engle, 2001). In addition, they have
been found to predict performance in a range of activities, including reading, listening
comprehension, following directions, note taking, writing, bridge playing, and reasoning
(see discussion in Engle, 2001; Engle, 2002). All of these activities seem to involve the
need for controlled processing and the retention of information over some distraction-
filled time delay.

2.2.3. Stroop Neuropsychological Screening Test. The Stroop Test is believed to
be a measure of both inhibition and susceptibility to interference (Stroop, 1935;
MacLeod, 1991). In this task, people must inhibit the activation of overlearned responses
and opt for a new one (Yee & Vaughan, 1996). Performance on this measure has been
used with some success to determine the presence of brain damage (see Kramer &
Conoley, 1992). In the standard version of this task, participants are presented with three
8x11 inch cards, with five columns on each. The first card lists the words “blue”, “green”, and “red”, arranged randomly and printed in black ink. Participants are to read the words, moving across rows and down the card, as quickly as they can. On the second card, strings of five x’s are each printed randomly in either blue, green, or red ink. Participants are to name the color of each string, moving across rows and down the card. On the third card, the words, “blue”, “green”, and “red”, appear in one of those three ink colors, but usually not the color described by the word. For example, the word “blue” would be printed in green or red ink. On this card, participants are to name the color of ink of each word, rather than reading the word itself. Reading speed for each card is measured in seconds. Scores are computed as the time to read the third card minus the average of the times to read the first and second cards.

2.2.4. Trail Making Test (TMT). Reitan & Wolfson (2001) have suggested that the Trail Making Test assesses general executive functioning (see also Jarvis & Barth, 1984). In fact, those with frontal lobe damage (Johnson, 1997; Quiroga, 1998; Sterne, 1973) and those with behavioral inhibition deficits, such as ADHD (Cholerton, 2000; Pinter, 2000), tend to perform more poorly on this test than do those without such problems. In addition, this measure has been used as an index of divided attention, or the ability to alternate one’s attention between two tasks or between two well-learned sequences (e.g., Krstic, Jovanovic, & Ispanovic-Radojkovic, 1999; Rogers, 1996; Smith, Large, Kavanagh, Karayinidis, Barrett, Michie, & O’Sullivan, 1998). In “Trails A,” participants are presented with a page of circles with a number in each. They then are instructed to draw a line from one number to the next in numerical order, working as quickly as
possible without lifting the pencil; thus, they should connect “1” to “2”, “2” to “3”, and so on. In ”Trails B”, participants are presented with a page of circles with either a number or a letter inside each, and they are instructed to draw a line from a number to a letter to a number, and so on in alternating, but consecutive order. For example, they would draw a line from the first number (“1”) to the first letter (“A”), then to the second number (“2”), and then to the second letter (“B”). Any errors are corrected immediately by the examiner, and the time for such correction is included in the overall time for performance. Scores are computed as the ratio of time to complete Trails B divided by time to complete Trails A. Higher ratio scores indicate greater likelihood of executive functioning deficits and poorer ability to switch attention.

2.2.5. Cognitive Fluency: Verbal and Nonverbal. The tasks used to assess cognitive fluency are the same ones that Kliegel and his colleagues (2002) found to be associated with the formation and execution phases of planning. Verbal fluency is measured by the S-Words Test (SWT; e.g., Regard, Strauss, & Knapp, 1992). In this task, participants are instructed to write down as many words starting with the letter “s” as they can generate, with the exception of proper nouns for persons or places, in four minutes. The score is the number of words produced, not including replications or instances of the same word with different endings (i.e., “dog” and “dogs”).

Nonverbal fluency is measured by the 5-Points Test (5PT; e.g., Lee, Strauss, Loring, & McCloskey, 1997). In this task, participants are instructed to draw as many
different connecting patterns through a design of 5 points (i.e., identical to the five-dot arrangement found on dice) as they can generate in four minutes. The score is the number of patterns produced, not including replications.

2.2.6. The State-Trait Anxiety Inventory, Form Y-2. Participants’ self-reported levels of trait anxiety is assessed by the State-Trait Anxiety Inventory, Form Y-2 (STAI-2; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). This widely used scale asks participants to indicate on a four-point rating scale (i.e., 1=almost never, 4=almost always) the degree to which each of the 20 items, e.g., “I feel nervous and restless” and “I worry too much over something that really doesn’t matter,” are representative of themselves. Total STAI-2 scores range from 20 to 80, with higher scores indicating higher levels of trait anxiety. Cronbach’s alpha for this measure typically range from .76 to .91 (Ray, 1984).

2.2.7. Adult Behavior Rating Scale. The Adult Behavior Rating Scale – Self-Report of Current Behavior (ABRS; Barkley, 1997b) is a self-report measure in which participants are asked to rate how often they experience the symptoms of ADHD, as listed in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994)\(^9\). The first nine items address inattention; whereas, the second nine items address hyperactivity-impulsiveness. Although Barkley (1997b) recommends the use of this form along with a thorough psychological interview

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\(^9\) The first 18 items on this scale ask about symptoms of ADHD; the final 8 items ask about symptoms of Oppositional Defiant Disorder (ODD; Barkley, 1997b). This index of ODD symptoms will not be included in the current study.
to assess the probability of ADHD, the scale does serve as an initial indicator of problems with attention and hyperactivity. In the current study, all items are summed to serve as an index of attentional deficits.

2.2.8. Personal Information Questionnaire. This Personal Information Questionnaire (PIQ) was used by Kliegel and his colleagues (2000; see Appendix D) as part of their modification of the Six Elements Task. During the plan retention phase, participants completed several tasks including the PIQ. Earlier in the study participants had been instructed that, after answering the question about their dates of birth on the PIQ, they were to begin working on the Six Elements Task. Thus, the PIQ serves both to gather some demographic information about the participants and to cue the participants to initiate their plans for working on the major task. Whether or not they self-initiate the Six Elements Task at the appropriate section on the PIQ is used as a measure of simple prospective memory performance.

2.2.9. Six Elements Task. The Six Elements Task (SET; Shallice & Burgess, 1991; see Appendix E) was created as a measure of planning. Kliegel and his colleagues (2000) modified the task in order to examine the various stages in the planning process. This modified version includes six subtasks of three different types (i.e., word search, arithmetic, and picture identification); the two subtasks of each type are equivalent in difficulty. These subtasks are divided into two sets (A & B), with each set containing one of each of the three types of subtasks. In the word search subtasks, participants are presented with 35 groups of 4 items, one of which is an actual word. The three “pseudo-words” in each group are spelled or pronounced similarly to the real word (e.g., conceal,
Participants are asked to indicate the real words by circling them. In each of the two arithmetic subtasks, participants are presented with ten math problems which they must solve (i.e., $200 / 5 \times 4 = ?$). And, in each of the two picture identification subtasks, participants are presented with 20 pictures of common objects or symbols (e.g., cat), and they are to write down an appropriate label for each object. The participants are to complete as much as they can of these six subtasks within six minutes; however, each subtask is designed to take more than one minute to complete. In addition, the participants are given a set of constraints which they must follow (see below for discussion; also see Appendix F). The goal, as described to the participants, is to perform in such a way as to maximize the total number of points.

2.2.10. Effort and Difficulty Check. The effort and task difficulty check, modified from an unpublished scale (Nygren, 19xx), was used as a rough measure of participants’ self-reported level of effort and motivation during task performance as well as their perception of task difficulty (see Appendix G). The first section asks participants to indicate on a seven-point rating scale (i.e., 1=not at all, 7=very much so) the degree to which each of the five items, e.g., “How difficult did you find working on the six subtasks to be?” and “How motivated were you to earn as many points as possible on the six subtasks?,” are representative of their task performance. Two scores were computed using subsets of the items. A difficulty score was equal to participants’ responses on the first item, and an effort score was computed as the sum of participants’ responses on the second, third, and fourth items. The other items on the form were not used in the current study.
2.3. Procedure

2.3.1. Introduction Phase. The participants, seen individually, were seated at a desk with a computer. A tape recorder was placed on the corner of the desk to record their responses during the planning segments of the session. The participants also were provided a stopwatch in order to allow them to track time during the Six Elements Task.

At the outset of the experiment session, the study was introduced as an investigation of the relationship of task performance and memory to personal characteristics and styles (see experimental script, Appendix H). The participants were asked to complete a variety of tasks, both written and computerized. The participants also were asked to give their watches to the experimenter on the pretext that it might interfere with their performance during the experiment. In addition, the participants were told to remind the experimenter to return the watches at the conclusion of the experiment session.

The participants then were told that later in the experiment, after several tasks, they would fill-out a number of questionnaires. The participants were further told that they would then work on a set of six subtasks with the goal of maximizing an overall score. These subtasks were then described with the use of a sample sheet (see Appendix E). For the word identification task, the participants were told to examine the four word choices of each item and identify the one word that is a real word. For the arithmetic task, the participants were asked to complete a number of complex arithmetic problems. For the picture identification task, the participants were told to give an appropriate label to
each figure. In addition, it was explained to the participants that there were two different forms of each subtask, Set A and Set B, and that all of these subtasks, divided into six file folders, were located in a drawer in the desk at which they were sitting.

The participants were then informed of the rules they must follow in completing the Six Elements Task. A card with these rules was displayed as the experimenter read them to the participants. These rules, following the procedure of Kliegel and his colleagues (2000), were as follows:

1. Your aim is to maximize your score. (a) Earlier pictures / problems / word groups will be given more points than later ones in each subtask. (b) Points will be given for correct answers, and performance errors or omissions will be penalized. (c) Each of the six subtasks will be given equal weight.

2. You are not allowed to do two sub-tasks (A) and (B) of the same type one after the other.

3. You will have 6 minutes.

4. Please press the start-button of this stopwatch to start the timing of the tasks yourself (p. 1043).

Once these rules were explained, the experimenter removed the written list of rules and asked the participants to recall them. Any errors or omissions were corrected. At this point, the participants were told that they would have to remember to begin the subtasks after answering the question about date of birth on the PIQ. When this question was reached, the participants were to stop working on the questionnaires, remove the subtasks from the file drawer, and start the timer as they begin working on the Six Elements Task.
2.3.2. Plan Formation Phase. After the rules were explained, the participants were assigned to one of three experimental conditions that varied in the degree of planning support offered. The first condition, the “plan instruction condition,” was the same as that employed by Kliegel and his colleagues (2000). Here, participants were instructed to devise a verbal plan for how they would proceed with the six subtasks. This plan was audiorecorded for later scoring (see Appendix I). In the second condition, the “no plan instruction condition,” the participants were not instructed to devise a plan. Rather, after the rules of the Six Elements Task were discussed, there was a pause in the experiment, during which the experimenter stated he or she needed to set things up for the next task. While waiting, the participants may have or may not have generated a plan. In the third condition, the “plan cue condition,” the participants were instructed to devise a verbal plan, but here, the participants were also asked to briefly outline this plan on a note card, which was provided as a memory cue during the Six Elements Task.

