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NEUROPSYCHOLOGICAL MALINGERING AND COGNITIVE LOAD: DISRUPTING DECEPTION ON NEUROPSYCHOLOGICAL MEASURES THROUGH COGNITIVE OVERLOAD

By

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ABSTRACT

NEUROPSYCHOLOGICAL MALINGERING AND COGNITIVE LOAD: DISRUPTING DECEPTION ON NEUROPSYCHOLOGICAL MEASURES THROUGH COGNITIVE OVERLOAD

By

Adam D. Alban

Research on malingering in neuropsychological assessments has received a great deal of attention in recent years. Most of the available literature in this area has examined the ability of neuropsychologists to detect invalid test scores and symptom manufacturing through the use of various assessment instruments or the examination of patterns of performance. There have been relatively few publications examining the problem of malingering from the perspective of the malingerer. This study was an attempt to understand some of the basic cognitive processes that underlie the task of malingering. If the task of malingering can be better understood, this information might be incorporated into existing and future efforts to detect and understand dissimulation.

It was hypothesized that malingering is an active process, one that requires considerable cognitive effort. If individuals who are attempting to malinger were concurrently given a task that increased their cognitive demands, the result should be a decreased cognitive capacity to control symptom presentation. It was also hypothesized that participants with differing levels of self-consciousness would be differentially affected by these additional demands. Malingering and control participants undertook a series of neuropsychological tests, once while under an increased cognitive load and once without an increased cognitive load.

These results indicated that the bulk of the measures in this study were relatively insensitive to the effects of the cognitive load, with the exception of reaction time measurements. The reaction time measures indicated that the presence of an added cognitive load made it more difficult for malingering participants to maintain a false symptom presentation. Self-consciousness did not appear to mediate the effects of the load.

The limitations of this study are discussed, as well as its implications for the general field of malingering research.

For my parents, brother, and grandparents

Who continue to give me strength and encouragement.

And to everyone with whom I have been fortunate to share my time thus far…

"I am a part of all that I have met;

Yet all experience is an arch wherethro'

Gleams that untravell'd world whose margin fades

For ever and for ever when I move."

- Alfred Lord Tennyson

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INTRODUCTION

There is a game that is frequently played at social gatherings as a get-to-know-you event. Each person is instructed to tell the group three things about themselves that no one else knows. They can be characteristics, stories, or anything else that the speaker wishes. One of these things, however, has to be a lie. Afterward the group tries to guess which was the fabrication, but they are frequently wrong. Party games such as this attest to western culture's fascination with lying and the detection of lying. Gadget, novelty, and computer stores sell products that connect to telephones so that the purchaser can tell if the person on the other end is telling the truth. These products supposedly do so by measuring the "stress" in someone's voice.

Psychologists have not been immune to popular culture's fascination with deception and lying. Two psychologists, William Marston and Elizabeth Holloway, interested in the detection of deception originally created the superhero, Wonder Woman (Hothersall, 1995). Not surprisingly, one of Wonder Woman's super powers is her "lasso of truth." Villains caught in her lasso were unable to tell a lie and were forced to disclose their diabolical plans or the location of their hideout. Unfortunately, the "lasso of truth" fantasy was psychology's best advance toward the reliable detection of deception for many years.

This study aims to investigate deception by using a cognition-based theory of deception to improve upon the behavioral indices of malingering in neuropsychological assessments. There is a lengthy and extensive clinical literature on deception in neuropsychological assessments, yet the vast majority of this research has failed to approach the question of deception from a more theoretical vantage point. The clinical literature is largely a-theoretical, and focuses on quantitative methods of detecting deception in assessment. Compare this to a sizeable literature from the areas of social psychology and communications, which have examined the problem of deception and lying from a different approach. The detection of deception in neuropsychological assessments may be greatly informed by a discussion of deception in other areas of specialization.

Before delving into this topic, however, some clarification on the topic of deception is warranted. Lying is the act of communicating information one knows to be false. This is different from malingering, the deliberate manufacturing of symptomatology to achieve a desired end. Yet, these two acts of deception may have some shared elements. An investigation of malingering may be highly informed by an examination of lying.

Lying appears to be a normal part of life, and a surprisingly common occurrence. One potential view of lying is that it is not necessarily meant to deceive others. It is, instead, a form of interpersonal editing used to highlight aspects of the self that are most positive and socially acceptable (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). In addition, some lies are often categorized as other-oriented (DePaulo et al., 1996; DePaulo & Kashy, 1998). Other oriented lies are often described as altruistic. Individuals who lie in response to questions such as, "did you like my casserole?", or "what do you think of my poetry?", frequently do so for the benefit of an other. The casserole might have been tasteless and the poetry over-dramatic, but to tell the truth might sacrifice some of the relationship's stability. Indeed, Kashy and DePaulo (1996) found that people who experienced more satisfying same-sex friendships reported telling more other-oriented lies.

DePaulo et al. (1996) found that their participants lied frequently (in between one-out-of-three and one-out-of-five social interactions), and thought of themselves as particularly successful at doing so. They were more likely to lie if they were physically removed from the person with whom they were communicating (e.g., on the telephone). The lies that individuals told frequently made him/her appear more positive, knowledgeable, and successful. The majority of the lies that participants told were not particularly "big," and thus were not accompanied by extensive rumination and/or negative emotions. "White lies" were commonplace. They were not particularly worried about getting caught, and were not particularly remorseful if their deception was discovered. This was thought to be partly due to the observation that many people reported that they told lies to protect the well being of others, and that they would likely follow the same course of action if they were to do it again.

In an investigation of lies in close relationships, DePaulo and Kashy (1998) hypothesized that the act of lying is counter to the principles of openness and honesty in close relationships, and that the frequency of lying would be lower in close relationships. They found that individuals were less likely to lie in these close relationships, with the interesting exception of (psychodynamic theorists take note:) mothers and lovers. Though these relationships were rated by their participants as close or closer than relationships with best friends, the participants lied in one-in-three interactions with romantic partners, and in one-in-two interactions with their mothers. DePaulo and Kashy (1998) hypothesize that these two sorts of relationships involve a certain amount of selfpresentational posturing, and are felt to be particularly evaluative relationships. One potential conclusion from this study is that individuals will engage in more deceptive behaviors in increasingly evaluative situations.

An overall picture soon emerges that there are two basic views of lying. The first is that it is an unavoidable part of normal interaction. It is clear that lying is commonplace, but most individuals do not detect this sort of everyday deception. In this view, people lie frequently, but most of these lies are "little" and are not serious threats to the self or relationships.

The second view of lies is that they can be damaging. Much of this research deals with how liars can be caught, or how training can improve the ability to separate truth from fiction. This research has investigated several different aspects of the "problem" of deception, including the attributes of "effective" liars. It is clear that some individuals are better at deceiving than are others. The processes behind what makes for effective deception can provide some important insights as how to accurately to identify deceptive from genuine communications.

Physiological Correlates of Deception

For many years, the research literature on deception focused on detecting the physiological correlates of deception. Were there physiological differences between individuals who were telling the truth and those who were lying? Perhaps the "lasso of truth" was not far-fetched after all. Much of the most popular research on lie-detection led to the development of the polygraph machine, appropriately nicknamed the "lie detector." Polygraphs captured the popular imagination with hopes of virtually infallible accuracy. This aspiration, however, has yet to be realized.

Polygraphs record physiological signals derived from sensors placed on a subject's body. The more typical measurements are of breathing rate, blood pressure, heart rate, and galvanic skin response (GSR) (Ekman, 1985). These recordings are then mapped onto paper or a computer screen to assess the subject's response to queries. Polygraphy attempts to detect deception by identifying the physical correlates of deception. This presumes a characteristic physiological accompaniment to the act of lying. Unfortunately for the practice of polygraphy, this does not consistently appear (Iacono & Patrick, 1997).

Individuals using a polygraph typically use one or more techniques in questioning. The Control Question Test (CQT) technique is the most popular of these. It typically lasts less than three minutes and is composed of a series of questions that are related to the topic at hand. It is presumed that innocent persons will physiologically respond to the arousing control questions (e.g., "Have you engaged in any deviant sexual practices?") and not to the target questions (e.g., "Did you murder John Smith?"). Guilty persons are presumed to display the opposite pattern. Research has shown, however, that this method is actually biased against innocent persons. It is approximately 84% accurate in detecting guilty persons, but only 56% accurate in correctly identifying innocent persons (Iacono & Patrick, 1997).

A second popular form of testing is the Relevant/Irrelevant method. The Relevant/Irrelevant Technique (RIT) of polygraph testing has been uniformly rejected by the scientific community due to its inaccuracy. Iacono and Patrick (1997, pg. 263) write, "The outcome of a RIT should be given no weight whatsoever." The results from a RIT can be easily manipulated by the individual taking the test.

A third form of polygraph testing, known as the Guilty Knowledge Test (GKT) presents an individual with a question, and a series of multiple choice answers. The questions and answers are chosen so that only a guilty person will have knowledge of the correct answer, and the physiological response to the alternative answers is recorded. The validity of the GKT has been very promising in that it does not appear to be biased against innocent persons. Its effectiveness in detecting guilty persons, however, is still questionable (Elaad, 1990).

An especially ironic twist in the story of polygraphs is that they require the individual taking the test to believe in the accuracy of the test. Individuals who understand the substantial risk of being falsely labeled a liar are likely to display such elevated levels of anxiety that they will invalidate the test. In an attempt to control for this potential error, *polygraph operators usually deceive the individual under question* into thinking that the test is virtually infallible. This is important because the polygraph actually measures emotional arousal, not lying (Ekman, 1985). Excess emotion must be accounted for if the test is to remain valid.

Due to criticism of polygraph testing from both the scientific and legal community, federal legislation entitled "The Employee Polygraph Protection Act", enacted in 1988, prohibited most polygraph testing. Polygraphy is still used in the private industries of security and pharmecuticals, as well as in governmental employment and law enforcement. It is most commonly used as an aid in interrogation and polygraph operators are rarely scientifically trained (Iacono & Patrick, 1997). Because of this, polygraph testing will likely remain controversial and hotly debated for the foreseeable future.

A similar controversy has taken place in the arena of voice stress analysis. This method of detecting deception evaluates the amount of stress that is expressed nonverbally during speech. It is presumed that individuals who are lying will produce these nonverbal signals of higher pitch, volume, etc. Just as with the polygraph, there is an extensive literature on the topic, and only a small portion of this writing is scientific. An even smaller amount is research-oriented (Ekman, 1985). Voice Stress Analysis is more accurately described as an indicator of strong emotion than as a lie detector.

What does this have to do with neuropsychology?

Methodologies such as those used in polygraph testing and voice stress analysis are distant cousins to modern neuropsychological methodologies. Both use behavioral indices to inform about an internal state, whether it is honesty or cognitive functioning. In the field of neuropsychology, deception goes by another name: malingering.

Neuropsychological research on malingering has undergone an explosive growth in the last fifteen years. This heightened inquiry into this area is due to a number of factors, one of which is neuropsychology's growth as a discipline. A steady growth of normative data, validity and reliability studies, and the general maturation of the field have helped neuropsychology to become increasingly accepted in areas outside of psychology. This is particularly the case within the legal system, which has come to embrace neuropsychological methods as a possible answer to the challenges presented by the *Daubert v. Merrell Dow Pharmaceuticals* court decision.

Prior to 1993, the legitimacy of scientific evidence presented in a federal court was decided by the use of the "Frye" standard. This standard held that scientific evidence was admissible in court if it was generally accepted within the scientific community (Reed, 1996). The Frye case was decided in 1923. In the following seventy years the nature of scientific discourse changed considerably. Science became increasingly specialized to such an extent that it became difficult for courts to determine science from "junk science." Responding to this need, the U.S. Supreme court reviewed the case of *Daubert v. Merrell Dow Pharmaceuticals* and set a new standard for the admissibility of scientific evidence in a forensic setting in federal courts. According to this decision, the

admissibility of scientific evidence and testimony was to be weighed based on the scientific principles of validity, reliability, method, and procedure: Could the "scientific" findings presented in the courtroom be replicated with the same or similar results? Were the findings of the research directly applicable to the issue raised in court?

