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THE EFFECT OF OBSERVATIONAL METHOD AND TASK COMPLEXITY ON NEUROPSYCHOLOGICAL TEST PERFORMANCE

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
In partial fulfillment of the
Requirements for the degree of
Doctor in Philosophy

In

The Department of Psychology

by
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ABSTRACT

Neuropsychologists are often called upon to conduct psychological examination in the presence of an observer in litigation cases despite research clearly demonstrating altered performance on neuropsychological tests under such conditions. Past research into the social facilitation effect suggests attentional conflict (Baron, 1986; Manstead & Semin, 1980) and increased anxiety (Guerin & Innes, 1982; Guerin, 1983) when observers are present and cannot be monitored. However, this research has found conflicting results depending upon the complexity of tasks and differences in observation condition. Meta analyses point to task complexity (Bond & Titus, 1983) and evaluation apprehension (Guerin, 1986) as important moderators of observer effects. Professional organizations have proposed audiovisual recording as an alternative to direct observation. The present study examined the effects of active observation and audiovisual recording on neuropsychological test performance on both simple and complex tasks to determine if task complexity is an important moderating factor in suggested observational conditions. It was expected that performance of simple tasks would not be affected by observation while performance of complex tasks would deteriorate with observation. Results indicate that neither simple nor complex tasks were affected by observation in this study.

INTRODUCTION

History of Third-Party Observation in Legal Cases

Neuropsychologists are often called upon by either the opposing or the representing attorney to conduct psychological examination of individuals involved in litigation cases. This evaluation is done to ascertain the extent of psychological damage resulting from the incident in question. Under the rules of discovery, the plaintiff may be entitled to have their legal representative present during such neuropsychological examinations, depending on state law or case-by-case decision by the judge in states that allow the presence of an observer (Kehrer, Sanchez, Habif, Rosenbaum, & Townes, 2000).

The practice of allowing third-party observation originated in litigation involving medical doctors who evaluated individuals involved in automobile or personal injury cases (McCaffrey, Fisher, Gold, & Lynch, 1996) to assure that the tests were conducted in such a way that results were fairly obtained without prejudice. These early cases were based on medical claims and seldom involved damages sought on psychological grounds.

With the development of scientifically based psychological testing techniques and increasing acceptance and recognition of psychological disorders as defined in the Diagnostic and Statistical Manual of Mental Disorders (1952, 1968, 1975, 1987, 1994), litigation involving psychological injury has greatly increased (McCaffrey et al., 1996). With this increase, the demand for psychological evaluation conducted at the request of the opposing attorney has also increased. To ensure that the rights of the plaintiff are safeguarded, the representing attorney often asks that a third-party observer be present.

Legal Issues

At present, Illinois routinely includes third-party observation during a mental examination (Section 512.1003(d) of the Code of Civil Procedure [1982]) while other states allow third-party observation based on a case-by-case decision of the judge in which the burden of the argument against the presence of a third-party observer lies with the examiner (e.g., Teitjen vs. Department of Labor and Industries, 1975; Vinson vs. Superior Court, 1987). The use of videotape and audiotape has also been requested in lieu of an actual observer (e.g., Galaxia Barraza vs. 55 W. 47th Street Company [1989]; Mosel vs. Brookhaven Hospital [1986], as cited in McCaffrey et al., 1996).

APA Division 40 Recommendations

Based on concerns relating to third-party observation of neuropsychological evaluation, the APA Division 40 Ethics Committee recommended that neuropsychologists serving as experts in litigation cases make an effort to exclude observers from portions of neuropsychological evaluation involving standardized testing (McSweeny et al., 1998). The committee suggests, as an alternative to third-party observation, recording of the testing session with audio or audiovisual devices for review by the plaintiff's expert or the observation of testing through a one-way window. However, they caution that the use of such alternatives lacks empirical confirmation and warn of inadequate protections to test security.

Arguments Against Observation During Testing

The presence of third-party observation during *physical* evaluations has had little opposition because routine medical tests such as x-rays, EEGs, computerized imaging, etc. are not easily influenced by the presence of a third-party observer (McCaffrey et al., 1996). This is not so in the case of *psychological* evaluations. The argument against allowing third-party observation of neuropsychological examination falls to the community of professional psychology and rests on three major issues: 1) test security, 2) standardized test administration and interpretation, and 3) known effects of third-party observation.