2.3.3. Delay Phase. Following the plan formation phase, participants completed the battery of measures described above. Participants were randomly assigned to one of two measure orders. In both orders, the PIQ was placed last in order to cue self-initiation of the Six Elements Task. Participants assigned to the first order completed the WMT, the cognitive fluency measures, the TMT, the Stroop, and then the questionnaire booklet. Those assigned to the second order completed the Stroop, the TMT, the cognitive fluency measures, the WMT, and the questionnaire booklet.

2.3.4. Plan Initiation Phase. At that point in completing the PIQ where the participants reached the date of birth item, they were to stop working on the
questionnaires in order to begin the Six Elements Task. If, however, the participants failed to do so, the experimenter would allow the participants to finish the questionnaire and would then ask the participants whether they recalled when that task was to be started.

2.3.5. Plan Execution Phase. The participants began the Six Elements Task either at the appropriate cue, if remembered, or at the experimenter’s direction. Six minutes were allowed for this task, and the participants timed themselves. If the participants were in the instruction plus cue planning condition, the outline was placed on the desk for use during the execution of the task. No aid was provided for those in the other two conditions.

2.3.6. Plan Recall Phase\(^ {10}\). Participants who were not directed to formulate a plan for the Six Elements Task were asked if they did so during the break. If the answer was yes, the participants, in addition to all of those in the other two plan formation conditions, were asked to recall their plans for the task. This recalling of the plan was recorded. The participants then were asked to complete any of the items remaining on the PIQ.

2.3.7. Debriefing Phase. At the conclusion of the session, participants were debriefed regarding the purposes of the study (see Appendix J). In addition, the

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\(^ {10}\) Kliegel and his colleagues (2000) asked participants to recall their plans before the actual plan execution phase. This review may reinforce the plan, thereby minimizing between-group differences. Because earlier research with cognitive dysorganization has revealed that similar cues given prior to action seem to remove group differences (Mirels, Nygren, & Dean, 1998), the recall phase has been moved to the end of the experiment session.
experimenter noted whether the participants asked for their personal belongings before leaving the room. If the participants left the room without requesting these things, the experimenter returned them to the participants and noted this as a failure of simple prospective memory.
3.1. Cognitive Dysorganization, Task Performance, and Effort

In order to check on the possibility that the scores on one or more of the tasks was influenced by effort, all participants completed a self-report measure asking them to describe their level of effort during task performance and their perception of task difficulty (see Appendix G). The three items which asked participants to rate their level of effort were summed to constitute overall effort scores. Means and standard deviations of effort level are shown in Table 3.1.

A 2 X 3 (CD level: low, high X Planning level: no instruction, instruction, instruction plus cue) analysis of variance on self-reported level of effort did not reveal a significant main effect for cognitive dysorganization, $F(1, 295) = 2.16$ (n.s.) (see Table 3.2). There, however, was a significant main effect for planning level, $F(2, 295) = 19.27, p < .001$. That is, participants in the no instruction condition reported expending less effort than those participants in the instruction and instruction plus cue conditions. There also was no interaction effect between planning level and cognitive dysorganization, $F(2, 295) = .96$ (n.s.). As there was only a significant main effect for planning level, further analyses were conducted with planning level as the independent variable.
<table>
<thead>
<tr>
<th>Planning Level</th>
<th>Low CD Group (n = 159)</th>
<th>High CD Group (n = 143)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction (n = 93)</td>
<td>13.35 (3.79)</td>
<td>12.02 (3.76)</td>
<td>12.72 (3.81)</td>
</tr>
<tr>
<td>Instruction (n = 104)</td>
<td>15.53 (3.43)</td>
<td>15.56 (3.06)</td>
<td>15.54 (3.24)</td>
</tr>
<tr>
<td>Instruction Plus Cue (n = 98)</td>
<td>15.40 (3.41)</td>
<td>14.91 (3.27)</td>
<td>15.17 (3.34)</td>
</tr>
<tr>
<td>Total</td>
<td>14.80 (3.65)</td>
<td>14.23 (3.68)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1: Means and Standard Deviations of Effort Level.
<table>
<thead>
<tr>
<th>Source</th>
<th>$Df$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD Group</td>
<td>1</td>
<td>25.81</td>
<td>2.18</td>
<td>.01</td>
</tr>
<tr>
<td>Planning Level</td>
<td>2</td>
<td>230.50</td>
<td>19.27**</td>
<td>.12</td>
</tr>
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<td>CD Group X Planning Level</td>
<td>2</td>
<td>11.42</td>
<td>.95</td>
<td>.01</td>
</tr>
<tr>
<td>Residual</td>
<td>295</td>
<td>11.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* ** $p = .00$; $\eta^2$ = effect size.

Table 3.2: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Effort Level.
effect for planning level, which suggests the manipulation of varying planning support was effective, effort scores were not used as a covariate in the following analyses.

3.2. Cognitive Dysorganization, Planning Aids, and Planning Performance

3.2.1. Plan Elaboration. Following Kliegel et al. (2000), the measure of plan elaboration in the plan execution phase was computed on the basis of: a) the number of rules included in participants’ plans, b) the number of times participants specified a particular order for performing the subtasks, and c) the number of executable steps included in the plans. More specifically, participants received one point for each rule they mentioned while formulating the plan. In addition, they received one point for each time they specified a particular order for completing the subtasks and for each time they gave a reason for that particular order. The number of executable steps was scored as follows: a) one point was given for each time participants stated they would work on a word search, arithmetic, or picture identification task, b) one point was given for each time participants specified the number of items to be completed, or the amount of time to pass, before moving to the next step, and c) one point was given for each mention of a procedural activity, such as opening the file drawer or starting the stopwatch. A plan elaboration score was computed as the sum of these points; this score theoretically ranges from zero (i.e., no plan) to an unlimited maximum (i.e., highly complex plan).

Scores of plan elaboration were based on the evaluations of four independent raters, who listened to audio recordings of participants’ verbal plan formulations. The raters independently scored each plan formulation for plan elaboration by using the aforementioned criteria. Inter-rater reliabilities ranged from .83 to .91 (N = 148, 157),
Scores were averaged across raters, and these averaged values served as participants’ final scores. Means and standard deviations for plan elaboration are shown in Table 3.3.

A 2 X 3 (CD level: low, high X Planning level: no instruction, instruction, instruction plus cue) analysis of variance on the plan elaboration scores revealed a significant main effect for planning level (see Table 3.4). As expected, participants who were instructed to formulate a plan showed better plan elaboration than those not instructed to formulate plans, $F(2, 290) = 129.00, p < .001, \eta^2 = .48$. There was no main effect for cognitive dysorganization, $F(1, 290) = .00$ (n.s.), and, there was no significant interaction between cognitive dysorganization and planning level, $F(2, 290) = .02$ (n.s.). In each of the planning conditions, the plans created by high cognitive dysorganization participants did not differ in the degree of elaboration from the plans created by low cognitive dysorganization participants.

3.2.2. Plan Retention. Participants received a score in the plan retention phase based upon the similarity of what was recalled about the plan to what was stated in the original formulation of the plan. This score was equal to the total number of matches between the recalled plan and the originally stated plan. Four independent raters listened to audio recordings of participants’ verbal recall of their initial plans and rated each one of the recalls independently. Inter-rater reliabilities ranged from .85 to .93 (N = 238, 266), $p < .001$. Scores were averaged across raters, and these averaged values served as participants’ final scores. Means and standard deviations for plan retention are shown in Table 3.5.
### Table 3.3: Means and Standard Deviations of Plan Elaboration Scores.

<table>
<thead>
<tr>
<th>Planning Level</th>
<th>No Instruction (n = 97)</th>
<th>Instruction (n = 99)</th>
<th>Instruction Plus Cue (n = 95)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low CD Group</td>
<td>0.04 (0.29)</td>
<td>7.52 (4.17)</td>
<td>6.66 (4.00)</td>
<td>4.84 (4.72)</td>
</tr>
<tr>
<td>High CD Group</td>
<td>0.00 (0.00)</td>
<td>7.40 (5.02)</td>
<td>6.75 (4.17)</td>
<td>4.62 (5.03)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cognitive Dysorganization Group

<table>
<thead>
<tr>
<th>Low CD Group (n = 153)</th>
<th>High CD Group (n = 138)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction (n = 97)</td>
<td>0.04 (.29)</td>
<td>0.00 (.00)</td>
</tr>
<tr>
<td>Planning Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction (n = 99)</td>
<td>7.52 (4.17)</td>
<td>7.40 (5.02)</td>
</tr>
<tr>
<td>Instruction Plus Cue</td>
<td>6.66 (4.00)</td>
<td>6.75 (4.17)</td>
</tr>
<tr>
<td>Total</td>
<td>4.84 (4.72)</td>
<td>4.62 (5.03)</td>
</tr>
<tr>
<td>Source</td>
<td>$Df$</td>
<td>$MS$</td>
</tr>
<tr>
<td>------------------------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>CD Group</td>
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<td>.05</td>
</tr>
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<td>Planning Level</td>
<td>2</td>
<td>1625.99</td>
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<td>CD Group X Planning Level</td>
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<td>.27</td>
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<tr>
<td>Residual</td>
<td>285</td>
<td>12.61</td>
</tr>
</tbody>
</table>

*Note: ** $p = .000$. $\eta^2$ = effect size.*

Table 3.4: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Plan Elaboration.
<table>
<thead>
<tr>
<th>Planning Level</th>
<th>Cognitive Dysorganization Group</th>
<th>No Instruction (n = 97)</th>
<th>Instruction (n = 98)</th>
<th>Instruction Plus Cue (n = 95)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low CD Group (n = 152)</td>
<td>1.03 (2.77)</td>
<td>1.43 (3.11)</td>
<td>1.23 (2.94)</td>
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<tr>
<td></td>
<td>High CD Group (n = 138)</td>
<td>1.43 (3.11)</td>
<td>5.87 (4.25)</td>
<td>5.78 (3.83)</td>
<td>5.92 (3.87)</td>
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<td></td>
<td>Total</td>
<td>4.16 (3.89)</td>
<td>4.30 (4.27)</td>
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</table>

Table 3.5: Means and Standard Deviations of Plan Retention Scores.
Plan retention scores were dependent on plan elaboration scores in that participants who created more elaborate plans would have more details which could be remembered, thereby possibly resulting in a higher plan retention score. Because of this dependency of plan retention scores on initial plan elaboration scores, a 2 x 2 (CD level: low, high X Planning level: instruction, instruction plus cue) analysis of covariance with plan elaboration as the covariate was conducted (see Table 3.6). Plan elaboration was significantly related to plan retention, $F(1, 192) = 864.91$, $p < .001$, $\eta^2 = .82$. As expected, there was no significant main effect for planning level, $F(1, 192) = 1.03$ (n.s.), suggesting that level of planning support did not affect how much of the initial plan was recalled. In addition, there was no significant main effect for cognitive dysorganization level, $F(1, 192) = .82$ (n.s.). That is, low and high cognitive dysorganization participants showed no differences in how well they remembered their initial plans. There also was no significant interaction between cognitive dysorganization and planning level, $F(1, 192) = .004$ (n.s.), on plan retention.