Also of importance was that the any scientific theory used in the courtroom adhere to the principle of falsifiability. Scientific principles that could not be directly tested were barred from contributing to the courts. Neuropsychology as a research science and practice met all of these requirements and as a result has become increasingly common in courtroom testimony and court evaluations.

The question of whether individuals could manipulate the outcome of the testing to achieve their own desired ends was inevitable. It had previously been asked of medicine. "Is the patient manufacturing the symptomatology to avoid working?" The question had also been asked of psychological diagnoses: "Is this person feigning mental illness to avoid imprisonment?" It was inevitable that neuropsychologists were asked similar questions in the court system.

Meanwhile, a parallel inquiry was taking place in the neuropsychological research literature. Unfortunately, the answers were not very encouraging. Were neuropsychologists considering the idea of malingering? Several studies gave an unqualified "no" when answering this question (Faust, Hart, & Guilmette, 1988; Faust, Hart, Guilmette, & Arkes, 1988; McCaffrey & Lynch, 1992).

Measures to detect malingering

To remedy this, neuropsychologists began to investigate more specialized procedures. This area of research has produced a large literature, particularly within the last ten years (for reviews see Nies & Sweet, 1994; or Sweet, 1999). Much of this literature is comprised of studies investigating the sensitivity of specific tests to detecting dissimulation. There are several methods currently used to detect malingering in neuropsychological assessments. They can be divided into three general categories, based upon the methods the tests use to detect this dissimulation. The first type of assessment method is typified by the Rey Fifteen-Item test. This test, as described by Lezak (1995) is presented to the client as a difficult memory task, though it is actually very simple. Several studies have validated the original hypothesis that individuals who are attempting to distort the results of an assessment in order to appear memory-impaired will overestimate the impairment of an individual with a verifiable brain injury. These studies have found that participants asked to malinger will, as a group, perform worse than individuals who have experienced traumatic brain injury (TBI) (Greiffenstein, Baker, & Gola, 1996), are psychiatric patients (Iverson & Franzen, 1996), or are substance abusers (Arnett & Franzen, 1997), in addition to a number of other neuropsychological deficits (Hayes, Hale, & Gouvier, 1998). This sort of method may be described as "norms-based" malingering assessment strategies. They perform their function by enabling the neuropsychologist to compare a client's performance on one of these tests to those with verifiable brain injury (and subsequent cognitive impairment), in addition to a normative sample of individuals who have been instructed to simulate a cognitive deficit or have been suspected of doing so. When an individual performs above or below a certain cutoff score, he/she is either thought to be genuine in their presentation or suspected of malingering.

Norms-based strategies such as the Fifteen-Item test of Digit Span thresholds are popular because they are relatively quickly administered. The Fifteen-Item test usually takes no more than a couple of minutes to administer. In addition, with sufficient data collection a cutoff score can be generated from virtually any test (Strauss, Spellacy, Hunter, & Berry, 1994); the possibilities for test construction are limited only by the amount of tests the neuropsychologist uses. It is important to note, however, that these strategies can have a high incidence of false negatives (Millis & Kler, 1995). Because of their relative insensitivity *when used as the only malingering test*, neuropsychologists commonly treat the results from these tests with caution. Positive indications of malingering from these tests' data are usually interpreted conservatively and additional malingering tests are employed.

Often, an additional malingering test uses a different strategy. One of these strategies is known as "Symptom Validity Testing" (SVT) (Lezak, 1995). SVT tests are sometimes adjusted to suit the complaints of individual clients. In such tests, the neuropsychologist repeatedly tests an area that is a specific complaint of the client and presents him/her with a forced-choice alternative answer. This approach assumes that if the claim is genuine the client will, at worst, answer incorrectly 50% of the time. For example, if a client is complaining of memory difficulties, the neuropsychologist may ask the client to remember fifty items, one after another. A short time after the presentation of an item, the client is presented with a choice of two answers, one correct and one incorrect. An individual with legitimate but severe deficits will answer a minimum of approximately 50% correct. This is presumed to be the worst-case scenario when testing

a completely impaired function, as it is the scored equivalent of guessing. The statistical likelihood of someone choosing the incorrect answer less than 50% of the time when responding randomly can be easily calculated. Response patterns where an individual answers wrong at a rate worse than chance, and the statistical likelihood that this could have happened due to chance is low, suggest that the individual is attempting to distort the test results by intentionally choosing the wrong answer. These SVT methods are useful, and there are several ready-made tests that have been developed to test memory functions. Tests such as the Portland Digit Recognition Test (PDRT) (Binder, 1993), the Test of Memory Malingering (TOMM) (Tombaugh, 1997), the Digit Memory Test (Hiscock & Hiscock, 1989), and the Letter Memory Test (LMT) (Inman, Vickery, Berry, Lamb, Edwards, & Smith, 1998) have been developed exclusively to evaluate memory-related complaints.

These tests are effective, but as with the norms-based malingering tests, there are drawbacks. Multiple trials produce relatively reliable indications that an individual is intentionally choosing the wrong answer, but it takes a long time for these trials to be completed. The tests are time-consuming (at times up to 25 minutes) and that is a drawback for many time-pressured neuropsychologists.

There is a third strategy to detect malingering on neuropsychological assessments, one that is based on a pattern of performance (Reitan & Wolfson, 1998). Tests that rely on this "profiling" technique have been shown to differentiate between malingerers and controls. An example of this sort of test is the Validity Indicator Profile, or VIP (Frederick, Crosby, & Wynkoop, In Press). This test is a modified version of a nonverbal intelligence test. The original test, like many cognitive tests, is comprised of items of

increasing difficulty and is concluded once a ceiling has been established. This test is administered in a two-alternative forced-choice format. The Validity Indicator Profile administers all 100 items from this test in random order, not in order of increasing difficulty. At the conclusion of the test, the items are scored in order of increasing difficulty and a profile emerges. For individuals who are putting forth their best effort, the percentage of items they answer correctly steadily decreases as the tests difficulty increases, eventually reaching the point where 50% of the items are answered correctly. For individuals who are dissimulating, the profile is very different. Often, when confronted with a series of items of varying difficulty, these individuals have difficulty monitoring their performance and answer incorrectly on those items where they know the answer. After the test is scored, what results is a profile that appears remarkably different than that of control participants. Whereas controls answer easy items correctly and their correct responses eventually drop to a level no better than chance, malingerers frequently display the opposite profile. They often respond incorrectly to the easy items, at a rate worse than chance, and eventually progress upward toward a chance rate of correct responses as the items become progressively more difficult.

Similarly, Bernard, McGrath, and Houston (1996) have shown that an investigation of pattern of performance is useful for detecting malingering on the Wisconsin Card Sorting Test (Heaton, 1981).

It should be noted that many tests utilize more than one of these strategies. The VIP, for example, uses a combination of the "profile" and SVT methods to detect malingerers. Most neuropsychologists use multiple methods in their clinical work. This is a necessary practice, as the research on malingering detection needs much improvement.

A Social Psychological Approach to the Detection of Deception

Research in social psychology has focused on examining deception in an interpersonal context. This research uses means of detecting deception that are, for the most part, more qualitative than those employed in the neuropsychological malingering research. Social psychology's approach to detecting deception has focused on methodologies such as the investigation of nonverbal behaviors. This is a more general approach than that of clinical neuropsychology, which has tended to focus on establishing cutoff scores for specific tests.

Some research in interpersonal relationships might suggest that individuals accept lies in close relationships because they are motivated to preserve their personal view of the relationship (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). However, this explanation does not address individuals' susceptibility to being deceived in relationships that are not close. Some interesting work by Gilbert, Tafarodie, and Malone (1993) might suggest that one reason individuals are so readily deceived is that the acceptance of information is fundamental to the process of comprehension. Only after information is comprehended is it then re-evaluated. In their study, they found that participants who were given a task that increased their level of cognitive busyness had more difficulty discounting information that was presented to them concurrently. Because they were unable to process the information as it was presented to them, they were unable to fully discount the information.

While this is an interesting explanation for why individuals are more susceptible to being deceived when they are cognitively busy, it does little to explain why individuals are deceived under normal circumstances. One possible hypothesis that is not too far removed from the conclusions of the Gilbert et al. (1993) study is that individuals are not ordinarily critical perceivers of information. That is, individuals implicitly believe everything they are told because it is an integral part of the comprehension process (Gilbert, 1991a). However, most of the time individuals are not inclined to critically evaluate information that is presented to them and thus they are readily deceived and persuaded, often times without their knowing that it is happening.

How do lies fail?

How do people go about detecting deception? According to Ekman (1988), lies fail for a number of reasons. One being that liars are frequently found out through a third party. Lies may also be discovered through the liar's own verbal contradictions, or evidence that disputes what is being communicated. However, much of the research on liars would suggest that individuals commonly rely on the behavior of liars to determine when they are being deceived. When lying, the primary goal of the liar is to avoid detection. As such, lies are often discovered when the attempts to disguise deception as normal behavior stand out. Ekman categorizes these "givaways" in two groups: 1.) failure to prepare and 2.) the interference of emotions.

Individuals who fail to prepare often give themselves away when they contradict themselves. He/She momentarily forgets to maintain the façade, or what he/she had previously said. In addition, when caught off guard, individuals need time to prepare a believable response, and stalling to prepare such a response can tip off the listener.

Speech irregularities such as stuttering or conspicuous voice intonations are often giveaways as well.

Of these two broad-based categories of "giveaways," by far the most research has been done on the interference of emotions, and the ways in which they reveal lies. According to Ekman (1988), the simplest way in which this happens is when individuals attempt to replicate an emotion and pretend that they are feeling one way or another. Few people have the acting ability to convincingly replicate an emotion, and this is a point at which many lies are discovered. More typically, however, deception involves the denial of an emotion that is present. This emotional suppression is also very difficult to accomplish, as the emotion tends to "leak" out through behaviors (Depaulo & Kirkendol, 1988). Observers of these behaviors are rarely able to pinpoint the cause for this leakage, but the inconsistency of verbal and nonverbal communication can be enough to arouse suspicion (Ekman, 1988). In addition, the emotion surrounding the behavior of lying can be enough to disrupt the flow of the deception. The uncontrollable thrill of getting away without being caught, or the fear of getting caught are two examples of strong emotions that can reveal a lie.

Individuals interested in catching lies are discouraged from relying on any one of these observations, and are instead encouraged to use a multifaceted approach (Ekman, 1985; Ekman, 1988; Ekman & O'Sullivan, 1991). This is because many who tell the truth frequently show signs of fear, nervousness, or produce speech irregularities. For example, most individuals would feel fear if they were interrogated by a police officer. Their nervousness may even be sufficient to cause verbal contradictions. (I can remember a car trip with a friend, when we were stopped upon our return at the U.S./Canadian border and were asked where we were going. My friend said Lansing, and I suddenly blurted out "Chicago!" for no apparent reason. The experience of interacting with the border agent was sufficiently nerve-racking as to upset my (relatively) normal cognitive processes.) As such, it is important to remember that individuals with truthful intentions frequently display behaviors that could be mistaken for indications of lying. Instead, the use of nonverbal cues, facial expressions, and measures of voice pitch are encouraged (Ekman, 1988).