Test Security

The American Psychological Association (1985, 1992) includes in its ethical guidelines the provision that psychologists must maintain the security of psychological tests. Psychologists, whether members of the APA or not, are bound by these ethical guidelines and are required to maintain test security to the best of their ability. Clearly, test security is an issue in allowing third-party observation by unqualified individuals not bound by such ethical criteria. Observers may, unfortunately, use information gained during testing to coach or prepare other clients to perform on neuropsychological tests in a way designed to influence the outcome of their cases.

Standardized Test Administration

Another major objection stands in regard to standardized test administration. As specified in test manuals such as the WAIS-III (Wechsler, 1997), norms are based on a standardized test administration. When a test is administered under nonstandard conditions, it becomes inappropriate to compare results of an individual to the normative sample. Administration of a test in the presence of a third party poses a serious risk to test validity and may make interpretation less meaningful. The decision to deviate from standardized test administration may be necessary in some cases (such as when a child needs the calming presence of his mother or with sensory-impaired individuals), but this decision should rest with the clinical neuropsychologist, who is ultimately responsible for integration of all information in interpreting test scores.

Another consideration in following proper test protocol is the presence of *distraction*. The *Standards for Educational and Psychological Tests (*American Psychological Association, 1985) states that "the testing environment should be one of reasonable comfort with minimal distractions...(Standard 15.2)." It is also explicitly stated in some manuals such as the Wechsler Intelligence Scale for Adults-III Administration and Scoring Manual (Wechsler, 1997, p. 29):

> "The physical setting - whether in a clinic, school, office, or private home - can affect the examinee's performance. Potential distractions or interruptions should be minimized. Conduct the testing in a room that has good ventilation and good lighting and that is free from distractions and outside interruptions. As a rule, no one other than you and the examinee should be in the room during the testing. Attorneys who represent plaintiffs sometimes ask to observe but typically withdraw this request when informed of the potential effect of the presence of a third party."

<u>Known Effects of Third-Party Observation</u>

A final major issue in conducting neuropsychological evaluation in the presence of a third party is based on the well-researched phenomenon known as social facilitation or reactivity. The study of social facilitation began with Norman Triplett in 1898 who observed that racing cyclists achieved faster times when accompanied by another pace-setting cyclist. He proposed that this improved performance was due to increased competitive instinct aroused by the other person. German educationalists Mayer (1904) and Meumann (1904) later found that schoolchildren working alone performed less well on tasks of memory, arithmetic, and hand strength than those working with another person (Strauss, 2002). It was not until 1924 that Allport first used the term "social facilitation" to define the increase in response that occurred when others were present and engaged in the same activity (Allport, 1924). From the 1960s on, numerous theories regarding the underlying mechanism of social facilitation effects abounded.

Activation Theories of the Social Facilitation Effect

Mere Presence Theory (Zajonc, 1965)

Zajonc (1965) was one of the first to research how and whether individuals modify their performance in response to the presence of others. He proposed an activation theory claiming that the *mere presence* of others would increase the general drive and activation level of an individual. An increased activation level in the presence of others, according to Zajonc, resulted in an increase in dominant behaviors. In the case of relatively simple, well-learned behaviors, the dominant behavior is a correct response. When the behavior is more complex or to-be-learned, the dominant behavior is most often an incorrect response. This results, then, in an increased performance for simple, well-learned tasks and a decreased performance in (complex) new tasks to be learned. Zajonc supported his theory using word association tasks (Matlin & Zajonc, 1968) and learning of nonsense words (Zajonc & Sales, 1966).

Evaluation Apprehension Theory (Cottrell, 1968 and Henchy & Glass, 1968)

Henchy and Glass (1968) proposed that the source of increased activation in the presence of others was *evaluation apprehension*, rather than mere presence. They argued that increased activation only happens when "actors" are afraid of being evaluated. Cottrell (1968) further developed that idea when he suggested that increased activation only occurred because actors were able to associate an audience with evaluation of their performance. This learned-drive hypothesis meant that the cause of the activation was learned. Although neither of these researchers differentiated between a negative or positive evaluation, Weiss and Miller (1971) later theorized that activation increases only when the individual perceives a negative evaluation. This idea, then, helped to form Geen's (1991) basis for a relationship between social anxiety and social facilitation effects.