3.2.3. Plan Initiation. As a measure of simple prospective memory, participants received a plan initiation score of either 1 (pass) or 0 (fail). This was based on whether they remembered to initiate the Six Elements Task after answering the question about date of birth. Those who failed to initiate the task were asked if they recalled when they were supposed to do so. Participants received an initiation recall score of 1 (yes) or 0 (no). A Chi-square with continuity correction showed that participants across the three planning support conditions did not differ in initiating the Six Elements Task at the
### Table 3.6: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Plan Retention.

<table>
<thead>
<tr>
<th>Source</th>
<th>$Df$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan Elaboration</td>
<td>1</td>
<td>2169.69</td>
<td>864.91**</td>
<td>.82</td>
</tr>
<tr>
<td>CD Group</td>
<td>1</td>
<td>2.06</td>
<td>.82</td>
<td>.004</td>
</tr>
<tr>
<td>Planning Level</td>
<td>1</td>
<td>2.58</td>
<td>1.03</td>
<td>.005</td>
</tr>
<tr>
<td>CD Group X Planning Level</td>
<td>1</td>
<td>1.67</td>
<td>.67</td>
<td>.004</td>
</tr>
<tr>
<td>Residual</td>
<td>188</td>
<td>2.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** ** $p = .000$. $\eta^2$ = effect size.
correct time, $\chi^2 (2) = .57$ (n.s.; see Table 3.7). In addition, high and low cognitive dysorganization participants did not differ in initiating this task at the correct time, $\chi^2 (1) = .88$ (n.s.; see Table 3.8). Of those who failed to start this test, participants across the three planning support conditions did not differ in how often they remembered the correct cue for beginning the Six Elements Task, $\chi^2 (2) = .04$ (n.s., see Table 3.9). High and low cognitive dysorganization participants also did not differ in how often they remembered the correct cue for beginning this task, $\chi^2 (1) = .35$ (n.s., see Table 3.10).

3.2.4. Plan Fidelity. Participants received a plan fidelity score which reflected whether they had completed the Six Elements Task according to their original plans. Overall performance was determined to be either 1 (consistent) or 0 (inconsistent) with original plans. Plan execution was deemed inconsistent with the initial plan if any part of plan execution differed from the originally stated plan. Inconsistency typically occurred in the order of completion of the subtasks, the number of items completed before moving to the next subtask, and the amount of time spent on each subtask before moving to the next one. A Chi-square with continuity correction showed that a much larger percentage of participants in the instruction plus cue condition performed the Six Elements Task in a manner consistent with their initial plans than did participants in the no instruction or

---

11 Two independent raters compared ten participants’ initial plans to their plan execution and independently determined whether plan execution was consistent with initial plan. Inter-rater reliability was 1.0, $p < .001$. Given the high degree of consistency in scoring, only one rater determined plan fidelity for the rest of the participants.
### Plan Initiation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Failed</th>
<th>Passed</th>
<th>$\chi^2$ (2)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction Condition (n = 97)</td>
<td>41</td>
<td>56</td>
<td>.57</td>
<td>.75</td>
</tr>
<tr>
<td>Instruction Only Condition (n = 104)</td>
<td>41</td>
<td>63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction Plus Cue Condition (n = 100)</td>
<td>37</td>
<td>63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.7: Number of Participants in Each of the Planning Levels Initiating Task at Correct Time.
### Plan Initiation

<table>
<thead>
<tr>
<th></th>
<th>Failed</th>
<th>Passed</th>
<th>( \chi^2 ) (1)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low CD Group</strong></td>
<td>57</td>
<td>101</td>
<td>.88</td>
<td>.35</td>
</tr>
<tr>
<td>(n = 158)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>High CD Group</strong></td>
<td>61</td>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 143)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.8: Number of High and Low Cognitive Dysorganization Participants Initiating Task at Correct Time.
### Recall of Plan Initiation Cue

<table>
<thead>
<tr>
<th>Condition</th>
<th>No Recall of Cue (n = 52)</th>
<th>Recall of Cue (n = 67)</th>
<th>$\chi^2$ (2)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction Condition</td>
<td>18</td>
<td>22</td>
<td>.43</td>
<td>.98</td>
</tr>
<tr>
<td>Instruction Only Condition</td>
<td>18</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction Plus Cue Condition</td>
<td>16</td>
<td>21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.9: Number of Participants in Each of the Planning Levels Recalling Plan Initiation Cue.
Recall of Plan Initiation Cue

<table>
<thead>
<tr>
<th>No Recall of Cue</th>
<th>Recall of Cue</th>
<th>$\chi^2$ (1)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 52)</td>
<td>(n = 67)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low CD Group</td>
<td>27</td>
<td>30</td>
<td>.35</td>
</tr>
<tr>
<td>(n = 158)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High CD Group</td>
<td>25</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>(n = 143)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.10: Number of High and Low Cognitive Dysorganization Participants Recalling Plan Initiation Cue.
instruction only conditions, $\chi^2 (2) = 6.09, p = .05$ (see Table 3.11)$^{12}$. In other words, participants using an outline for plan execution showed greater fidelity to their original plans than did those not using such an aid. In addition, high and low cognitive dysorganization participants did not differ in how consistent their performance of the Six Elements Tasks was to their original plans, $\chi^2 (1) = .01$ (n.s.; see Table 3.12).

3.2.5. Number of Subtasks Started. The number of subtasks initiated by each participant during the Six Elements Task was counted. This sum served as one indicator of overall task performance, with higher scores indicating better performance. Means and standard deviations of the number of subtasks started are shown in Table 3.13.

A 2 X 3 (CD level: low, high X Planning level: no instruction, instruction, instruction plus cue) analysis of variance on the number of subtasks started did not reveal a significant main effect for planning level (see Table 3.14). Participants at each of the planning levels did not differ significantly in the number of subtasks started, $F (2, 301) = 1.35$ (n.s.). In addition, there was no main effect for cognitive dysorganization, $F (1, 301) = .01$ (n.s.). There also was no significant interaction between cognitive dysorganization and planning level, $F (2, 301) = .13$ (n.s.).

3.2.6. Number of Rule Violations. The number of rules a participant violated during the Six Elements Task served as one indicator of overall task performance, with lower scores indicating better performance. Means and standard deviations of the number of subtasks initiated are shown in Table 3.15.

$^{12}$ Many of the participants did not create plans detailed enough to determine whether their plan performance was consistent with their initial plans, resulting in a much smaller sample size for this analysis.
### Plan Fidelity

<table>
<thead>
<tr>
<th></th>
<th>Inconsistency With Plan</th>
<th>Consistency With Plan</th>
<th>$\chi^2$ (1)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No Instruction</strong></td>
<td>(n = 33)</td>
<td>(n = 73)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td></td>
<td></td>
<td>6.09</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>(n = 5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Instruction Only</strong></td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>(n = 55)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Instruction Plus</strong></td>
<td>21</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cue Condition</strong></td>
<td>(n = 46)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.11: Number of Participants in Each of the Planning Levels Showing Plan Fidelity.
<table>
<thead>
<tr>
<th></th>
<th>Inconsistency With Plan (n = 33)</th>
<th>Consistency With Plan (n = 73)</th>
<th>$\chi^2$ (1)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low CD Group</td>
<td>17</td>
<td>40</td>
<td>.01</td>
<td>.92</td>
</tr>
<tr>
<td>(n = 57)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High CD Group</td>
<td>16</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 49)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.12: Number of High and Low Cognitive Dysorganization Participants Showing Plan Fidelity.
<table>
<thead>
<tr>
<th>Planning Level</th>
<th>Cognitive Dysorganization Group</th>
<th>Low CD Group</th>
<th>High CD Group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(n = 159)</td>
<td>(n = 143)</td>
<td></td>
</tr>
<tr>
<td>No Instruction</td>
<td></td>
<td>4.08 (1.16)</td>
<td>4.06 (1.16)</td>
<td>4.07 (1.15)</td>
</tr>
<tr>
<td>Instruction</td>
<td></td>
<td>4.29 (1.18)</td>
<td>4.20 (1.08)</td>
<td>4.25 (1.13)</td>
</tr>
<tr>
<td>Instruction Plus Cue</td>
<td></td>
<td>4.30 (1.13)</td>
<td>4.37 (1.14)</td>
<td>4.33 (1.12)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4.23 (1.15)</td>
<td>4.21 (1.12)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.13: Means and Standard Deviations for Number of Subtasks Started.
<table>
<thead>
<tr>
<th>Source</th>
<th>Df</th>
<th>MS</th>
<th>F</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD Group</td>
<td>1</td>
<td>.01</td>
<td>.01</td>
<td>.000</td>
</tr>
<tr>
<td>Planning Level</td>
<td>2</td>
<td>1.76</td>
<td>1.35</td>
<td>.009</td>
</tr>
<tr>
<td>CD Group X Planning Level</td>
<td>2</td>
<td>.16</td>
<td>.13</td>
<td>.001</td>
</tr>
<tr>
<td>Residual</td>
<td>296</td>
<td>1.30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: $\eta^2$ = effect size.*

Table 3.14: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Number of Subtasks Started.
<table>
<thead>
<tr>
<th>Planning Level</th>
<th>Low CD Group (n = 159)</th>
<th>High CD Group (n = 143)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction (n = 98)</td>
<td>.06 (.24)</td>
<td>.13 (.33)</td>
<td>.09 (.29)</td>
</tr>
<tr>
<td>Instruction (n = 104)</td>
<td>.07 (.26)</td>
<td>.12 (.33)</td>
<td>.10 (.30)</td>
</tr>
<tr>
<td>Instruction Plus Cue (n = 100)</td>
<td>.02 (.14)</td>
<td>.13 (.34)</td>
<td>.07 (.26)</td>
</tr>
<tr>
<td>Total</td>
<td>.05 (.22)</td>
<td>.13 (.33)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.15: Means and Standard Deviations for Number of Rule Violations.
A 2 X 3 (CD level: low, high X Planning level: no instruction, instruction, instruction plus cue) analysis of variance on the number of rule violations revealed a significant main effect for level of cognitive dysorganization (see Table 3.16). More specifically, high cognitive dysorganization participants committed more rule violations than did low cognitive dysorganization participants, $F(1, 301) = 5.47, p = .02, \eta^2 = .02$. However, there was no main effect for planning level, $F(2, 301) = .19$ (n.s.), and there was no significant interaction between cognitive dysorganization and planning level, $F(2, 301) = .34$ (n.s.). High, as compared to low, cognitive dysorganization participants committed more rule violations across all planning levels. This difference was not significant in the no instruction, $t(96) = .27$ (n.s.), or instruction only, $t(102) = .40$ (n.s.), conditions, but there was a significant difference in the number of rule violations committed in the instruction plus cue condition, $t(98) = .03, p = .03$.