Recent research by Ekman, O'Sullivan, and Frank (1999) suggests that law enforcement personnel and psychologists who use these techniques can be effective in detecting lying. Several studies utilize methodologies where participants watch videotapes of people responding truthfully and untruthfully. This research indicates that, on the whole, participants are typically unable to distinguish truth from fiction. There is, however, variation in the interviewees' abilities to fool the participants. Ekman and O'Sullivan (1991) compared the different ways in which their participants judged two of their deceptive interviewees. One of the two interviewees was thought to be particularly easy to detect, and the other was thought to be particularly difficult to detect. The participants in this study were able to accurately identify the predicted transparent interviewee 84% of the time, but were only able to detect the interviewee that was thought to be difficult to detect 44% of the time. An analysis of the methods that accurate participants used revealed that in order to correctly identify the more deceptive interviewee, they used primarily nonverbal cues to make their decision. Participants relied more on verbal cues to detect the subject that was thought to be easier to detect. These observations support Ekman's (1988) suggestion that the usage of nonverbal cues is preferable for the detection of deception.

How effective are people at detecting deception?

The vast majority of research in the detection of deception indicates that people are very ineffective at detecting deception. A study by Ekman and O'Sullivan (1991) on a group of individuals who would be expected to be able to discern truth from fiction revealed that even trained professionals are relatively poor at distinguishing liars from truth-tellers. They tested a sample of U.S. Secret Service agents, federal polygraphers (which included Central Intelligence Agency (CIA), Federal Bureau of Investigation (FBI), and National Security Agency (NSA) personnel), municipal and superior court judges, police (who were members of the California Robbery Investigators Association), psychiatrists, individuals taking a course on deceit, and college students. The participants were shown 10 taped interviews and were told that half of the interviewees were lying. They were asked to identify each of the interviewees as "deceptive" or "honest," and were asked to rate their ability to determine who was lying. Interestingly, the only group that performed at a rate significantly better than chance were the Secret Service agents, who themselves were correct only 64% of the time. In addition, participants' ratings of how effective they were had no statistically significant bearing on their actual performance. Most participants used incorrect cues for making their judgements. A review by Bull (1988) (no pun intended) of police training manuals found that these manuals would have their readers believe that detecting deceptive communications can be a relatively simple exercise. There is no evidence that would show this to be the case.

DePaulo and Pfeifer (1986) tested the influence of on-the-job experience on the ability to detect deception. College students, new recruits at a federal law enforcement program, and veteran law enforcement personnel were compared on their ability to detect deception in an audiotaped interview. Though law enforcement personnel were significantly more confident in their ability to detect deception, none of the groups differed in their ability to discriminate between truthful and deceptive communications.

In much of the deception detection literature, participants are forced to make an evaluation as to the truthfulness of someone's communication. Often this is a guess and usually a forced choice experimental paradigm. Recognizing that this may be a significant shortcoming in the literature, DePaulo et al. (1997) investigated whether a participant's confidence in their decision significantly influences accuracy. In a meta-analysis of 18 studies, they found only a .04 correlation (non-significant) between accuracy and confidence. This indicated that it is unrealistic to use one's confidence in one's judgements as an indication of their accuracy (see also Kassin & Fong, 1999). Beware the overconfident forensic psychologist.

What makes a better liar?

An experiment by DePaulo, LeMay, and Epstein (1991) measured the influence of the importance of success on participants' ability to successfully deceive. After manipulating the importance of success on the part of the interviewees, they examined whether they were more able to deceive those who watched the interviews. They found that, paradoxically, the more important it was for their interviewee to succeed, the more their deception became transparent. DePaulo et al. described this as "choking under self-imposed pressure." They theorize that emotional involvement hindered the interviewees' ability to lie without being caught.

DePaulo and Kirkendol (1988) call this curious phenomenon "motivational impairment." Individuals who are more highly motivated to succeed with their lies are less able to do so when their observers are witness to their nonverbal and verbal communications. DePaulo discovered this interesting effect while trying to get her lying participants to lie more effectively. The general assumption was that while lying is difficult to detect, there are discernable differences between those that are lying and those who are telling the truth. If liars could be motivated to tell more convincing lies, then perhaps their lies would be virtually undetectable. These authors hypothesized that, paradoxically, when people are highly motivated to lie, their verbal communications will become more deceptive, but their nonverbal behaviors will become more transparent.

Indeed, this was the case. Individuals lying to attractive people are more easily revealed by their nonverbal behaviors, presumably because they felt the need to ingratiate themselves. In the same study, while lies to same-sex people were virtually undetectable, lies to members of the opposite sex were also betrayed by nonverbal behaviors (DePaulo, Stone, & Lassiter, 1985). Effective lying involves the monitoring of very complex processes, not all of which are easy to control. Verbal behaviors are relatively easy to monitor, as people hear themselves talk. They receive constant feedback as to how they sound. Nonverbal behaviors are not so easy to monitor, as individuals rarely have constant feedback as to their facial expressions and body movements.

DePaulo and Kirkendol (1988) provide a possible explanation for the motivational impairment effect when they explain that the decrease in believability on the part of

highly motivated liars may be due to a heightened need for control over their behaviors. When they are asked to lie, they attempt to control all of their behaviors. Controlling verbal *and* nonverbal behaviors is a relatively unfamiliar task. When they attempt to do so they appear unnatural and suspicious. This provides a convincing explanation for why the most effective strategies for detecting lies are to attend to nonverbal behaviors. In situations where people tell the truth, their nonverbal communication is largely an automated process. Most people do not actively think about gesturing or vocal inflection. These are largely unconsciously directed behaviors. When individuals are asked to lie convincingly, however, they become aware of all of their communications, both verbal and nonverbal. Without practice, the expression of verbal and nonverbal in a controlled context is awkward, and it is the difficulty in managing the smooth flow of intentional verbal and nonverbal communications that stands out as suspicious.

Individual and personality characteristics that affect the transparency of lies

Research on the trait of self-consciousness may contribute to knowledge of the ability to lie successfully. Vrij, Akehurst, and Morris (1997) found that individuals who received higher scores on a self-consciousness scale (Fenigstein, Scheier, & Buss, 1975) displayed a decrease in the amount of hand movements while lying. Vrij et al. hypothesized that those who are highly self-conscious self-monitor to a greater degree and that this imposes a higher cognitive load. Higher cognitive load and the limits of cognitive capacity then impose limits on the amount of planning and effort that can be diverted toward the deception task.

Support for this hypothesis can also be found in the commonly held perception of the fast-talking liar. Con-artists are often given the pejorative label of "lacking a conscience." The "conscience" is presumed to be the psychological entity that gives away lies. Ekman (1985) supported this hypothesis when he wrote that lies are only detectable insofar as the liar believes them to be lies. Lies are detectable only when "conscience" gets in the way. If "conscience" contributes to cognitive load, performance decrements would be expected on tasks where self-conscious individuals are induced to perform well.

Baumeister (1984) tested a similar hypothesis in research on "choking under pressure." He found that participants showed decrements in performance on tasks when they were pressured to perform well. This pressure was brought to bear on these participants via several different means, including introducing competition, observation, or the incentive of a reward. In this study, it was hypothesized that attention to the act of completing the task introduced a level of self-observation that was previously not present. This explanation was supported by the finding that participants who scored higher on a measure of self-consciousness (Fenigstein, Scheier, & Buss, 1975) were more susceptible to displaying this sort of performance decrement. Several studies that support the hypothesis that automatic processes can be disrupted when brought under conscious control (e.g., Baumeister, Hamilton, & Tice, 1985; Langer & Weinman, 1981).

How might this curious phenomenon be explained?

Research in basic cognition would indicate that mental processes can be categorized in a number of different ways, one of which is to evaluate the consciousness of thoughts (Fiske & Taylor, 1991). One way to formulate consciousness is as an awareness and executor of thoughts and activities. These are also known as controlled processes. The role of the executive is important, in that it can also rein in more automatic processes. Fiske and Taylor (1991) point out that this executive is not without limitations (see also Baumeister, Bratslavsky, Muraven, & Tice, 1998). An individual's ability to carry out controlled tasks is dependent on their available cognitive resources.

Automatic processes, as opposed to more controlled processes, are largely outside of awareness and take place involuntarily. They do not need to be controlled, and take place separately from more controlled behaviors. Fiske and Taylor (1991) describe a particular type of automatic behavior, which they call "goal-dependent automaticity."

These behaviors are directed to some degree, but vary according to an individual's goals. The goal is to some degree conscious, but the process by which the individual carries out these goals is largely outside of awareness.

This view of consciousness as an executive and an automator is particularly germane to the discussion of deception, as this executive and the limitations of the executor may be the primary cause of deceit's success and/or failure. The motivational impairment effect may be best explained in terms of "resource depletion" and "cognitive load." This effect may not be due to "motivation," per se, but instead may be the result of resource depletion that accompanies the act of deception.

Success at deception, then, may have less to do with an emotional state than it has to do with a cognitive state. Genuine behavior comes naturally. Each aspect of normal (or practiced) behavior is an automatic task and takes up little or no cognitive resources. When individuals tell the truth, there is no attention to the process of being genuine. When individuals are being deceitful, however, attention is usually drawn to each aspect of behavior that is automatic, and in doing so the behaviors become controlled. Wegner and Bargh (1998) refer to this process as one of "disruption." A crude example of disruption occurs whenever an individual's attention is drawn to their breathing. Until this point in the text, the reader was probably not attending to the pace or quality of his/her breathing. At the mere mention of this activity, however, the reader most likely assumed control of the activity of breathing. In this way, breathing is much the same as genuine and unintentional expressive communication. It takes up little or no cognitive space unless we assume control. Conversely, when cognitive resources are used by other tasks, such as critiquing a dissertation, the tasks of breathing and facial expression are once again assumed by automatic control. When individuals are particularly cognitively busy, they do not forget to breathe, nor is their face expressionless. These tasks are well practiced and can easily slip into automaticity.

This becomes a problem for tasks that are not well practiced, such as that of deceit. Assuming that deceit is a relatively infrequent activity for most people and does not readily slip into automaticity, there is a tremendous amount to control. This is a difficult task and many hazards abound. Greene, O'Hair, Cody, and Yen (1985) skirt this issue in their deception and behavioral confirmation study. They wrote:

> "The basic premise underlying the notion of cognitive difficulty is that as the mental operations required to produce some communication become more complex or demanding, there should be an increase in the behavioral indicants of high cognitive load... With respect to the issue of deception, we should expect that lying generally requires more cognitive work than telling the truth because the deceiver must construct a message that does not contradict the listener's knowledge, that contains no gross inconsistencies, and that provides sufficient detail so as to seem plausible and truthful...The increased complexity of these demands should be reflected in behaviors indicative of heavy demands upon central processing..."

As Greene et al. indicate, a heavy cognitive load may be responsible for the nonverbal leakage that is so often found by deception researchers (e.g., DePaulo, 1988; Ekman, 1988). It may be possible, then, to exploit the natural limitations of cognitive capacity by increasing cognitive load and overwhelming the self-monitoring system. Gilbert and Hixon (1991) indicated that cognitive busyness facilitated the behavioral expression of a suppressed thought.

A recent literature search on PsycInfo found no published research in this area. Given the many similarities between these two camps, research that combines these two approaches appears quite promising. The detection of deception in neuropsychological assessments may be significantly improved if this problem was approached from a different theoretical perspective. Research conducted using multiple methodologies and varying theoretical approaches seems to point to the same conclusion: deception, at its heart, is a cognitive process that increases cognitive load and taxes executive functions. Why not apply this body of knowledge to neuropsychological assessments?

One way to improve upon these current methods would be to identify the cognitive processes underlying malingering. If there are telltale signs of these cognitive processes at work, they could be incorporated into existing malingering detection methods to improve accuracy.

An adequate investigation of this conclusion should take place using two methods. The first should attempt to discriminate between malingerers and controls. The second should investigate and manipulate the cognitive processes behind the act of malingering, and if successful in this manipulation, improve the discrimination rates. It would be optimal to test multiple cognitive domains in this endeavor, as the cognitive-process of deception is not thought to be domain-specific. Thus, multiple strategies of malingering detection that involve relatively distinct domains should be utilized.

Using Multiple Strategies of Malingering Detection

Domain #1, Practice Effects

One way to detect malingering may be through the use of practice effects. Reitan and Wolfson (1998) reported that in repeated neuropsychological assessments, the absence of practice effects was a significant indicator of malingering. Practice effects are a robust finding. They are not limited to cognitive ability or condition and occur in a variety of domains. In conditions as severe as anterograde amnesia, practice effects are pronounced. Indeed, the famous case of H. M. showed practice effects on motor tasks for which he had no declarative memory (Kolb & Whishaw, 1996). Because practice effects are such a robust and virtually universal finding, the absence of practice effects should be a marker of malingering. Dissimulators are frequently motivated to present a consistent picture of impairment. In doing so they fail to account for improvement that takes place naturally, and show minimal or nonexistent practice effects (Reitan & Wolfson, 1998). This is an advantageous approach, because it takes advantage of an existing and robust cognitive process and can be assessed using instruments already in use by most neuropsychologists. In addition, for the purposes of this inquiry, it may be helpful to use an existing neuropsychological test and use it in a method that it is more sensitive to the questions being asked in this study. For example, a simple test of psychomotor ability could be administered several times in a single assessment. Performance will improve with successive administrations. Individuals who are manufacturing symptoms may be so intent on maintaining their presentation that they fail to account for a practice effect. Improvement over time is an automatic process, one that occurs outside of awareness.

<u>Domain #2, Response Latency</u>

The use of reaction time in neuropsychological assessments is not limited to tests of malingering. Reaction time, while not as popular an index of neuropsychological functioning as set shifting, is an aspect of functions commonly tapped in assessments. Popular tests such as the Trailmaking and Finger Oscillation tests from the Halstead-Reitan Neuropsychological test battery (Reitan & Wolfson, 1993) involve the use of reaction time to a certain degree. Western and Long (1996) suggest that the relationship between reaction time and neuropsychological functioning is substantial enough to warrant careful consideration as a tool when assessing selected patients.

There is some evidence that response latency is an effective method for distinguishing malingerers from those putting forth his/her best effort. Research by Strauss, Spellacy, Hunter, and Berry (1994) found that when compared to participants in a control group, individuals in a malingering group took far longer to push a key in response to a tone. Also of note is that participants in a malingering group had reaction times that were approximately twice as long as participants who had verifiable closed head injuries. This finding that malingerers overestimated the deficits of those who are cognitively impaired is consistent throughout the test-faking literature. Additional studies have replicated this finding and determined that the measurement of response latency *and* correct/incorrect responses improved the accuracy of malingering determinations over and above the more common strategy of recording the ratio of correct and incorrect responses on symptom validity measures(Rose, Hall, & Szalda-Petree, 1995; Rees, Tombaugh, Gansler, & Moczynski, 1998). These studies involve two-alternative forced-choice paradigms where the stimuli and answer choices are presented and collected by a computer.

There are a number of explanations for the finding that the measurement of response latency improves the accuracy of neuropsychological malingering tests. One is that malingerers slow their response speed in an effort to appear brain damaged. Laypersons often believe that individuals with mild head injuries are dizzy, slow moving, and experience head and neck pain (Aubrey, Dobbs, & Rule, 1989). The long response latency periods observed on tests of malingering may be an effort to replicate this presentation.

Another explanation of this finding may be that individuals who are malingering neuropsychological deficits have more to monitor, and require more time to think of their response. Individuals undergoing an assessment for legitimate complaints have only to identify and select the correct answer. A malingerer must complete at least two mental processes before selecting his/her response. First, he/she must decide which is the correct response. Second, he/she must decide which of these two choices to endorse. It should be noted that the second decision also involves a continual monitoring of his/her performance on the test, in addition to an evaluation of whether a correct or incorrect response would support his/her claim.

This study was based upon the prediction that malingering is similar to many other cognitive processes that require sustained effort and attention. It requires the dedication of cognitive resources, which are in limited supply. Malingering in neuropsychological measures is most likely an unpracticed skill, and as such the cognitive processes that manufacture this presentation are more controlled than automatic. In addition, malingering is similar to other controlled processes that require dedicated resources in that when cognitive resources are scarce, self-monitoring will be compromised. Malingering in neuropsychological assessments will be more easily identified when cognitive load is increased. There may be limits on the effectiveness of adding a cognitive load, because as malingering is practiced it becomes more automatic and less susceptible to detection, whether by adding cognitive load or by conventional means.

METHODS

Participants

In this study, 40 participants were selected from a population of Michigan State University college students. They participated in this experiment to fulfill a requirement for a psychology class. Only native English speakers were eligible to participate.

Procedure

The participants were divided into two groups, the malingering group and the control group. The malingering group received instructions to malinger a head injury on the tests throughout the entire experiment, while the control group was asked to do their best throughout the entire experiment (see appendix A). The participants in both of these groups completed the experimental procedure twice, once under normal conditions and once when exposed to a cognitive load. The participants were tested individually, and were assigned to the experimental conditions randomly, using a coin. There was a 20/20 split. The order in which the participants were exposed to the cognitive load treatment was counterbalanced. There was a 19/21 split (see Table 1).

Table 1
Number of subjects in each dataset

	Cognitive load treatment 1st	Cognitive load treatment 2nd
Malingering group	11	9
Control group	10	10

When completing the protocol under a cognitive load, participants were asked to listen to a tape-recording adapted from the NEPSY: A Developmental Neuropsychological Assessment (Korkman, Kirk, & Kemp, 1998) Attention and Response Set subtest.

When each participant arrived for the experiment, he/she was reminded that the experiment consisted of two testing sessions, one week apart, and that he/she was to attend both sessions in order to receive credit for the experiment. After signing the consent form, participants were administered a self-consciousness questionnaire (Fenigstein, Scheier, & Buss, 1975). He/She was then seated at a computer and told to follow the instructions on the screen. The computer first asked him/her to help calibrate the software by pressing either the "A" or ";" key as soon as he/she saw something (strings of numbers) on the screen. He/She viewed 12 strings of numbers before the program halted and asked him/her to see the experimenter. The experimenter then gave the participant a sealed envelope containing the malingering or control group instructions. The experimenter then introduced him/her to a second experimenter who was to administer the tests. The first experimenter then left the room and the second experimenter administered the following procedures:

Participants who were to receive the cognitive load treatment were told that they would hear a voice on a tape say a number of words, one after another, for the duration of the experiment. When they heard the word "red" spoken on the tape, they were to say "red." They were told that the test administrator would be recording their responses. Participants in the no-load session did not receive this instruction from the experimenter and instead completed the tests while not concurrently listening to the tape.

The participants then completed the Trailmaking Tests, parts A and B (Reitan & Wolfson, 1993). Immediately after completing the set of the Trailmaking Tests (parts A and B), they were asked to take the tests again. This time, however, the tests were on different color paper. This was presented to the participants as a standardization project to make neuropsychological testing more colorful and festive.

After the second administration of the Trailmaking Tests set, participants were seated at a computer. The computer screen told them that they were going to take a memory test. They were told that on the screen they would see a series of numbers for a short period of time (5 seconds), after which the numbers would disappear and the screen would be blank for a short period of time. When the delay was over, they saw two series of numbers appear on opposite sides of the screen, one of which was identical to the one that they had just seen. They were to press either the "A" key or the ";" key to indicate which number they saw. They were instructed to press the correct key as fast as possible. After the 24^{th} item, a message on the screen told them that because their performance was good, the task difficulty would increase. For the final 24 items, the delay between the initial presentation and the recognition task increased from 5 seconds to 10 seconds. This computer program, called the Computerized Forced Choice Test (CFCT) is a Symptom Validity Test adapted from the Digit Memory Test (Hiscock & Hiscock, 1989). In symptom validity measures such as this, the correct answer was randomly placed. The right side was correct 50% of the time and the left side was correct 50% of the time. Also of note is that the increase in the delay, from five seconds to ten seconds, is a significant part of the test. It is thought to cue malingerers to enhance their symptom production because of the supposed increased difficulty (Lezak, 1995).

After completing both recognition trials of the Computerized Forced Choice Test (CFCT), the participants were asked to complete the Trailmaking Tests set two more times, on different colored sheets of paper.

Before leaving each testing session, the subjects were seated at the computer once again and asked to answer a series of questions about their effort during the tests as a manipulation check. The test administrators were not able to view these responses. Participants then left the testing room and met once again with the first experimenter who reminded them to return one week later to repeat the testing protocol.

Upon their return, the participants again read and filled out the consent form. They completed the self-consciousness questionnaire, were given the same control/malingering instructions that they had received in the previous testing session, and completed the Trailmaking tests and CFCT in the same order. Following this, they completed the manipulation check once again. No participant was tested by the same experimenters for both of the testing sessions.

HYPOTHESES

The effects of load within-subjects

1. Because the cognitive load manipulation was expected to be cognitively taxing, all participants were hypothesized to display poorer performance when under an increased cognitive load than when not under an increased cognitive load.

A. On the Trailmaking tests, participants under load would be partaking in the added task of monitoring the tape, which would result in an increase in the amount of time they required to complete the tests.

B. On the digit recognition test, participants under load were hypothesized to require more time to endorse one of the two recognition choices. This is because of the added cognitive effort that must be expended to monitor the tape.

The interaction effects of load

2. Participants' scores would vary depending on combinations of malingering and load conditions. There an interaction between cognitive load and malingering conditions was hypothesized, such that:

A. Individuals instructed to perform to the best of their abilities (i.e., not malingering) who were not undergoing a cognitive load were hypothesized to perform better than all other participants on the Computerized Forced Choice Test (CFCT). They would have the shortest response times on the digit recognition tests, and would have the fewest number of errors on the digit recognition test.

B. Individuals instructed to perform to the best of their abilities who were undergoing a cognitive load were not expected to differ from non-malingering/no-load participants in terms of the number of errors committed on this test. Load was expected to slow them down, but not necessarily create additional errors on such a simple recognition task. They were predicted to have longer response times than those in the non-malingering/no-load protocol; in this regard, they would appear very much like participants in the malingering/no-load condition (and would not be significantly different from the malingering/no-load group).

C. Participants instructed to malinger who were not undergoing a cognitive load were expected to take longer than non-malingering/no-load participants to complete these tasks for a number of reasons, two of which are because of the cognitive effort expended in manufacturing a "cognitively impaired" presentation and/or a deliberate attempt to appear slower. In addition, these participants were expected to commit more errors on the digit recognition task as a product of their attempt to feign cognitive impairment.

D. Participants instructed to malinger a cognitive impairment who are under a cognitive load would, because of the additive demands of symptom manufacturing and cognitive load, have the longest response times. The effect of the cognitive load should also make them less able to monitor their performance on the digit recognition task, and the result should be that those in this group would make a more errors than those in any of the other groups.

<u>Practice effects on the trailmaking tests</u>

3. Because the absence of practice effects were hypothesized to be a positive sign of malingering, practice effects were assessed by subtracting time four on the Trailmaking tests from time one. It was predicted that, using this definition of a practice effect, the

participants in the malingering/no-load dataset would display a smaller practice effect than any of the other datasets.

4. Moreover, it was thought that when malingerers manufacture symptomatology, they make an attempt to be consistent in their presentation. As such, the absence of practice effects is not a planned activity, but instead is a byproduct of this effort. Added cognitive load should make it more difficult for participants to monitor their performance, and practice effects should emerge from the lack of cognitive resources that would ordinarily monitor and control. Thus, participants in the malingering/cognitive load condition should display a larger practice effect when compared to individuals in the malingering/no-load protocol.

Self-consciousness

5. It was hypothesized that the presence of high self-consciousness produces a degree of self-examination that acts as an added cognitive load, over and above that which is presented in the testing protocol. Thus, for all participants, higher scores on the self-consciousness measure would be correlated with a greater degree of change when moving from the load to the no-load condition.

A repeated measures ANOVA was used to evaluate each of the hypotheses where a Load X Condition interaction is predicted. Other analyses, which require a comparison of main effects, will be evaluated using paired t-tests. Hypothesis #5 will be evaluated via a correlation.