3.2.7. Number of Items Completed. The number of items each participant completed during the Six Elements Task was summed to constitute one indicator of overall task performance, with higher scores indicating better performance. Means and standard deviations of the number of items completed are shown in Table 3.17.

A 2 X 3 (CD level: low, high X Planning level: no instruction, instruction, instruction plus cue) analysis of variance on the number of items completed revealed no significant main effects for planning level, $F(2, 301) = .85$, or cognitive dysorganization, $F(1, 301) = .18$ (see Table 3.18). There also was no interaction effect between planning
<table>
<thead>
<tr>
<th>Source</th>
<th>$Df$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD Group</td>
<td>1</td>
<td>.43</td>
<td>5.47**</td>
<td>.018</td>
</tr>
<tr>
<td>Planning Level</td>
<td>2</td>
<td>.02</td>
<td>.19</td>
<td>.001</td>
</tr>
<tr>
<td>CD Group X Planning Level</td>
<td>2</td>
<td>.03</td>
<td>.34</td>
<td>.002</td>
</tr>
<tr>
<td>Residual</td>
<td>296</td>
<td>.08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* **$p < .025$; $\eta^2$ = effect size.*

Table 3.16: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Number of Rule Violations.
## Table 3.17: Means and Standard Deviations for Number of Items Completed.

<table>
<thead>
<tr>
<th>Planning Level</th>
<th>Low CD Group (n = 159)</th>
<th>High CD Group (n = 143)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction (n = 98)</td>
<td>69.16 (22.46)</td>
<td>71.71 (17.40)</td>
<td>70.41 (20.08)</td>
</tr>
<tr>
<td>Instruction (n = 104)</td>
<td>73.67 (20.84)</td>
<td>74.14 (21.89)</td>
<td>73.89 (21.24)</td>
</tr>
<tr>
<td>Instruction Plus Cue (n = 100)</td>
<td>76.06 (18.48)</td>
<td>70.13 (16.05)</td>
<td>73.33 (17.58)</td>
</tr>
<tr>
<td>Total</td>
<td>73.06 (20.68)</td>
<td>72.03 (18.62)</td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Df</td>
<td>MS</td>
<td>F</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>CD Group</td>
<td>1</td>
<td>70.59</td>
<td>.18</td>
</tr>
<tr>
<td>Planning Level</td>
<td>2</td>
<td>329.20</td>
<td>.85</td>
</tr>
<tr>
<td>CD Group X Planning Level</td>
<td>2</td>
<td>483.40</td>
<td>1.24</td>
</tr>
<tr>
<td>Residual</td>
<td>296</td>
<td>388.98</td>
<td></td>
</tr>
</tbody>
</table>

*Note: ** $p < .025$; $\eta^2$ = effect size.*

Table 3.18: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Number of Items Completed.
level and cognitive dysorganization, \( F (2, 301) = 1.24 \). Low and high cognitive dysorganization participants did not differ significantly in the number of items in any of the three planning conditions.

3.3. Cognitive Dysorganization and Simple Prospective Memory Performance

Another measure of simple prospective memory was whether or not a participant remembered to ask for his or her watch prior to leaving the experiment. A Chi-square with continuity correction revealed no significant differences in the percentages of high and low cognitive dysorganization participants who remembered their watches before leaving the experimental session, \( \chi^2 (1) = .00 \) (n.s.; see Table 3.19).

3.4. Cognitive Dysorganization, Task Performance, and Perceived Difficulty

As already noted, all participants completed a self-report measure asking them to describe their level of effort during task performance (see Appendix G). One item asked participants to rate the perceived difficulty of the experimental task. Means and standard deviations of perceived task difficulty are shown in Table 3.20.

A 2 X 3 (CD level: low, high X Planning level: no instruction, instruction, instruction plus cue) analysis of variance on perceived task difficulty revealed no significant main effect for cognitive dysorganization, \( F (1, 300) = 1.09 \) (n.s.), or for planning level, \( F (2, 300) = 1.23 \) (n.s.; see Table 3.21). However, there was a significant interaction effect between planning level and cognitive dysorganization, \( F (2, 300) = 4.20, p = .02 \) (see Figure 3.1). Low and high cognitive dysorganization participants did not differ in their perceptions of task difficulty in the no instruction condition, \( t (96) = 1.62 \), or in the instruction plus cue condition, \( t (98) = -.94 \), but, in the
<table>
<thead>
<tr>
<th></th>
<th>No (n = 56)</th>
<th>Yes (n = 85)</th>
<th>$\chi^2$ (1)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low CD Group (n = 78)</td>
<td>31</td>
<td>47</td>
<td>.00</td>
<td>1.00</td>
</tr>
<tr>
<td>High CD Group (n = 63)</td>
<td>25</td>
<td>38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.19: Number of High and Low Cognitive Dysorganization Participants Remembering Their Watches.
<table>
<thead>
<tr>
<th>Planning Level</th>
<th>Low CD Group (n = 158)</th>
<th>High CD Group (n = 142)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Instruction</td>
<td>3.32 (1.33)</td>
<td>2.89 (1.26)</td>
<td>3.11 (1.30)</td>
</tr>
<tr>
<td>Instruction</td>
<td>3.00 (1.12)</td>
<td>3.63 (1.32)</td>
<td>3.30 (1.25)</td>
</tr>
<tr>
<td>Instruction Plus Cue</td>
<td>2.91 (1.36)</td>
<td>3.17 (1.47)</td>
<td>3.03 (1.41)</td>
</tr>
<tr>
<td>Total</td>
<td>3.07 (1.27)</td>
<td>3.24 (1.37)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.20: Means and Standard Deviations of Perceived Task Difficulty.
<table>
<thead>
<tr>
<th>Source</th>
<th>Df</th>
<th>MS</th>
<th>F</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD Group</td>
<td>1</td>
<td>1.87</td>
<td>1.09</td>
<td>.00</td>
</tr>
<tr>
<td>Planning Level</td>
<td>2</td>
<td>2.11</td>
<td>1.23</td>
<td>.01</td>
</tr>
<tr>
<td>CD Group X Planning Level</td>
<td>2</td>
<td>7.20</td>
<td>4.20**</td>
<td>.03</td>
</tr>
<tr>
<td>Residual</td>
<td>300</td>
<td>1.71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ** $p < .02$; $\eta^2$ = effect size.

Table 3.21: Two-Way Analysis of Variance for Cognitive Dysorganization Group and Planning Level on Perceived Task Difficulty.
Figure 3.1: Means of Perceived Task Difficulty for Cognitive Dysorganization Group and Planning Level.
instruction only condition, high cognitive dysorganization participants rated the task as more difficult than did their low cognitive dysorganization participants, 
\[ t(102) = -2.64, \ p = .01. \]

3.5. Cognitive Dysorganization, Executive Functioning, and Planning Performance

Multivariate hierarchical regression analyses of the planning phases on behavioral measures of executive functioning, anxiety, attentional deficits, and cognitive dysorganization were used to determine the individual and cumulative contributions of each block of independent variables on each planning phase. The intercorrelations of these variables are shown in Table 3.22. Cognitive dysorganization was expected to affect performance in the various planning phases beyond the effects of executive functioning, anxiety, attentional deficits, and performance in earlier planning stages.

3.5.1. Plan Elaboration. Table 3.23 presents the multivariate hierarchical regression on plan elaboration. In equation (1), plan elaboration was regressed on the behavioral measures of executive functioning. Then, trait anxiety and attentional deficits (equation (2)) and cognitive dysorganization (equation (3)) were added to the model separately in succeeding equations. Across all four equations, no factors were significantly related to plan elaboration. Scores on the Stroop test (\( \beta = -0.11, \ p = 0.09 \)) were marginally significantly related to plan elaboration, with faster times on the Stroop tending to correspond with more elaborate plan formation.

3.5.2. Plan Retention. The multivariate hierarchical regression on plan retention is shown in Table 3.24. Plan retention was regressed on the measures of plan elaboration in equation (1). Then, executive functioning was added to the model. In the third equation,
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*Note: *p < .05, **p < .01.

Table 3.22: Intercorrelations of Cognitive Dysorganization, Executive Functioning Measures, Attentional Deficits, and Anxiety.
For Table 3.23: Plan elaboration regressed on executive functions, anxiety, attention, and cognitive dysorganization (N = 272).


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_Note: * p < .05, ** p < .001._

Table 3.24: Plan retention regressed on plan elaboration, executive functions, anxiety, attention, and cognitive dysorganization ($N = 271$).
trait anxiety and attentional deficits were added to the model. The full model was created by adding cognitive dysorganization into the last equation. Across all five equations, plan elaboration ($\beta = .86, p < .001$) and working memory ($\beta = .06, p = .05$) were significantly and positively related to plan retention. As expected, more elaborate plans were associated with more thorough plan recall. Greater working memory also was associated with better plan retention.

3.5.3. Plan Initiation. Table 3.25 presents the multivariate hierarchical regression on plan initiation. In equation (1), plan initiation was regressed on the measures of executive functioning. Then, trait anxiety, attentional deficits, and cognitive dysorganization were added to the model separately in two further equations. Across all three equations, no factors were significantly related to plan initiation.