RESULTS

Data Transformation

In order to reduce measurement error, an attempt was made to more directly examine the amount of time participants used to evaluate their choices on the CFCT. Recall that during the test, participants viewed the stimulus and following a short delay they saw two answer choices, one of which was correct. Their task was to choose the correct response as quickly as possible. It was thought that if the time the participants required to register the stimulus and physically press a key was eliminated, the remainder would be a more accurate portrayal of the amount of time they required to consider their choice and decide upon a response. The goal was to reduce the measurement error that would have resulted had the raw reaction times been used in the analyses.

To accomplish this, the response latency times from the last ten presentations of the "calibration task" were averaged to use as a baseline measure. The mean per-participant response latency for items 2-24 of each recognition trial (i.e., both the 5 and 10-second trials) were then derived for each participant. The baseline measure was then subtracted from the participants' response latency times to calculate adjusted response latencies. By subtracting the baseline response time, a more accurate indication of "cognition time" was achieved. These "cognition time" measures were used for the data analyses.

After the cognition time data were derived, it was necessary to transform the data. The analyses utilized in this study are based on the assumption that the data are normally distributed. However, with response latency data this is not necessarily the case.

Participants experienced a ceiling effect where the limits of psychomotor speed do not allow them to respond faster. As a result, the data were skewed. One technique that is commonly used with this type of distribution is a logarithmic transformation, which converts the scores to achieve greater symmetry of distribution. These more symmetrical distributions are preferable to skewed distributions for statistical analysis (Rosenthal & Rosnow, 1991). All of the analyses on reaction time and cognition time were conducted using the natural log equivalents of the raw data.

The Trailmaking test change-score data also had to be transformed. It was hypothesized that load would differentially influence change scores by malingering status, such that the combination of the demands placed upon participants who received the malingering instructions *and* the cognitive load would inhibit the normal formation of a practice effect. However, there were some unexpected trends in the data which made analysis challenging. Participants in the malingering conditions exhibited a great degree of variability in test performance. The time they required to complete the Trailmaking tests, regardless of the cognitive load condition, was greater than that required by the participants in the control conditions. Recall that the experimental hypothesis predicted differential rates of change over four successive administrations. Unfortunately, the experimental instructions created an a priori difference between the experimental and control group. This introduced a great deal of bias into the analysis because, though both groups were required to complete the same Trailmaking tests, the control and malingering group started off from very different points.

In addition, participants in the malingering group varied much more from test 1 to test 4, than did the participants in the control group. It is probable that this was due to the nature of the task. The Trailmaking Tests are paper-and-pencil tests that assess, among other things, psychomotor speed and agility. A practice effect was hypothesized to be present in the control group, and indeed this is what was found. Participants' time scores dropped significantly from time1 to time 4. The amount of this improvement, however, may have been restricted by human limitations on psychomotor speed. Participants' improvement may have reached a floor where a substantial decrease in completion time was not possible, relative to the malingering group. Because of this, the control group may have had diminishing returns from their practice. To minimize the effects of these disparate data trends, a standardized change score was used (Kenny, 1975) in the repeated measures ANOVA. This data conversion method allows for the comparison of mean change scores between groups by minimizing the noise created by a priori design

differences. In this case, the standardized mean change score conversion minimized the noise created by the disparate variability and between groups starting points. It did this by adjusting the location and spread of the two different (e.g., malingering and control) change score curves.

To do this, raw change scores were calculated by subtracting the first Trails A score from the fourth Trails A score. This was done twice for each participant, once for each load condition. After these raw change scores were obtained, the load and experimental conditions were combined so that a mean and standard deviation could be calculated across datasets. That is, when the mean and standard deviations were calculated, they were measures of central tendency and variability for the raw change scores, conditions combined. Using these indices of central tendency, a standard score [z = (raw score – mean) / S.D.] was created for each raw change score. Each participant, then, had two z-scores (one for the load condition and one for the no-load condition) that represented the size of the raw change score, relative to all of the other change scores in group. This process was repeated for the Trails B data.

When assessing whether the cognitive load manipulation resulted in an increase in the amount of time participants required to complete the tests, the total number of seconds required to complete each of the Trails A tests in the no-load condition was computed for each subject (TrailsA #1 + TrailsA #2 + TrailsA #3 + TrailsA #4). These totals were compared to the total number of seconds required to complete the Trails A tests in the load condition.

Order Effects

In this study, order was considered a potential confound. Order could influence test performance, such that participants' scores in the second testing session might be different, depending on whether or not they experienced the load manipulation in the first testing session. It was for this reason that the study was counterbalanced.

To investigate the effects that the order of the cognitive load manipulation may have had on these data, several 2 X 2 X 2 ANOVAs were conducted. A 2 (order: load 1st vs. load 2nd) X 2 (malingering status: control vs. malingering) X 2 (load: load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the five-second and the ten-second cognition time data. This revealed that the main effect for order in both the five-second ten-second delay trials was nonsignificant, $F(1, 36) = .018$, $p < ..90$; $F(1, 36) = .005$, $p < .95$, respectively. The interaction of order, malingering status, and cognitive load was also nonsignificant for both the five and ten-second delay trials, $F(1, 36) = 1.62, p < .22$; $F(1, 36) = .78, p < .39$, respectively. The effect sizes for order in the five and ten-second trials were .13 and .15, respectively. Effect sizes were computed using the following formula: average cognition time score for order one (over all other factors) - the average cognition time score for order two (over all other factors) / the SD of scores for order one.

The data were also analyzed with regard to possible order effects on the amount of errors participants made on the CFCT. A 2 (order: load 1^{st} vs. load 2^{nd}) X 2 (malingering status: control vs. malingering) X 2 (load: load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the number of errors participants made during the CFCT five-second recall trials. This revealed that the main effect for order in both the five-second a ten-second delay trials was nonsignificant, $F(1, 36) = .69, p < .42$; $F(1, 36) = .36, p < .56$, respectively. The interaction of order, malingering status, and cognitive load was also nonsignificant for both the five and ten-second delay trials, $F(1, 36) = 2.91, p < .10$; $F(1, 36) = .03, p < .86$, respectively. The effect sizes for order in the five-second and ten-second trials were computed using the same formula as outlined above for the cognition time data, but with "number of recognition errors" substituted for "cognition time." These effect sizes for the five and ten-second delay trials were .22 and .14, respectively. The lack of evidence for an order effect led to the decision to collapse the participant groups separated by load order. This was done in an effort to increase the power for the other analyses of the CFCT data.

On the Trailmaking tests, there were some indications of order effects. These will be discussed in more detail below.

The effects of load within subjects

Hypothesis 1

It was predicted that participants would perform better under the no-load condition than under the load condition.

Hypothesis 1a

A 2 (malingering status; control vs. malingering) X 2 (order; load 1^{st} vs. load 2^{nd}) X 2 (load; load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the Trails A total time scores. The hypothesis that the cognitive load manipulation would result in longer total time scores was not supported by these data, $F(1, 36) = .84$, $p < .37$. However, the data from a similar ANOVA on the Trails B total time scores supported the hypothesis that the participants' Trails B scores, as a group, were affected by the load manipulation, $F(1, 36) = 9.78$, $p < .01$. The cognitive load manipulation resulted in an increase in total Trails B time scores (see Table 9).

Hypothesis 1b

It was hypothesized that the cognitive load would impose additional demands on participants when completing the Computerized Forced Choice Test (CFCT). As a result, participants under load were expected to require more time to endorse one of the two recognition choices. A 2 (malingering status; control vs. malingering) X 2 (load; load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the five-second delay cognition-time data (see Tables 4 & 5). The same analysis was conducted on the ten-second delay cognition-time data (see Tables 4 & 6). The data did not appear to support the hypothesis that participants under cognitive load would require more time to endorse one of the two recognition choices. These analyses revealed a non-significant main effect for load in the five-second delay trials, $F(1, 38) = 1.63$, $p < .22$. The ten-second cognition time data analyses were also non-significant, $F(1, 38) = 1.76$, $p < .20$ (see Table 4).

The interaction effects of load

Hypothesis 2

It was hypothesized that there would be an interaction between load and malingering status, such that participants' scores would vary depending on the combinations of these conditions. Please note that when reporting the results of these comparisons, each dataset and its relationship to all of the other datasets are discussed. Thus, each of these paired t-tests is discussed twice.

Controls/No Load

Cognition time

It was predicted that participants in the control group would produce the best performance on the Computerized forced Choice Test (CFCT) tasks. In general, the data supported the hypothesis that they would have the shortest cognition times (see Table 5). Paired t-tests showed that they had significantly shorter cognition times on the five second trials of the CFCT than on the same tasks while experiencing a cognitive load, $t(1, 19) = -2.04$, $p < .055$. These performances were also significantly shorter than those of participants in the malingering group who were not under a cognitive load, $t(1, 19) = -$

7.20, $p < .01$, as well as malingering participants' performances when under a cognitive load, $t(1, 19) = -5.63$, $p < .01$.

In the ten-second delay trials of the CFCT trials, there were no statistically significant differences between control subjects who were under a cognitive load as compared to control subjects who were not under a cognitive load, $t(1, 19) = -1.32$, $p < .21$ (see Table 6). However, their performances were better than malingering participants who were not under a cognitive load, $t(1, 19) = -7.80$, $p < .01$, and malingering participants who were under a cognitive load, $t(1, 19) = -4.31$, $p < .01$.

Errors

It was hypothesized that these participants would have the fewest number of errors on the CFCT. The support for this hypothesis was mixed. The total number of errors these participants committed on the 5-second delay portion of this test was not significantly fewer than the amount of errors they committed when under a cognitive load, $t(1, 19) = -.83$, $p < .42$ (see Table 2). They committed significantly fewer errors than malingering participants who were not experiencing a cognitive load, $t(1, 19) = -4.47$, $p < .01$. They also committed significantly fewer errors than malingering participants who were experiencing a cognitive load, $t(1, 19) = -5.41$, $p < .01$.

The amount of the errors these participants made when in the FCFT 10-second delay trials were not significantly different than the amount of errors they made when under a cognitive load, $t(1, 19) = .16$, $p < .88$ (see Table 3). The number of errors made under this control condition when not under a cognitive load was significantly less than the amount of 10-second delay errors that was made by malingering participants when not under a cognitive load, $t(1, 19) = -5.37$, $p < .01$, as well as the number of errors made by malingering participants when experiencing a cognitive load, $t(1, 19) = -6.62$, $p < .01$.

Controls/With Load

Cognition time

It was predicted that, for the control group, the addition of the cognitive load would produce significantly longer cognition times. Paired t-tests were used to evaluate these hypotheses, which were supported by these data. The Computerized Forced Choice Test (CFCT) cognition times in the five-second delay trials (see Table 5) exhibited by the participants in the control group who were experiencing a cognitive load were significantly longer than the performance of control participants who were not

experiencing a cognitive load, $t(1, 19) = -2.04$, $p < .055$. Unexpectedly, these cognition times were significantly different than the cognition times of participants in the malingering condition who were not experiencing a cognitive load, $t(1, 19) = -6.87$, $p < .01$. They were also significantly shorter than the cognition times of the malingering participants who were experiencing a cognitive load, $t(1, 19) = -5.24$, $p < .01$.

There were no statistically different cognition times in the ten-second delay trials (see Table 6) between the participants in the control group as compared to control participants who were not experiencing a cognitive load, $t(1, 19) = -1.32$, $p < .21$. These cognition times were significantly shorter than the cognition times of participants in the malingering condition who were not experiencing a cognitive load, $t(1, 19) = -8.46$, $p < .01$. They were also significantly shorter than the cognition times of the malingering participants who were experiencing a cognitive load, $t(1, 19) = -6.94$, $p < .01$.

Errors

It was not expected that the number of errors in the five-second delay trials (see Table 2) committed by control participants who experienced a cognitive load would be significantly different than the number of errors they committed when they were not experiencing a cognitive load. This was not the case, $t(1, 19) = -.83$, $p < .42$. However, they committed significantly fewer errors than malingerers who were not experiencing a cognitive load, $t(1, 19) = -4.23$, $p < .01$, and also committed significantly fewer errors than the malingering participants who were experiencing a cognitive load, $t(1, 19) = -5.26$, $p < .01$.

As with the number of errors committed in the five-second delay trials, there was not a statistically significant difference in the number of errors committed in the ten-second delay trials (see Table 3) between the participants in the control group as compared to control participants who were not experiencing a cognitive load, $t(1, 19) = .16$, $p < .88$. They committed significantly fewer errors than malingerers who were not experiencing a cognitive load, $t(1, 19) = -5.52$, $p < .01$, and also committed significantly fewer errors than the malingering participants who were experiencing a cognitive load, $t(1, 19) = -6.85$, $p < .01$.

Malingerers/No Load

Cognition time

It was predicted that participants instructed to malinger who did not experience a cognitive load would exhibit longer cognition times than non-malingering/no-load participants. Again, paired t-tests were used to compare these means (see Table 5). This hypothesis was supported by the data, $t(1, 19) = -7.19$, $p < .01$. They also exhibited significantly longer cognition times when compared to control participants who were experiencing a cognitive load, $t(1, 19) = -6.87$, $p < .01$. These malingering participants' cognition times were significantly shorter in the load condition than when not experiencing a cognitive load, $t(1, 19) = 2.67$, $p < .02$.

On the ten-second delay trials of the CFCT (see Table 6), malingering participants who were not experiencing a cognitive load had significantly longer cognition times than control participants who were not experiencing a cognitive load, $t(1, 19) = -7.80$, $p < .01$. They also had longer cognition times than control participants who experienced a cognitive load, $t(1, 19) = -8.46$, $p < .01$. The cognition times of malingering participants were significantly shorter when they were experiencing a cognitive load than when they were not, $t(1, 19) = 2.59$, $p < .02$.

Errors

In addition, the hypothesis that participants would commit significantly more errors on the digit recognition task as a product of their attempt to feign cognitive impairment was supported by these data. These participants made significantly more errors on the CFCT 5-second delay trials (see Table 2) than did the control participants who were not experiencing a cognitive load, $t(1, 19) = -4.47$, $p < .01$. They also made significantly more errors than did the control participants who were experiencing a cognitive load, $t(1, 19)$-4.23, $p < .01$. There were no statistically significant errors between the malingering participants when under a cognitive load as compared to when they were not under a cognitive load, $t(1, 19) = -1.62$, $p < .13$.

Malingerers who were experiencing a cognitive load made significantly more errors on the CFCT 10-second delay trials (see Table 3) than did the control participants who were not experiencing a cognitive load, $t(1, 19) = -5.37$, $p < .01$. They also made significantly more errors than did the control participants who were experiencing a cognitive load, $t(1, 19) = -5.52$, $p < .01$. There were no significant differences in the amount of errors participants made when they were under a cognitive load as compared to when they were not, $t(1, 19) = -1.86$, $p < .08$.

Malingerers/With Load

Cognition time

It was hypothesized that participants instructed to malinger a cognitive impairment who are under a cognitive load would, because of the additive demands of symptom manufacturing and cognitive load, have the longest cognition times. On the CFCT 5-second delay trials, malingering participants who were experiencing a cognitive load had significantly longer cognition times than control participants in the no-load or load treatment conditions, $t(1, 19) = -5.63$, $p < .01$; $t(1, 19) = --5.24$, $p < .01$, respectively. However, on the CFCT 5-second delay trials, malingerers had significantly shorter cognition times when they were under a cognitive load than when they were not under a cognitive load, $t(1, 19) = 2.67$, $p < .02$.

On the CFCT 10-second delay trials, malingering participants who were experiencing a cognitive load had significantly longer cognition times than control participants in the no-load or load treatment conditions, $t(1, 19) = -4.31$, $p < .01$; $t(1, 19) = -6.94$), $p < .01$, respectively. Similarly, on the CFCT 10-second delay trials, malingerers had significantly shorter cognition times when they were under a cognitive load than when they were not under a cognitive load, $t(1, 19) = 2.59$, $p < .02$.

Errors

The hypothesis that participants in this protocol would make a significantly higher number of errors made on this recognition task, when compared to participant data from any of the other protocols, was partially supported by these data. Malingering participants who experienced a cognitive load made significantly more errors on the 5-second delay portion of the CFCT than did the control participants whether they were or were not experiencing a cognitive load, $t(1, 19) = -5.41$, $p < .01$; $t(1, 19) = -5.26$, $p < .01$, respectively. However, there was not a statistically significant difference between the number of errors malingering participants made when they were experiencing a cognitive load and when they were not experiencing a cognitive load, $t(1, 19) = -1.62$, $p < .13$.

On the 10-second delay portion of the Computerized forced Choice Test (CFCT), malingering participants who experienced a cognitive load made significantly more errors than did the control participants whether they were or were not experiencing a cognitive load, $t(1, 19) = -6.62$, $p < .01$; $t(1, 19) = 6.85$, $p < .01$, respectively. There was not a statistically significant difference between the number of errors malingering participants made when they were experiencing a cognitive load and when they were not experiencing a cognitive load, $t(1, 19) = -1.86$, $p < .08$.

The effects of load on CFCT Errors

It was hypothesized that load would have a differential effect on malingerers, such that malingerers who were under a cognitive load would make a significantly higher number of errors than they would while not under a cognitive load. They were also hypothesized to make a significantly higher number of errors than would the control participants who were under a cognitive load. To investigate these predicted interactions, a 2 (malingering status: control vs. malingering) X 2 (load: load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the number of errors participants made during the Computerized Forced Choice Test (CFCT) five-second recall trials (see Table 2). This revealed that the number of errors malingerers made was likely not significantly affected by the load treatment, $F(1, 38) = 1.90$, $p < .19$. A similar ANOVA was conducted on the ten-second recall data (see Table 3) which revealed a possible trend toward significance, $F(1, 38) = 3.19$, $p < .09$.

Table 2
Number of Recognition Errors

5-Second Delay	No Load	Load
Controls	**0.30**, 0.57	**0.45**, 0.76
Malingerers	**4.26**, 3.71	**5.40**, 3.94

Note: **Mean**, SD

Table 3
Number of Recognition Errors

10-Second Delay	No Load	Load
Controls	**0.60**, 0.94	**0.55**, 1.00
Malingerers	**5.05**, 3.75	**6.55**, 3.89

Note: **Mean**, SD

Table 4
Analyses of CFCT focusing on Load

	Independent Variables	F(1, 38)	p-value
5-second cognition time	Load	1.63	.21
	Malingering Status	45.57	< .01
	Load x Malingering Status	11.09	< .01
10-second cognition time	Load	1.76	.19
	Malingering Status	55.81	< .01
	Load x Malingering Status	8.22	< .01
# of errors at 5-second delay	Load	3.13	.09
	Malingering Status	31.94	< .01
	Load x Malingering Status	1.90	.18
# of errors at 10-second delay	Load	2.79	.10
	Malingering Status	46.45	< .01
	Load x Malingering Status	3.19	.08

The effects of load on cognition time

With regard to the hypothesis that the cognition times of malingerers would be differentially affected by a cognitive load, the results appear to support this hypothesis. To investigate this predicted interaction, a 2 (malingering status; control vs. malingering) X 2 (load; load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the five-second cognition time data (see Table 5). The same was done for cognition time at a ten-second delay (see Table 6). These analyses revealed that malingering and control participants were differentially affected by the load manipulation. This was true at both the five-second delay, $F(1, 38) = 11.09$, $p < .01$, and the ten-second delays, $F(1, 38) = 8.22$, $p < .01$ (see Table 4). Both the 5-second and 10-second cognition time data for malingerers *decreased* when under a cognitive load, as compared to the identical task when not under a cognitive load (see Figures 1 & 2).

Table 5
<u>Cognition Times in Seconds</u>

5-Second Delay	No Load	Load
Controls	**0.71**, 0.35	**0.83**, 0.21
Malingerers	**1.78**, 0.60	**1.51**, 0.53

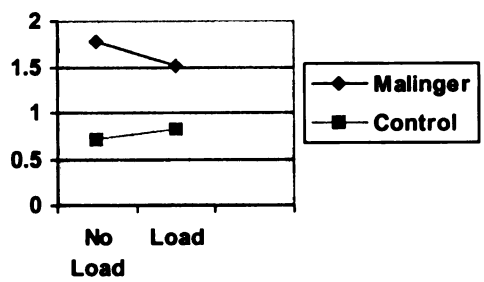
Note: **Mean**, SD

Table 6
<u>Cognition Times in Seconds</u>

10-Second Delay	No Load	Load
Controls	**0.84**, 0.51	**0.93**, 0.22
Malingerers	**2.02**, 0.61	**1.76**, 0.54

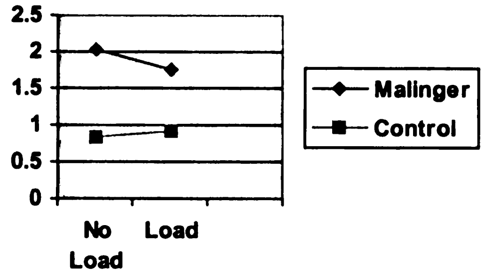
Note: **Mean**, SD

Figure 1
<u>5-second delay graph</u>



Note:cognition times in seconds

Figure 2
<u>10-second delay graph</u>



Note: cognition times in seconds

<u>The effects of load on the Trailmaking test practice effects</u>

A malingering status X load treatment interaction was hypothesized, such that an added cognitive load would make it more difficult for participants to monitor their performance and would disrupt malingering efforts. These interactions were investigated when a 2 (malingering status; control vs. malingering) X 2 (order; load 1^{st} vs. load 2^{nd}) X 2 (load; load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the Trails A change scores (see Table 9). The results of this analysis revealed that as a group, control subjects were significantly different than participants who were asked to malinger, $F(1, 36) = 5.45$, $p < .04$. The main effect for load was nonsignificant, $F(1, 36) = .84$, $p < .38$. There was a trend toward an interaction of load and order, $F(1, 36) = 3.48$, $p < .08$ (see Table 9). This pattern appeared to be that when participants who received the cognitive load manipulation first were compared to participants who received the cognitive load manipulation second, those who received the load manipulation first improved more in the load condition than the no-load condition, as opposed to participants who received the cognitive load manipulation second, who improved more in the no load condition than the load condition (see Figure 3). The predicted interaction of cognitive load and malingering condition, however, was not found, $F(1, 36) = .26$, $p < .63$ (see Table 9).

Table 7

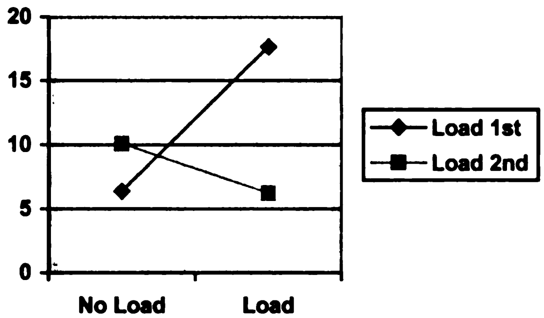
Improvement (in seconds) on Trails A, from administration #1 to #4

	No Load	Load
Controls	**5.3**, 6.7	**7.6**, 4.0
Malingerers	**10.7**, 20.6	**16.6**, 24.3

Note: **Mean improvement (in seconds)**, SD

Figure 3

Trend toward interaction of load and order in Trails A data



Note: improvement (in seconds) between Trails A administration 1 and administration 4

A similar 2 (malingering status; control vs. malingering) X 2 (order; load 1st vs. load 2nd) X 2 (load; load vs. no-load) mixed design ANOVA was conducted, with load as the within-subjects variable, on the Trails B change scores (see Table 8). A comparison of malingering and control subjects revealed non-significant main effect between-groups differences, $F(1, 36) = .05$, $p < .84$. There was a significant interaction of load and order, $F(1, 36) = 8.55$, $p < .01$ (see Table 9), suggesting that participants who received the cognitive load manipulation , as compared to participants who received the cognitive load manipulation second, improved more in the load condition than the no-load condition, and had a greater rate of improvement than the participants who received the cognitive load manipulation second (see Figure 4). Though it was predicted, there was not a significant load x malingering status interaction, $F(1, 36) = .16$, $p < .70$ (see Table 9).