3.5.4. Plan Fidelity. The multivariate hierarchical regression on plan fidelity is shown in Table 3.26. In the first equation, plan fidelity was regressed on the measures of executive functioning. Then, in two additional equations, trait anxiety, attentional deficits, and cognitive dysorganization were added to the model. Across all three equations, no factors were significantly related to plan fidelity.

3.5.5. Number of Subtasks Started. Table 3.27 presents the multivariate hierarchical regression on the number of subtasks started. In equation (1), the number of subtasks started was regressed on the measures of executive functioning. Then, in two additional equations, trait anxiety, attentional deficits, and cognitive dysorganization were added to the model. Across all equations, three executive functions, verbal cognitive fluency ($\beta = .28, p = .00$), nonverbal cognitive fluency ($\beta = .17, p = .003$), and
### Table 3.25: Plan initiation regressed on executive functions, anxiety, attention, and cognitive dysorganization (N = 284).

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*Note: * $p < .05$, ** $p < .001$.**
### Table 3.26: Plan fidelity regressed on plan elaboration, executive functions, anxiety, attention, and cognitive dysorganization (N = 284).

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*Note: * p < .05,  ** p < .001.*
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Note: * $p < .05$, ** $p < .001$.

Table 3.27: Number of subtasks started regressed on plan elaboration, executive functions, anxiety, attention, and cognitive dysorganization ($N = 283$).
Stroop performance ($\beta = -.18, p = .002$) were significantly related to the number of items completed. Having greater cognitive fluency, verbal and nonverbal, was associated with completing a greater number of items. In addition, faster scores on the Stroop were associated with completing a greater number of items.

3.5.6. Number of Rule Violations. The multivariate hierarchical regression on the number of rule violations is shown in Table 3.28. The number of rule violations was regressed on the measures of executive functioning in the first equation. Trait anxiety and attentional deficits were added in the second equation, and cognitive dysorganization was added in the third equation to complete the model. Only verbal cognitive fluency ($\beta = .14, p = .03$) was significantly related to the number of rule violations across all three equations. More specifically, higher verbal cognitive fluency was associated with a greater number of rule violations. In the second equation, attentional deficits ($\beta = .14, p = .04$) were related to the number of rule violations, with more attentional problems associated with a greater number of rule violations.

3.5.7. Number of Items Completed. Table 3.29 presents the multivariate hierarchical regression on the number of items completed. In equation (1), the number of items completed was regressed on the measures of executive functioning. Three executive functions, verbal cognitive fluency ($\beta = .26, p = .00$), nonverbal cognitive fluency ($\beta = .29, p = .00$), and Stroop performance ($\beta = -.20, p = .001$) were significantly related to the number of items completed. Having greater cognitive fluency, verbal and nonverbal, was associated with completing a greater number of items. In addition, faster scores on the Stroop were associated with completing a greater number of items. Then,
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*Note: * $p < .05$, **$p < .001$.

Table 3.28: Number of rules violated regressed on plan elaboration, executive functions, anxiety, attention, and cognitive dysorganization ($N = 285$).
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*Note: * $p < .10$, ** $p < .001$.*

Table 3.29: Number of items completed regressed on plan elaboration, executive functions, anxiety, attention, and cognitive dysorganization ($N = 285$).
trait anxiety and attentional deficits were added to the model in equation (2), but neither of these two factors was significantly associated with the number of items completed. The full model was created by adding cognitive dysorganization to full model in equation (3). In addition to the executive functions of cognitive fluency and Stroop performance, attentional deficits ($\beta = .15, p = .02$) and cognitive dysorganization ($\beta = -.13, p = .06$) were significantly related to the number of items completed. Having more attentional deficits was associated with completing a greater number of items. Having a lower level of cognitive dysorganization was related to completing more items.
CHAPTER 4

DISCUSSION

Level of planning support showed fewer effects on performance than originally anticipated. In the plan execution phase, those participants instructed to formulate a plan performed similarly to those not instructed to do so. However, although participants using an outline for plan execution performed similarly to those not having such an aid, participants using an outline did show greater fidelity to their original plans. Level of cognitive dysorganization also showed a minimal relationship to planning. In general, high cognitive dysorganization participants, as compared to their low cognitive dysorganization counterparts, did not show poorer planning performance in any planning phase, either with or without external planning support. However, high cognitive dysorganization participants were more likely to violate the rules of the Six Elements Task than were low cognitive dysorganization participants. Finally, cognitive dysorganization was found to have no effect on performance in the various planning phases over and above the effects associated with behavioral measures of executive functioning, self-report measures of anxiety and attentional deficits, and performance in earlier stages of the planning process. Only a few of the behavioral measures of executive functioning were found to be correlated with planning performance.

4.1.1. Plan Elaboration. As expected, participants tended to create more elaborate plans when they were instructed to devise a plan than when they received no such instruction. However, contrary to expectation, low and high cognitive dysorganization participants did not differ in the degree of plan elaboration in any of the three planning support levels. This suggests that a relatively high degree of cognitive dysorganization does not interfere with the ability to formulate an intention or a plan in the first phase of the planning process.

4.1.2. Plan Retention. Neither level of planning assistance nor level of cognitive dysorganization affected how much of the initial plan was recalled. That is, at all levels of planning support, low and high cognitive dysorganization participants did not differ in how well they remembered their plans. The failure to find a cognitive dysorganization effect for retrospective memory is consistent with findings of a study by Dean (2001) in which high, as compared to low, cognitive dysorganization participants performed more poorly on prospective memory tasks but not on retrospective memory tasks. Moreover, findings of other investigators (e.g., Maentylae, 2003) suggest that prospective memory performance may be a more sensitive referent of self-reported difficulties in memory than is retrospective memory performance.

4.1.3. Plan Initiation. Low and high cognitive dysorganization participants did not differ in remembering to initiate the Six Elements Task at the correct time. Of those who failed to start the task, low and high cognitive dysorganization participants remembered the correct cue for doing so with about equal frequency. Moreover, there was also no
significant difference in the number of high and low cognitive dysorganization participants who remembered to reclaim their watches before leaving the experiment session. Both remembering to initiate the Six Elements Task when asked to give one’s birth date and remembering to reclaim one’s watch at the end of the experiment session were simple prospective memory tasks. More specifically, both tasks were event-based prospective memory tasks in that participants were to remember to carry out an intended action when they were presented with an external cue. In earlier work by Dean (2001), differences in the performance of low and high cognitive dysorganization participants were found in time-based, but not event-based, prospective memory tasks. In general, time-based prospective memory tasks are purported to be more difficult than event-based prospective memory tasks because of their greater dependence on self-initiation and suppression of distractions (see Cockburn, 1995; Einstein & McDaniel, 1990; Einstein et al., 1995). As such, time-based prospective memory tasks are more likely to reflect cognitive dysfunction than are event-based prospective memory tasks.

4.1.4. Plan Fidelity. High cognitive dysorganization participants were as likely to complete the Six Elements Task in a manner consistent with their original plans as were low cognitive dysorganization participants. In addition, both low and high cognitive dysorganization participants were much more likely to perform the Six Elements Task according to their initial plans when they used an outline of their original plans than when they did not use a memory aid. How having a written outline assists performance is unclear. Using an outline may have reminded participants of their initial intentions and then prompted them to act. Groot, Wilson, Evans, and Watson (2002) found that
participants who used note-taking to aid their prospective memory performed better than those participants who chose not to use notes. However, the purpose of note-taking in the Groot et al. study was to prompt the initiation of an action rather than remembering how to perform it. In the current study, participants did not receive their outlines until after they had begun the Six Elements Task; thus, these outlines did not prompt the action, but rather, guided the execution of the action. The outlines, then, may have served to cue memory of the originally formulated plan, which the participants followed, or the outlines may have encouraged the participants to follow a plan regardless of its suitability once the task had begun.

4.1.5. Task Performance. Task performance was evaluated by measuring the number of subtasks started, the number of items completed, and the number of rule violations. Low and high cognitive dysorganization participants, across all three levels of planning support, started about the same average number of subtasks and completed about the same average number of items. They differed, however, in the number of rule violations. High cognitive dysorganization participants consistently violated the rules more often in completing the Six Elements Task than did low cognitive dysorganization participants, with this difference being significant only in the instruction plus cue condition. Thus, although they were getting as much work finished as their low cognitive dysorganization counterparts, they tended to violate the rules more frequently, and they did so despite being able to recite the rules earlier in the experiment session. The rule violations almost always involved working on two subtasks of the same type sequentially, rather than alternating subtask type. This may reflect impaired inhibition.
That is, the high cognitive dysorganization participants tended to show perseveration in their actions by continuing to work on the same type of task without inhibiting that behavior in order to initiate a more appropriate one (see Barkley, 1997a).

4.2. Cognitive Dysorganization, Executive Functioning, and Planning Performance

In multiple regression analyses for each of the planning stages, level of cognitive dysorganization was not associated with performance above and beyond the effects associated with behavioral measures of executive functioning, self-report measures of anxiety and attentional deficits, and performance in earlier planning phases. As in research by Kliegel and his colleagues (2000, 2002), behavioral measures of executive functioning and performance in earlier planning phases were related to performance in some of the planning phases. The few discrepancies in significant predictors of planning performance between the current study and that of Kliegel et al. are likely related to the increased variance in performance and executive functioning due to the inclusion of both young and old adults in the Kliegel et al. study.

There was a statistical trend for scores on the Stroop test, which measures inhibition and divided attention, to be related to plan elaboration, with poorer inhibition and divided attention corresponding to less elaborate plan formation. Kliegel and his colleagues (2000) initially found no predictors of plan elaboration. In a later research, they (Kliegel et al., 2002) included several additional measures of executive functioning and found both non-verbal cognitive fluency and planning ability, as measured by the Plan-A-Day test (PAD; Funke & Krüger, 1993; Kohler, Poser, & Schönle, 1995), to be...
significant predictors of plan elaboration. Planning ability was not included in the current study. Non-verbal cognitive fluency, however, was included in the current study, but was not found to be a significant predictor.