Table 8

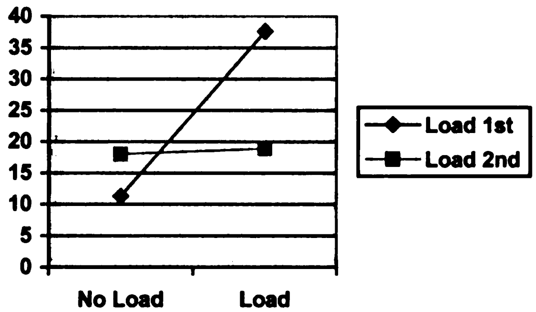
Improvement (in seconds) on Trails B, from administration #1 to #4

	No Load	Load
Controls	**14.35**, 15.83	**29.75**, 33.74
Malingerers	**14.35**, 22.29	**26.95**, 22.05

Note: **Mean improvement (in seconds)**, SD

Figure 4

Interaction of load and order in Trails B data



Note: improvement (in seconds) between Trails B administration 1 and administration 4

Table 9

Analyses of the Trailmaking tests focusing on load and order

	Independent Variables	F(1, 36)	p-value
Trails A practice effects	Load	.84	.37
	Malingering Status	5.45	< .03
	Order	1.67	.20
	Load x Malingering Status	.26	.62
	Load x Order	3.48	.07
	Load x Order x Malingering	.09	.77
Trails B practice effects	Load	9.78	< .01
	Malingering Status	.05	.83
	Order	1.01	.32
	Load x Malingering Status	.32	.69
	Load x Order	8.55	< .01
	Load x Order x Malingering	1.67	.20

Self-Consciousness effects

The presence of high levels of self-consciousness was predicted to produce an added cognitive load, over and above that induced by the testing protocol. For all participants, high self-consciousness scores were hypothesized correlate with a significantly greater degree of change when moving from the no-load to the load condition.

Because the self-consciousness measure was administered twice, one time per testing session, the scores for the two testing sessions were correlated. The total self-consciousness scores from time 1 and time 2 were significantly correlated, $r = .87$, $p < .01$. For the remainder of the analyses involving the self-consciousness measures, the time-1 and time-2 self-consciousness scores for each participant were averaged to form one self-consciousness score per participant. These scores were similar to those in the original Fenigstein, Scheier, and Buss (1975) study, where the self-consciousness questionnaire was shown to have a .80 reliability.

The change scores in these measurements were derived by subtracting the scores in the no-load condition from the scores in the load condition. On the Computerized forced Choice Test (CFCT), the natural log of the cognition times for participants in the no-load condition were subtracted from the natural log of their cognition times in the load condition to produce the change score. The change scores for the number of errors made on the CFCT was determined by subtracting the number of errors made in the no-load condition with the number of errors made in the load condition. The change score for the Trailmaking tests was determined by using the previously derived change scores (see above), and subtracting the change score in the no-load condition from the change score in the load condition.

The results of these analyses revealed that Self-consciousness was not significantly correlated with a change in test performance when moving between cognitive load treatments (see Table 10).

Table 10
Correlations of change scores and self-consciousness

Change Scores	Correlations
CFCT cognition time, 5-second delay	-.114, $p < .25$
CFCT cognition time, 10-second delay	-.047, $p < .39$
CFCT errors, 5-second delay	.011, $p < .48$
CFCT errors, 10-second delay	.047, $p < .39$
Trails A change score	.031, $p < .43$
Trails B change score	-.073, $p < .33$

To recap, the load manipulation had a varied effect on these data. Participants' times on the Trailmaking tests and the CFCT cognition times differed according to the load manipulation. This was not entirely uniform across measures, however, as several of the main effect analyses for load were not significant. Perhaps the most significant effect that the load had on these data was that for the malingering group, the addition of the cognitive load resulted in *shorter* cognition times.

The number of errors participants made on the CFCT was not significantly affected by the load manipulation. In addition, cognitive load did not appear to have a significant impact on Trailmaking test practice effects. The hypothesized link between self-consciousness scores and the effects of the cognitive load manipulation was also non-significant.

DISCUSSION

These results are confusing, in large part because of what seems to be contradictory results. The number of errors on the CFCT did not appear to be affected by the cognitive load, nor was there any apparent discrepancy in Trailmaking test practice effects beyond the order and cognitive load interaction. However, there were some significant indications that cognitive load had a definite effect on the reaction time data. It might be best, then, to discuss the implications of these two general things separately. There are two major groups of conclusions that we should discuss: what this study adds to the existing body of knowledge about tests of malingering, and what this study says about the impact of cognitive load on participants' ability to malinger.

Recall that while the hypotheses made very specific predictions about the data collected in the experiment, this occurred in the context of a more broad and theoretically-based hypothesis about the fundamental processes involved in maintaining a deceptive presentation. Malingering was hypothesized to be similar to other cognitive tasks in that it requires the dedication of cognitive resources that are in limited supply. For most individuals, malingering is an unpracticed task and is more likely to be a highly controlled task that requires a detectable amount of cognitive resources. Should these limited cognitive resources become scarce, it was predicted that effortful tasks, such as those involved in malingering, would be compromised.

In this experiment, the imposition of a cognitive load on these participants was an effort to stress their cognitive capacities. It was hypothesized that this cognitive stress would affect the malingering participants differentially because, compared to the control participants, they were already faced with the additional cognitive burdens associated with malingering efforts.

The effects of the cognitive load

The first step in testing the hypothesis was to establish that the cognitive load, by itself, had an effect on the participants' test scores. The hypotheses related to these were that participants' performance on the Trailmaking tests and the CFCT would be affected by the load manipulation. The results indicated that cognitive load significantly affected participants' performance on the Trails B tests, but not on the Trails A tests. This would indicate that the cognitive load manipulation was powerful enough to affect a change in scores, across conditions. Participants' Trails B times increased with the addition of the cognitive load. The two different Trailmaking tests, parts A and B, while they share similar names and features, are actually very different tasks. Trails A is a relatively simple psychomotor tracking test. Trails B requires the same psychomotor tracking abilities as does Trails A, but also demands a set-shifting and a more complex attentional capacity that is not required by it's simpler counterpart (Lezak, 1995). It is the additional requirements of complex attention and set-shifting that have been hypothesized to make Trails B the more sensitive of the pair to cognitive impairment. Trails B has been shown to be one of the most sensitive tests in the entire Halstead-Reitan Neuropsychological Battery, the test battery in which the Trailmaking tests are frequently used (Reitan & Wolfson, 1993). The differential sensitivity of the Trailmaking tests to cognitive impairment may explain why Trails B was affected by the cognitive load manipulation, whereas the Trails A data was not.

On the CFCT, the cognitive load treatment did not affect participants' cognition time scores. Of the possible explanations, three appear to be the most likely. The first possible explanation is that the cognitive load was not powerful enough to affect change in the CFCT cognition time scores across both malingering status conditions. A second potential explanation is that the CFCT was not sensitive enough to detect any changes that the cognitive load may have produced. A third possible explanation is that there was, in fact, a detectable change in the CFCT cognition time scores produced by the cognitive load, but that this change occurred as an interaction of cognitive load and malingering status condition, and not as a main effect.

The first potential explanation that cognitive load did not affect the participants is unlikely to be true. The cognitive load treatment had a significant effect on the Trails B total times, which indicated that the cognitive load was an effective manipulation. The second potential explanation that the cognition time or number of error measures on the CFCT were not sufficiently sensitive to detect the effects of the cognitive load treatment is unlikely to be true, given the significant interaction effect of load treatment and malingering status condition. This necessarily points to the third potential explanation that the CFCT was only sensitive to the cognitive load in the context of the interaction between malingering status condition and load treatment.

The interaction of malingering and cognitive load

The four data subsets (controls without cognitive load, controls with cognitive load, malingerers without cognitive load, and malingerers with cognitive load) were hypothesized to exhibit distinct performances on the CFCT. The control/no-load dataset was predicted to have the best performance (i.e., the shortest cognition times and the fewest errors). The malinger/load dataset was predicted to show the worst performance (i.e., the longest cognition times and the most errors). The control/load dataset and the malinger/no-load dataset were hypothesized to be similar in the number of errors committed, but with significantly different cognition times.

On the CFCT error data, the hierarchical order of performance of the four datasets did not appear as predicted. Control participants were quite different than the malingering participants. The cognitive load treatment did not appear to affect the number of errors the participants made when it was examined as a within-subjects main effect. The only significant results were found on the between-groups comparisons of malingering and control participants.

The CFCT cognition time data presented a different picture. Each of the datasets were found to be significantly different from each other. The sole exception was the nonsignificant difference between the ten-second delay cognition times for the controls/no-load and controls/load datasets. However, the specific relationship between the four datasets was not what was originally predicted. It was predicted that the control/no-load dataset would have the shortest cognition times, followed by the control/load dataset and then the malingering/no-load dataset. The malingering/load dataset was hypothesized to have the longest cognition times.

In this sample, the control/no-load dataset had the shortest cognition times, which was followed by the control/load dataset and then the malingering/load dataset. The malingering/no-load dataset had the longest cognition times. This represented an interaction of malingering status condition and within-subjects treatment that was different than that which was originally predicted.

CFCT errors in the context of malingering status condition *and* the load manipulation

It was predicted that the amount of errors participants made would be affected by the presence of a cognitive load, and the interaction of load and malingering status condition. The assignment to the malingering or control condition was clearly reflected in the participants' scores. However, the finding that malingering instructions can produce large between-groups main effects is well established (Bernard, 1990; Nies & Sweet, 1994). Of primary interest in this study was the effect that a cognitive load would have on participants' ability to malinger. Of the two trials of the CFCT, the second trial that used a 10-second delay appears to have been slightly more sensitive to this interaction. This may be due to the nature of the test: in the instructions for the CFCT, participants were instructed before the initiation of the 10-second trials that the test was going to increase in difficulty. There is no available evidence to show that the addition of five seconds onto the delay period results in a more difficult test (Lezak, 1995). It appears to serve its purpose by clueing malingerers that they should adjust their efforts accordingly and act increasingly impaired. After all, if malingerers intentionally commit *x* amount of errors in the first trials of this study, they would necessarily commit even more errors on a "more difficult" section of the test. This would suggest that the trend toward an interaction of load and malingering status condition in only the 10-second delay trials may have been due to the amplifying effect of the instructions that the participants received prior to the 10-second delay trials.

In general, however, the participants' CFCT errors did not appear to be particularly sensitive to the cognitive load manipulation. Forced choice tests such as the CFCT are useful in the detection of malingering because they are generally more sensitive to the motivation of the subject than they are to actual cognitive functioning. In fact, part of the utility of these types of malingering detection instruments is that they are relatively insensitive to cognitive effort. Individuals with minimal functional cognitive abilities are expected to perform relatively well on these tests. Yet, this relative insensitivity to cognitive effort may have allowed participants to complete the CFCT while remaining insulated from the effects of the cognitive load.

CFCT cognition time in the context of malingering status condition *and* the load manipulation

The CFCT cognition time data lend considerable support to the hypothesis that deception can be thought of as a process that requires a significant amount of cognitive resources. It was predicted that there would be a main effect for load. The reasoning for this was that participants would expend additional cognitive resources to monitor the audio distracter tape, and that this additional effort would be measured by an increase in reaction time when subjected to the additional cognitive load. It is likely that participants expended additional cognitive effort to monitor the tape. However, the cognitive resource depletion that was hypothesized did not occur in the form of increased reaction times.