The findings of the current study also differ from those of Kliegel et al. (2000) in that none of the factors assessed or manipulated in the current study were found to be related to plan initiation. Kliegel et al. (2000) found both working memory and inhibition were associated with plan initiation, with larger working memory capacity and better inhibition related to increased likelihood of beginning the task at the appropriate time. In another study (Kliegel et al., 2002), better cognitive flexibility, problem-solving, and, to a lesser extent, non-verbal fluency were related to more accurate plan initiation. Although Kliegel et al. (2000, 2002) have found some relationship between executive functioning and plan initiation, others have argued that prospective memory tasks with external memory cues, such as using the question about date of birth to prompt performance of the Six Elements Task, do not rely on executive functioning to the same extent as do those prospective memory tasks without such external cues (Cockburn, 1995; Einstein & McDaniel, 1990; Groot et al., 2002). The findings of Kliegel and his colleagues (2000, 2002) again may be due to their inclusion of both young and old adults in the sample, who likely show greater variation in executive functioning and prospective memory performance than a sample of strictly young adults. This is likely to be true even where some of the young adults are reporting some problems with executive functioning.

Also contrary to earlier findings (Groot et al., 2002; Kliegel et al., 2000; Kliegel et al., 2002), plan retention was significantly related to working memory, suggesting
those participants, who were better able to use controlled processing to hold their plans in an easily retrievable state while working on other tasks were also better able to recall those plans at the end of the experiment session (see Engle, 2001). In some sense, plan retention within a short time period may have been more reflective of working memory capacity than of retrospective memory, particularly if participants chose to hold this information in mind throughout the experiment session rather than encode it for later use. This “ability to control attention to maintain information in an active, quickly retrieveable state” (Engle, 2002, p. 20), while simultaneously avoiding distraction, is considered to be working memory capacity (Engle, 2002).

It is important to note that working memory capacity contributed to plan retention despite the significant positive relationship between plan elaboration and plan retention. Plan retention was expected to be dependent on plan elaboration because those participants who created more elaborate plans would have more details to recall. Greater working memory, then, allowed participants to recall more of their initial plans, even when the number of details in the original plans was controlled.

Contrary to earlier findings (Kliegel et al., 2000), none of the measures of executive functioning or performance in the earlier planning phases were significantly related to plan fidelity. For example, Kliegel and his colleagues found that plan fidelity was related to both plan elaboration and working memory. The discrepancy between the earlier and the present findings may be due to differences in the way plan fidelity was measured. Kliegel and colleagues counted the number of actions by participants that were consistent with their original plans, resulting in plan fidelity being largely dependent on
plan elaboration and, thus, the two were correlated in the analyses. To avoid this dependency of scores in the current study, plan fidelity was measured as a nominal variable in which participants were either consistent or inconsistent with their initial plans. Because of this scoring method, there was no way to determine the degree to which participants performed the task consistent with their original plans, and, therefore, it was impossible to determine whether working memory increased the degree of plan fidelity in the current study.

Consistent with studies by Kliegel and his colleagues (2000, 2002), plan execution was found to be related to working memory, inhibition, and cognitive fluency in the present study. When plan execution was measured as the number of subtasks started or as the number of items completed, cognitive fluency (verbal and nonverbal) and inhibition with divided attention (i.e., Stroop performance) were found to be significantly related to plan performance. That is, being able to generate a greater number of patterns and words (i.e., cognitive fluency) was found to be related to starting more subtasks and completing more items. In addition, being better able to inhibit prepotent responses (i.e., inhibition) and being able to switch more rapidly between alternate cognitive sets (i.e., divided attention) were also found to be associated with starting a greater number of subtasks and completing more items.

The number of rule violations served as a third indicator of plan execution in the current study. Those participants with greater verbal cognitive fluency were more likely
to commit a greater number of rule violations during the plan execution phase. Perhaps
their ability to generate more possible responses interfered with their adherence to the
guidelines for task performance.

Attentional deficits and cognitive dysorganization were found to be related to plan
execution. More specifically, having more self-reported attentional problems was found
to be related to completing more items; whereas, lower cognitive dysorganization was
found to be marginally related to completing more items. Interestingly, attentional
deficits only became a significant predictor of the number of items completed when
cognitive dysorganization also was included in the regression model. Attentional deficits
and cognitive dysorganization, therefore, appear to be correlated and are likely to balance
one another in the current analyses. In other words, while neither construct alone appears
to be related to the number of items completed, both appear to have a minimal effect
when included as predictors in the same model. However, the effects of attentional
deficits counter the effects of cognitive dysorganization, resulting in no overall net effect
on the number of items completed during task execution.

4.3. Limitations and Future Directions

The Six Elements Task may not be sensitive enough to detect subclinical
differences in executive functioning. In fact, some research has shown that subclinical
deficits are not readily apparent in formal tests of executive functioning. For example,
Burgess (2000b) identified a pattern of deficits related to frontal lobe dysfunction in
which people clearly evidence poor decision-making, poor planning, absentmindedness,
and disorganization in daily tasks but not in formal neuropsychological measures. Given
that cognitive dysorganization is understood as a subclinical deficit in executive functioning, its effects may not be manifest in performance on the Six Elements Task. In addition, participants may be able to compensate for any deficits in planning performance attributable to cognitive dysorganization. That is, by increasing their effort and concentration, they may be able to overcome their weaknesses in order to perform fairly well. In light of earlier findings (Dean, 2001), it would seem more likely that the test is not appropriate for assessing impairment due to cognitive dysorganization than it is that cognitive dysorganization is simply unrelated to the quality of planning.

Given the possibility that the Six Elements Task may not be sensitive enough to detect subclinical differences in executive functioning, assessing such differences may become more problematic within a college population. The students, even those reporting a high level of cognitive dysorganization, mostly have been able to function well enough to complete their high school education and attend college classes. In fact, students failing college courses would be unlikely to participate in experiments as part of the experimental component of their introductory psychology course. Therefore, the college students participating in the current study are likely to have the cognitive capacity both to fully understand and to complete the Six Elements Task without much difficulty.

Previous studies using this task have typically compared younger adults to older adults in order to assess age-related differences in executive functioning and planning (see Kliegel et al., 2000; Kliegel et al., 2002); whereas, the current study used the Six Elements task to compare young adults to their same-age cohorts in order to assess subclinical differences in executive functioning and planning due to cognitive dysorganization.
The limited ecological validity of the Six Elements Task and of the experimental procedure dictates caution in generalizing the conclusion that cognitive dysorganization is not related to planning performance. That is, the unusual nature of this task and of the setting in which it was carried out may have contributed to the participants’ performance. In addition, given that the participants were tested while being evaluated by an experimenter, they may have been provoked to exert special effort to compensate for some of their deficits, thus obscuring the effects of cognitive dysorganization on planning performance.

Further examination of planning performance in more realistic situations would serve to increase our understanding of how cognitive dysorganization might impair the planning of tasks and the carrying out of intentions in everyday life (see Dean, 2001). At least theoretically, one would expect that persons high in cognitive dysorganization would show a wide variety of difficulties, such as poor work or school performance due to poor planning, financial pressures from poor budgeting, and strained social relationships from unreliability. And, as a result, such individuals would be expected to show higher levels of anxiety, distress, and depression.

Although studying people in naturalistic settings poses special problems, there are ways of increasing ecological validity while maintaining adequate experimental control. One such method would be to increase the complexity of the experimental task, as most real planning tasks occur in the rich context of people’s lives. The Six Elements Task could be made more complex in a number of ways. Additional subtasks and rules could be included which would require participants to manage a greater number of tasks within
a more complicated framework that would bear greater similarity to tasks that people encounter in their daily lives. Also, the difficulty of each of the subtasks could be increased so that participants would become more absorbed in their work. In addition, the delay period between plan formation and execution could be increased in order to allow for a greater number of distractions. Finally, the prospective memory component of the Six Elements Task could be converted from an event-based to a time-based task, reflecting the frequent need for people to carry out intentions by a certain time rather than when some external event occurs.

Other experimental tasks may be more ecological valid as well as more sensitive to subclinical deficits in executive functioning than is the Six Elements Task. One such task, the Plan-a-Day test (PAD; Funke & Krüger, 1993; Kohler, Poser, & Schönle, 1995), is a computerized planning task in which participants have to complete a variety of errands in a fictitious setting given constraints related to errand priority and time limits. The CyberCruiser (Kerns, 2000), another more naturalistic and complex task, is a computer game in which participants simulate driving a car along a road. Participants are instructed to go as fast as they can, passing as many cars as they can without hitting any. Their scores, along with the three highest scores, are shown at the top of the screen as a means of motivating them to perform well. While the participants are engaged in this primary task, they also complete a time-based prospective memory subtask which involves monitoring the level of fuel and refueling when the level falls to a certain point. Performance on the CyberCruiser has not been found to be strongly associated with more
traditional tests of prospective memory (Kerns & Price, 2001), but it, along with the PAD, appear to mimic more typical daily activities of adults. These tests also seem to have the capacity to be fairly complex and difficult.

The use of external memory supports by persons varying in degree of cognitive dysorganization deserves exploration. In the current study, those participants, both high and low in cognitive dysorganization, who used written reminders of their plans, performed the Six Element Task in a manner more consistent with their initial plans than did those who did not use such reminders. Such external memory supports serve to externalize the cues for remembering how and when to carry out task components and, thereby, reduce reliance on the need for a well-functioning executive system (see Einstein & McDaniel, 1996; Groot et al., 2002). As such, differences in executive functioning tend not to affect prospective memory performance when external memory cues are accessible (Groot et al., 2002). Therefore, differential planning performance related to executive functioning or cognitive dysorganization may be more apparent in performance of planning and prospective memory tasks in which external memory supports are absent.

Although, in the present study, the use of external memory cues increased adherence to an initial plan, such adherence may not always be beneficial, particularly when the task demands require abrupt changes in behavior. Impairment in executive functioning has been found to be related to difficulty in making such adjustments (see Barkley, 1997a; Shallice & Burgess, 1993). Therefore, to the extent that cognitive dysorganization is related to subclinical deficits in executive functioning, low and high cognitive dysorganization participants are likely to differ in their ability to deviate from
an initial plan to meet changing task demands. The current study found that low and high cognitive dysorganization participants were equally likely to perform in a manner consistent with their initial plans, but here such fidelity was encouraged. If, instead, the task requires altering plans, differences in performance between the two groups may become apparent.

It would also seem profitable to investigate the relationship between Attention Deficit Hyperactivity Disorder and cognitive dysorganization. Barkley’s (1997a) model of ADHD has been proposed as a useful framework for understanding cognitive dysorganization primarily because ADHD and cognitive dysorganization are believed to derive from executive system dysfunction, and, as a result, individuals with both ADHD and cognitive dysorganization are expected to exhibit similar behavioral deficits. In fact, just as those with high levels of cognitive dysorganization have been found to exhibit difficulties on time-based, but not event-based, prospective memory tasks (Dean, 2001), another study found that children with ADHD have more difficulties with time-based tasks than their normal peers but were likely to perform equally as well on event-based tasks (Kerns & Price, 2001). Yet, although those with ADHD have been found to have difficulty with planfulness and planning behaviors (see Barkley, 1997a; Perchet, Revol, Fourneret, Mauguiere, & Garcia-Larrea, 2001), in the current study those with high cognitive dysorganization were not found to have such difficulties. The similarities and differences in the behavioral consequences of ADHD and cognitive dysorganization warrant further exploration.
4.4. Conclusion

The current study explored the relationship between cognitive dysorganization, prospective memory, and planning, and the ways in which executive functioning may mediate these relationships. With regard to the first hypothesis, level of cognitive dysorganization showed a minimal relation to planning. In general, high cognitive dysorganization participants, as compared to their low cognitive dysorganization counterparts, did not show poorer planning performance in any planning phase, either with or without external planning support. However, high cognitive dysorganization participants were more likely to violate the rules of the Six Elements Task than were low cognitive dysorganization participants. With regard to the second hypothesis, only a few of the behavioral measures of executive functioning were found to be correlated with planning performance. In addition, cognitive dysorganization was found to have no effect on performance in the various planning phases over and above the effects associated with behavioral measures of executive functioning, self-report measures of anxiety and attentional deficits, and performance in earlier stages of the planning process. Overall, this study contributes to the exploration of cognitive dysorganization and the Sense of Personal Disorganization as useful indices of subclinical problems in executive functioning, memory, and attention.
REFERENCES


APPENDIX A

THE SENSE OF PERSONAL DISORGANIZATION SCALE
Please indicate your degree of agreement or disagreement with each of the statements below. There are no “right” or “wrong” answers. Mark each statement, at the left, according to how much you agree or disagree with it. Use the following code:

+1 Slightly agree           -1 Slightly disagree
+2 Moderately agree        -2 Moderately disagree
+3 Strongly agree          -3 Strongly disagree

1. ** I spend a lot of time looking for things I have misplaced.
2. _______ In general, I seem to have little difficulty working in situations that require dividing my attention among various tasks.
3. ** I have a tendency to forget to do things that I had planned to do.
4. ** My life often seems very disorganized.
5. _______ I have a pretty clear picture of what my future will be like.
6. _______ I am pretty good at remembering peoples’ names after having been introduced to them.
7. _______ Compared to me, most people seem to have clearer life objectives.
8. ** I often get very frustrated at how disorganized I am.
9. ** I tend to be absent-minded.
10. _______ My work space at home is neat and uncluttered.
11. _______ I don’t seem to perform well at tasks or games that require keeping many things in mind at the same time.
12. _______ I often put off answering important letters.
13. ** Even when I write down what I have to do, I still often forget to do it.
14. ______ It seems easy and natural for me to keep my work space orderly and well-organized.
15. ______ I seem to have more difficulty than most people in following rapidly presented information.
16. ** R It is easy for me to keep my work and responsibilities well organized.
17. ** Forgetting to do things has caused problems for me.
18. ______ I will usually keep working on a project even when I am very tired.
19. ______ I enjoy games that involve thinking several steps ahead.
20. ______ I have a hard time keeping track of the story in movies and books that have many characters and many scene changes.
21. ______ Things on my desk somehow find a way of piling up in a disorganized way.
22. ______ My life seems to be lacking a sense of direction.
23. ** R I almost never misplace bills or important papers.
24. ______ I prefer working on a task that has many possible solutions rather than one that has a single correct answer.
25. ______ I am confident about where my life is headed and what I want to achieve.
26. ** People who know me well have told me that I am disorganized.
27. ______ Working on several tasks during the same time period brings out the best in me.
28. ______ Others have often commented on how neat my work space is.
29. ** I have a tendency to forget appointments.
30. ______ When I work in a group, I like to be the leader.
31. ______ If I have to work on several things at the same time, it’s usually hard for me to complete any of them efficiently.

32. ______ The saying “There’s a place for everything and everything in its place” is an accurate description of my living area.

33. ** I often have difficulty finding important items because of the clutter in my work area.

34. ______ I have a clear and steady sense of my own aims and goals.

35. ______ For some reason, I hardly ever seem able to keep my desk neat.

36. ______ In general, I am optimistic about the future.

37. ______ My life seems scattered and lacking clear objectives.

38. ______ I often feel that I don’t know what I want out of life.

39. ______ My personal belongings often seem to be in a state of disarray.

40. ______ Most of the time my work is cluttered and disorganized.

** These 12 items are the Sense of Personal Disorganization Scale as used in the current study. The other items belong to additional factors which have been examined in other studies.

R These items are stated in the opposite direction and were reversed-scored.
APPENDIX B

EMAIL RECRUITMENT SCRIPT
EMAIL RECRUITMENT SCRIPT

At the beginning of the quarter, you completed several questionnaires in your Psychology 100 class. If you remember, at that time you gave your email address indicating that you were willing to be contacted to schedule some of your experiments. And that’s why I’m writing.

You are being invited to participate in a research study in our laboratory in order to earn research experience credit for your Psych 100 requirements. Professor Mirels’ research group is currently exploring the factors that affect people’s task performance, especially how personality characteristics, memory, and attention affect problem-solving. If you would like to participate, we would be asking you to complete a problem-solving task, a computerized task, and several written tasks. In addition, you will be asked to complete several questionnaires about your personal styles and characteristics. The entire experiment will take approximately seventy-five minutes; so, for participating, you would receive one and one-half credits toward your class requirements.
If you would like to participate in this study, please go to our webpage on the REP website www.psy.ohio-state.edu/rep or respond to this email. This experiment is CHM-2, and you may sign up for any of its posted sessions. Be sure to write down the time, date, and location of the session in which you enrolled.

It’s very important that you arrive for the study on time. If you are late, it will not be possible to include you in the session, and you will have to reschedule. In the event that you need to cancel your appointment, you should call or email us at least twenty-four hours in advance. The number of the lab is 292-8009, and you can leave a message for Janet. Or, just see the experiment on the research we page in order to email us (dean.106@osu.edu).

Please feel free to contact me with any questions you may have about this research experience.

Thank you.

Janet Dean
Graduate Student
Clinical Psychology
APPENDIX C

WORKING MEMORY TEST
WORKING MEMORY TEST

Examples of Presented Strings.

IS ( 3 / 1 ) + 3 = 6  ?  bad
IS ( 10 / 2 ) – 4 = 3  ?  base

IS ( 9 x 1 ) – 1 = 8  ?  spot
IS (10 / 2 ) + 4 = 3  ?  miss
IS ( 9 x 3 ) – 2 = 25?  out
IS ( 7 / 1 ) + 2 = 7  ?  mouth

WM Scoring Form.

Subject # ____________       Span ____________

Trial 1 ______  ______  ______  ______  ______  ______  ______
Trial 2 ______  ______  ______  ______  ______  ______  ______
Trial 3 ______  ______  ______  ______  ______  ______  ______
APPENDIX D

PERSONAL INFORMATION QUESTIONNAIRE
PERSONAL INFORMATION QUESTIONNAIRE

Title (please circle one): Miss Mrs. Ms. Mr.

Sex (please circle one): F M

Date of Birth: _______________ Age: ______________

Please check one:

_____ American Indian or Alaskan Native
_____ Asian or Pacific Islander
_____ African-American (not Hispanic)
_____ Hispanic
_____ White (not Hispanic)
_____ No answer

How would you rate your health at the present time?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Fair</td>
<td>O.K.</td>
<td>Good</td>
<td>Excellent</td>
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</table>

How many prescription drugs are you currently taking? _________

How much do health problems limit your daily activities?

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<tr>
<th>1</th>
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<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>A Lot</td>
<td>Some</td>
<td>A Little</td>
<td>None</td>
</tr>
</tbody>
</table>

Years of education (starting with first grade): ________________

In your daily activities, do you mostly work with

a. figures O
b. words O
c. physical actions O
APPENDIX E

SIX ELEMENTS TASK – SAMPLE SHEET
Here you see examples of the three task-types:

1. Finding the actual word:

   You are given groups of four words. In each group there are three nonsense-words and one actual existing words. The words are similar and might only differ in one letter. Please circle in each group the existing word. There is only one.

   Example (2 x 35 groups):
   
   a) dar - car - kar - carr.

2. Solving two block of arithmetic problems:

   You are given arithmetic problems. You have to solve them without a calculator. Make notes on the sheet if you want.

   Example (2 x 10 problems)
   
   a) 20 - 7 + 45 =

3. Writing down the names of pictures:

   You are given a set of pictures. You have to write down a proper name of these pictures. There is no perfect answer. Just write down, whatever you think is the appropriate label.

   Example (2 x 20 pictures):

   a) ______________
APPENDIX F

SIX ELEMENTS TASK – RULES FOR TASK PERFORMANCE
SIX ELEMENTS TASK – RULES FOR TASK PERFORMANCE

You must follow these rules:

1. **Your aim is to maximize your score.**
   - Earlier pictures/problems/word groups will be given more points than later ones in each subtask.
   - Points will be given for correct answers.
   - Errors or omissions will be penalized.
   - Each of the six subtasks is given equal weight.

2. You are not allowed to do two subtasks of the same type (arithmetic) and (arithmetic) one after the other.

3. You have 6 minutes time.
4. Please press the start-button of this stopwatch to start these tasks by yourself.
APPENDIX G

EFFORT AND DIFFICULTY CHECK
# EFFORT AND DIFFICULTY CHECK

Please tell us your impressions of the tasks you completed & your performance today.

1. How difficult did you find working on the six subtasks to be?

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<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
<tr>
<td></td>
<td>Not difficult at all</td>
<td>Slightly difficult</td>
<td>Moderately difficult</td>
<td>Very difficult</td>
<td></td>
<td></td>
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</table>

2. How much effort do you think you put forth to complete the six subtasks?

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<th>5</th>
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<tbody>
<tr>
<td></td>
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<td>Slightly difficult</td>
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<td>Very difficult</td>
<td></td>
<td></td>
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</table>

3. Did you try to stick to your original plan when you worked on the six subtasks?

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<tr>
<td></td>
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<td>Very difficult</td>
<td></td>
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</table>

4. How motivated were you to earn as many points as possible on the six subtasks?

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<td>Very difficult</td>
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5. Were the instructions for the six subtasks clear?