The interaction between malingering status condition and cognitive load on the facilitation time data provides evidence for such a conclusion. The facilitation time data was the most sensitive measure in this study. That these data showed a significant difference between malingering and control subjects was expected. The interaction of cognitive load and malingering status condition, however, was much more meaningful. These data showed that, when the load and no-load conditions were compared, only the malingerers displayed a significant difference in facilitation time. Control subjects' facilitation times increased modestly with the addition of the cognitive load. Malingerers showed a much different pattern. Malingering participants' facilitation times *decreased* with the addition of a cognitive load. This was true for measurements of facilitation time at both the five-second and ten-second delay trials. Cognition time would be expected to increase with the addition of a cognitive load, which is what happened with the control group.

The only explanation for these results is that the addition of the cognitive load inhibited the ability of these participants to delay their response times, which was in this case an indication of performance. For these participants, the cognitive demands presented by concurrent tasks (malingering and attending to the cognitive load stimulus) were too high to accomplish both successfully. Performance on one of these tasks had to suffer, and because participants were not allowed to ignore the cognitive load, their malingering performance had to suffer.

Trailmaking test practice effects in the context of malingering status condition *and* the load manipulation

While it was predicted that malingerers would display different practice effects on the Trailmaking tests, these and the related hypotheses were not borne out by the data. The absence of a practice effect has previously been shown to be a positive sign of malingering (Reitan & Wolfson, 1998). The very different distributions caused by the experimental protocol were an unforeseen obstacle and created several difficulties in data analysis. The most notable of these was the ceiling effect that the control participants reached. Recall that it was hypothesized that, when under a cognitive load, the control participants would show a greater practice effect than the malingering participants. Unfortunately, the raw improvement in these tasks was limited by psychomotor ability. It became more of a test of how fast one can draw a line on a paper, and less of a psychomotor tracking test. As a result, the practice effect was attenuated, not because participants could not improve, but because of a performance ceiling which was predominately blocked by factors other than the facilities the test was designed to measure. This introduced a great deal of noise into the data. An attempt to manage this difficulty used Kenny's (1975) approach to managing nonequivalent control groups. This approach was helpful because it used z-scores as a basis for a common "starting point" in data analysis. While this is helpful for nonequivalent datasets, it did not address the problem that may be created by skewed distributions. This is a potential problem when investigating hypothesized differential practice effects where differentially skewed data distributions may have occurred.

The mean practice effect of the malingering group without the cognitive load and the control group without the cognitive load were exactly the same, although the distributions were different. Recall that it was originally hypothesized that malingering participants, in an attempt to appear consistently impaired, would show a lesser or nonexistent practice effect when compared to their control counterparts. Contrary to the experimental hypothesis, these participants did not produce these data trends. Previous research by Reitan and Wolfson (1998) on the absence of a practice effect as an indication of malingering utilized repeated measures that were separated by a longer period of time than this experimental protocol. In this study, the repeated measures were separated by a maximum of several minutes, as opposed to the Reitan and Wolfson study where the protocols were separated by a minimum of several weeks. Also of note in the Reitan and Wolfson study is that the absence of an improvement in performance was not only attributed to a practice effect; it was also expected to be present as a result of some spontaneous recovery.

Self-consciousness

Although it was predicted as a significant moderating variable, self-consciousness did not appear to mediate the effects of the cognitive load manipulation. Previous research had shown self-consciousness to mediate the effects of pressure on performance. In this experiment, self-consciousness did not appear to influence participants' deceptive abilities.

There are a number of possible explanations for why self-consciousness, which had previously been shown to be, under some circumstances, a significant liability to good performance, did not appear to do so in this experiment. One possibility is that in other studies where self-consciousness hindered performance, participants were directed to examine their own performance (Baumeister, 1984). This methodology results in a change in the degree of self-consciousness and treats self-consciousness as a state. The manipulation of self-consciousness produced the effect. This experiment treated self-consciousness as a trait, and included no post-test measurement of self-consciousness. Enhancement of self-consciousness may be necessary to activate it as a performance-inhibiting variable. Indeed, this appears to be the case for some of the previously cited studies. In a study by Baumeister (1984), performance decrements were seen when participants were forced to monitor their own performance. Recall that in the present experiment, as opposed to the Baumeister study, self-consciousness was measured only before experimental instructions were administered for that testing session. In addition, participants in this study never faced a direct self-consciousness manipulation or enhancement, followed by an immediate post-test.

It is possible that self-consciousness, without deliberate enhancement, could have had very little impact on performance. Recall that on the spectrum of automaticity, novel and/or challenging tasks require a substantial amount of cognitive resources and are controlled relative to automatic tasks. Well-practiced tasks do not require as many cognitive resources (e.g., attention, concentration, memory, etc.). In much the same way that tasks can be considered to require more or less cognitive effort, and thus capacity, the same might be said of state characteristics. For example, most individuals express a relatively stable amount of extroversion. Under routine conditions, individuals rarely contemplate their sociability and extroversion. Additional extroversion is not displayed without considerable effort, such as at a party. Under certain conditions where extroversion is desirable, individuals frequently expend considerable energy in an effort to appear more sociable. We might assume that there is an analogous cognitive process, where under normal conditions, individuals who are not normally highly self-conscious do not become increasingly self-conscious unless directed to do so. The participants in this study and the study by Fenigstein and Sheier (1975) received similar scores on the self-consciousness measure. As a group, the participants in this study were not highly self-conscious, nor were they found to have low self-consciousness scores. Without a direct manipulation of self-consciousness, it may not have been possible to detect performance decrements.

Another possible explanation of why self-consciousness was not found to be a moderating variable might be due to the nature of the tests administered to the participants. This experiment required participants to take a number of cognitively demanding and taxing tests. These tests usually produce some uneasiness in individuals, and this may have increased self-consciousness uniformly in all participants, regardless of malingering status condition. If an increase in self-consciousness as a state requires an added amount of cognitive resources, the amount of resource depletion may have been uniform and resulted in a range of scores that had minimal variance by malingering status condition.

This specific experimental hypothesis that self-consciousness mediates the effect of cognitive load on malingering was not supported by these data. However, this has positive implications for the continued refinement of malingering instruments. Currently, the majority of instruments used to detect malingering do not assess personality or mood characteristics. If self-consciousness was found to have a significant effect on the ability to successfully malinger, then it could create another layer of complexity and source of error. The vast majority of malingering instruments are already currently limited in discriminability and specificity.

<u>How is it that the cognition time scores were the only ones to detect this effect?</u>

The theme of differential test sensitivity may explain many of these results. The tests in this protocol that were the most sensitive in to cognitive dysfunction in clinical settings were also the most sensitive to the cognitive load manipulation. The most insensitive tests, Trails A and the number of CFCT errors, were the most resistant to the cognitive load manipulation. This would lend support to the idea that the Trails B and cognition time measurements were more sensitive to cognitive stressors than were the other measures. This may also account for their utility as indicators of cognitive dysfunction in clinical settings.

Cognition time scores are used in many different types of experiments, precisely because they are highly sensitive. The data from facilitation scores are used in stereotyping research to detect implicit attitudes that most participants would either refute or disbelieve that they possess. Their sensitivity allows them to detect effects that otherwise might remain unobservable. The cognitive load treatment had a clear effect on the CFCT data, as evinced by the load X malingering status condition interaction. It is possible that the number of CFCT errors was insensitive to this manipulation because, as discussed above, it is insensitive to cognitive effort. Though the number of errors and the cognition time measures came from the same test, their relative sensitivities could not be more different. Cognition time measurements are exquisitely sensitive to cognitive effort, and were thus able to detect what a more traditional forced choice malingering test could not detect *by virtue of its design*.

These results suggest that in at least one very important way, the cognitive processes involved in malingering are no different than any other cognitive process. As hypothesized, individuals who malinger are presented with additional cognitive demands, when compared to individuals who make a genuine effort. In addition to completing the tasks with which they are presented, they also must juggle the demands that are required by a fabricated and constantly monitored presentation. Cognitive capacity is inherently limited. When malingerers are presented with overwhelming cognitive demands, the chances of successful completion of all competing demands is small. The system becomes compromised and the indices that are most sensitive to cognitive demands may reveal these purposeful deceptions.

Limitations of this research and directions for the future

While it appears that malingering is a cognitive process that requires the allocation of resources, the amount of effort that participants expended in these dissimulation efforts was not clear. This study produced information on the relative sensitivity of the measures used, but it did not fully explore the nature of the cognitive demands required by a malingering effort. Future research might evaluate this by comparing the demands of malingering and other cognitive tasks using a common measure.

Although it might be undertaken in the future, this study was not a direct attempt to increase accuracy rates in the detection of malingering. The goals of this study were to explore the cognitive processes that produce malingering, and to determine if these processes have limitations that might be exploited. This is an important distinction, as much of the malingering and deception literature discusses how accurately these communications are detected. Instead of focusing on the detection of these communications, the present study focused on how these communications are produced. This study does not purport to improve accuracy rates for the detection of malingering, and caution should be exercised if these findings are used in such an enterprise. These findings will hopefully lead to further research on the improving accuracy rates in the detection of deception. Future research in several different areas will be needed to accomplish this goal.

Continuing research on the impact of cognitive load on deceptive communications could seek to further explain some of the findings of this study. A conclusion that might be drawn from this study is that as tasks are increasingly sensitive to actual cognitive functioning (and cognitive impairment), they may be able to detect the more subtle and telling signs of malingering. When presented with a distracter stimulus or cognitive load, these highly sensitive instruments might detect the "fallout" from any manufactured presentation.

It would also be necessary to assess the effects of a cognitive load on individuals with verifiable cognitive impairment. It is likely that, for individuals who are cognitively impaired, the addition of a cognitive load would result in poorer test performance. However, this hypothesis would need to be tested.

Another promising area of future research would be to assess the effects of a cognitive load on non-neuropsychological deceptions. It might be worthwhile to replicate one of the experiments in the verbal deception detection literature (e.g., Ekman, O'Sullivan, & Frank, 1999) to assess the impact of cognitive load on the transparency of deceptive communications.

These are just a few examples of future research that could further explain and refine the results of this study. This would be necessary to apply these findings to real-world communications or clinical practice. The processes that are involved in constructing deceptive communications have been overlooked for too long. Continuing research in this area may add much to the already large deception and malingering field.

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APPENDIX A: Condition Instructions

Malingering group instructions

Your instructions for this testing session are as follows:

In this study you will be asked to complete a set of tasks that are often used to measure a variety of changes that occur in people who have brain damage. As you take each test, we would like you to pretend that you are someone who has experienced some brain damage from a car accident.

Pretend that you were involved in a head-on collision. You hit your head against the windshield and were unconscious for 15 minutes. You were hospitalized overnight for observation and then released. Gradually, over the past few months, you have started to feel normal again. However, your lawyer has informed you that you may get a larger settlement from the court if you look like you are still suffering from brain damage. In the real world, the purpose of the tests you are about to take is to determine if the accident has produced any impairments in your abilities due to brain damage.

As you pretend to have brain damage, try to approach each test as you imagine a person would respond if he or she had been given the same instructions from his or her lawyer or someone else hoping to influence the amount of the settlement. Try to create responses on the tests that will convince the examiner that you are truly brain damaged, keeping in mind that settlement money depends upon your being diagnosed as cognitively impaired on these tests. Also, be aware that involvement in a lawsuit often raises the suspicion that people may try to exaggerate their difficulties. This means that your impairments resulting from the head injury must be believable. Major exaggerations, such as not being able to do anything, remembering absolutely nothing, or completely failing to respond, are easy to detect.

Control group instructions:

Your instructions for this testing session are as follows:

Please perform to the best of your ability.