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<td>Moderately difficult</td>
<td>Very difficult</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The six subtasks you just performed require a lot of what we call “MENTAL WORKLOAD.” Mental workload is thought to have three major psychological components to it – the amount of TIME DEMAND or PRESSURE you feel, the amount of MENTAL EFFORT you feel you have to exert, and the amount of PSYCHOLOGICAL STRESS you feel is associated with doing the task.

In thinking about the six subtasks that you just performed, rank these workload factors in importance as either 1st, 2nd, or 3rd in terms of what you think was their contribution in determining the mental workload you experienced while performing this task.

__ Time Load  __ Mental Effort Load  __ Stress Load

In thinking about the tasks that you typically perform (e.g., work-related, studying for courses, writing papers, etc.), indicate what levels of these three components you find most optimal for your best performance.

1. TIME DEMANDS  __ I perform best with no time demands or constraints.
   __ I perform best with little time demands or constraints.
   __ I perform best with moderate time demands or constraints.
   __ I perform best with high time demands or constraints.

2. MENTAL EFFORT  __ I perform best with no mental demands or constraints.
   __ I perform best with little mental demands or constraints.
   __ I perform best with moderate mental effort or constraints.
   __ I perform best with high mental effort demands or constraints.

3. MENTAL EFFORT  __ I perform best with no mental demands or constraints.
   __ I perform best with little mental demands or constraints.
   __ I perform best with moderate mental effort or constraints.
   __ I perform best with high mental effort demands or constraints.
APPENDIX H

EXPERIMENTAL SCRIPT
EXPERIMENTAL SCRIPT

General

Hi, I’m ___________. I’m a research assistant with the Psychology Department. This is Experiment CHM-2.

The study you are participating in today is about personality characteristics, problem solving, memory, and attention, and the relationships among these. The session will last approximately seventy-five minutes. Before I describe the study any further, it’s important you know that your responses are completely confidential and that you can withdraw your participation at any time without penalty. Okay?

Later, I will need to audio record some of your responses about the tasks we’ll be doing today. This will allow us to review your responses at a later time. Your name will in no way be linked to the recording. May I have your permission to record your responses?

Now, I would like to ask you to give me your wristwatch, because I want you to use this clock (stopwatch) when you perform some time-based tasks. Please remind me after the experiment to return your watch to you!

One general piece of advice: Please ask me immediately if you are not sure you understand what I tell you to do. This is important because, during task performance, you will not be able to ask any questions. There will be practice parts in the beginning of most of the tests, though, during which you can ask whatever you want at any time.

Instructions

Now on to our experiment. Usually, we start with questions about personal information, like your sex, age, and so forth. Today, though, I’ll ask you to give me
this information after some other tasks. We call this form the “Personal Information Form.” Take a look at it so you’ll recognize it later. [Show Personal Information Form.]

Later, when you fill out this form, there will be several additional tasks that have to be performed – actually six tasks. These tasks consist of three different types. There are two similar versions of each type, and that’s why there are six tasks. These types are explained on this example sheet. [Show subtask example sheet.]

The tasks are in folders in the second drawer of this table. Please open the drawer and take a look inside, then close the drawer again. Good. When you perform these tasks, there are several rules you have to follow. They are listed on this sheet, and I’ll explain them to you. [Show rules, and leave on table.]

There are a lot of items on these six subtasks, and you have only six minutes to work on them. You will not be able to finish all of the tasks. Keep this in mind for your performance – your goal is to get as many points as possible, and you do this by following the rules we just went over. Do you have any questions? Okay, to make sure you know all the rules, would you please tell me what they are? [Cover rules. Correct any errors or omissions in their recall of the rules. Leave rules on desk.]

Okay, good. One more thing: You have to start the performance of these six subtasks by yourself after you answer the question about your “date of birth” on the Personal Information Form that I showed you earlier. So, after you come to this form and answer the question about your date of birth, start these six subtasks by yourself. Please remember to do this; I will not remind you again.

Experimental Conditions of Planning Support Level

Condition A. I need to step out for a moment in order to prepare the next part of the experiment. Please wait here; I will be back in a few minutes. [Leave for 4 minutes.]

Condition B. When people do tasks like these, it has been proven to be very helpful to make a plan. This plan is something like your idea of how you are going to complete these tasks, or what is the best way for you personally to perform these tasks given the task types and rules. I’d like to ask you to make a plan for your performance of these tasks, which I will record. So, I want you to verbally describe how you are going to
perform these tasks later. Please take as much time as you need and say aloud all the things you are thinking while developing your plan. I’m interested in both your plan and the way you get to your plan. Go ahead.

Condition C. When people do tasks like these, it has been proven to be very helpful to make a plan. This plan is something like your idea of how you are going to complete these tasks, or what is the best way for you personally to perform these tasks given the task types and rules. I’d like to ask you to make a plan for your performance of these tasks, which I will record. So, I want you to verbally describe how you are going to perform these tasks later. Please take as much time as you need and say aloud all the things you are thinking while developing your plan. I’m interested in both your plan and the way you get to your plan. Go ahead.

Okay, now briefly write down the steps of your plan on this note card. [Hide card when finished.]

Working Memory Test

In this test of working memory, the task is to quickly determine whether a mathematical expression is true or false while also trying to remember a short list of words. On the computer screen, you will see an equation and a word like on this flash card. Note that a slash mark means to divide. Several equations, each followed by a word, will be presented on the screen. A single question mark then will appear. When this happens, write on your answer sheet the most recent set of 2 to 6 words you have seen. It is important, though, that you concentrate on the math, not the words. Try to evaluate the equations as fast as possible, while maintaining good accuracy, for we will be timing you. The best way to do this is not to think of the words while checking the equations or between equations. There are eighteen trials; the first three trials are for practice. On all trials, write the words from left to right, on a single row, in the order of presentation. Leave blanks for words you don’t remember. Any questions?
**Trail Making Test**

*Part A.* On this page are numbers inside of circles. Begin at number 1 and draw a line from 1 to 2, 2 to 3, 3 to 4, and so on, in order, until you reach the end. Do it as quickly as you can. Do not lift the pencil from the paper. Ready? Begin!

Good! Let’s try the next one. On this page are numbers from 1 to 25. Do this in the same way. Begin at number 1 and draw a line from 1 to 2, 2 to 3, 3 to 4, and so on, in order until you reach the end. Remember, work as fast as you can. Ready? Begin!

*Part B.* On this page are numbers and letters inside of circles. What I want you to do is to start at number 1 and go to the first letter A, then to number 2, and to the second letter B, then to 3 and the third letter C and so on until you reach the end at D. First you go to a number, then to a letter, then to a number, then a letter. Do it as quickly as you can. Ready? Begin!

I want you to do the same thing here. There are just more numbers and letters. Start here at number 1, and draw a line from 1 to A, A to 2, 2 to B, B to 3, 3 to C, and so on, in order, until you reach the end. Remember, you alternate number, letter, number, letter. Do it as quickly as you can. Ready? Begin!

**Stroop Test**

Now, I’d like to show you another test. It is about colors. There are three different colors. On this first card, you will see lists of the words red, blue, and green. Please read across each row as quickly as you can. Begin!

On this card, you will see strings of XXX’s printed in different colors of ink, red, blue, and green. Please name the color of the ink of each string, moving across each row as quickly as you can. Begin!

On this card, you will see lists of the color words. The words here are printed in one of the three ink colors. This time, I want you to name the color of ink that each word is printed in; try not to read the actual word. Again, move across each row as quickly as possible. Begin!
Cognitive Fluency

In this task, I want you to write down as many words as you can think of that begin with the letter S. You will have four minutes. You may write down any words at all with only two exceptions. They cannot be proper names, like San Francisco, nor can they be two forms of the same word, like cat and cats. Go ahead and begin.

In this next task, I want you to make as many designs as you can think of within four minutes. Make the designs using each group of five dots. In essence, you will be connecting the dots in different ways. Go ahead and begin.

Questionnaires

Very good. Now something simple. Please just fill out this questionnaire booklet. Be sure to read the instructions on the top of each page.

Six Elements Task

(Participants should have begun this by themselves. If not, ask the following question.) Good. You’ve finished the questionnaire booklet. Do you remember when you were supposed to start the six subtasks? Okay, go ahead and begin them now.
(After six minutes, stop the participants.)

Plan Retention

Condition A. Do you remember when I left the room? During that time, did you create a plan for completing the six subtasks? If so, would you tell me what that plan originally was?

Conditions B & C. Now, do you remember the plan you developed for the six subtasks? I’d like you to tell me your plan again.

Debriefing

Thanks. Here is a debriefing form to tell you about the experiment. [Give debriefing form.] Please don’t tell your classmates or friends any details about the experiment or about its purposes as explained on this paper, because if they know about it and participate later, they will do it in a different way. Do you have any questions? Thanks so much for your participation. [If they forget watch, say ‘Oh, by the way, here is your watch.’]
APPENDIX I

WRITTEN PERMISSION TO RECORD
WRITTEN PERMISSION TO RECORD

[Ohio State University, Department of Psychology Letterhead]

I understand that during this experimental session I will be asked to describe my procedure for working on tasks in detail and that my description will be audiotaped. The general purpose of the study as well as the reason for the taping has been explained to me.

I also understand that the tape as well as all other material that I work on will be confidential, and this material will be accessible only to the principle investigator, Dr. Herbert Mirels, and his associates.

____________________________   ___________________________
Herbert Mirels, Ph.D., Professor   Research Participant

____________________________
Research Assistant
APPENDIX J

DEBRIEFING FORM
DEBRIEFING FORM

Thank you for participating in this study. As was mentioned at the outset of the session, we are interested in how a variety of personal attributes might be related to one another. We are particularly concerned with how our ability to keep our attention focused might be involved in our planning abilities, memory, and daily functioning. One measure in this study is specifically concerned with people’s attentional styles. We are particularly interested in how people’s scores on this measure relate to the formation and execution of plans.

The pattern of data that you and other participants in our studies are providing will not only help us to ascertain the relationships between attentional abilities, memory, and other personal characteristics, but may also lead to a better understanding of the sources of attentional problems and possible interventions.

If you are interested in the methodology we used and the subtasks which you completed, see the following article as an example:


Performance on the tasks you completed today is affected by prior knowledge of the tasks. Therefore, please do not talk to your friends or fellow students about what you did in today’s study.

Should you be interested in the findings of this study, or if you have any questions about this study, feel free to contact us, Janet Dean or Dr. Herbert Mirels. Our laboratory can be reached at 292-8009, dean.106@osu.edu, and mirels.1@osu.edu.