Alertness Theory (Zajonc, 1980)

Zajonc modified his original theory of generalized drive and suggested that the presence of observers triggers uncertainty in the actor because the actor generally doesn't know how the other person is going to behave. This leads to an alertness, or preparedness, in the presence of others that results in an increase in general level of energy. Zajonc retained his theory that this increased level of energy resulted in improved performance of simple tasks but impaired performance of complex tasks.

Monitoring Theory (Guerin & Innes, 1982 and Guerin, 1983)

Guerin and Innes (1982) proposed that a basis for the mere presence effects found by Zajonc may be alertness or arousal due to perceived physical threat in the presence of another person (a stranger) and suggested that this arousal was an innate response. Guerin (1983) later proposed that social facilitation effects only occur when a situation triggers uncertainty. Possible mediating behaviors to the perception of threat might be whether or not the other could be watched, whether the other was familiar or not, whether the other's behavior was predictable or controllable, and whether the other was watching or not (Guerin, 1983). When an individual knows the observer, is familiar with the situation or task, and is able to monitor the observer continuously, uncertainty is not triggered. However, when the situation or task is unfamiliar and the observer cannot be monitored, the individual becomes uncertain, and his or her arousal level increases.

Guerin tested these assumptions with both simple and complex pair-association tasks. He found that when the observer was inattentive and could be monitored, there were no performance differences to working alone. There were significant differences when the individual could not monitor the observer and when the observer was watching. However, these differences only held for complex pair-association tasks, not simple tasks.

In a 1989 study, Guerin showed a significant difference in performance of a simple task depending on *where* the observer was placed. Performance deteriorated in conditions where the observer sat behind a subject but did not deteriorate when the observer was in front of the subject. According to Guerin, these results supported the monitoring model in that effects were found only when the observer could not be watched (monitored).

Attention Theories of the Social Facilitation Effect

Self-awareness Theory (Duval & Wicklund, 1972)

According to Duval and Wicklund's (1972) theory of objective self-awareness, social facilitation effects can be explained by an individual's self-awareness of the discrepancy between actual behavior and ideal behavior. When a discrepancy is noticed, the subject tries various means of correcting his behavior (providing the correct response).

Carver and Scheier (1981) later expanded on Duval and Wicklund's work, suggesting a *feedback loop theory*. The discrepancy between actual behavior and ideal behavior is monitored through feedback loops of repeated comparisons between actual and desired behavior. In complex tasks when enough time is not available, the search for an appropriate behavior leads to performance decrements.

Distraction-Conflict Theory (Baron, Moore, Sanders, 1978)

The *distraction-conflict theory* of findings from social facilitation research maintains that individuals in performance situations are simply distracted by the presence of others and cannot focus attention completely on the task at hand. Sanders and Baron (1975) argued that the drive-like effects that occur in the presence of others were due to attentional conflict. Baron et al.

(1978) later demonstrated that the presence of others is more distracting than working alone, even though the expected results of a facilitated performance on simple tasks and an impaired performance on complex tasks occurred in the presence of an observer.   Support for their theory was the finding that recall of the task was poorer for those being observed than for those working alone.

Overload Hypothesis (Baron, 1986)

Baron (1986) later modified the distraction-conflict hypothesis, suggesting that it is not the increased activation of attentional conflict that results in decrements in performance of complex tasks, but *cognitive overload* that exhausts attentional capacity. On complex tasks, attention must focus on the stimuli, and any attention directed to an observer leads to a performance decrement on difficult tasks. On simple tasks, automatic performance requires less attention, and any attention directed to an observer does not exhaust attentional capacity. Rather, the automatic performance of a simple task often improves performance in the presence of a distractor. Huguet, Galvaing, Monteil, and Dumas (1999) used the Stroop task to support this assumption.

Capacity Model (Manstead & Semin, 1980)

Very similar to Baron’s theory, Manstead and Semin's (1980) capacity model draws on Shiffrin and Schneider's (1977) two-process theory of information processing that classifies tasks into those that require cognitively controlled processing and those that require automatic processing. In automatic processing, the presence of others focuses attention on the automatic execution of the task, and performance therefore improves. On tasks that require cognitively controlled processes, more attention is required and any attention directed to an audience detracts from successful completion of the task. This diversion of attention explains the decrements in performance of complex tasks in the presence of an observer.

Further Models of the Social Facilitation Effect

Self-presentational Approach (Bond, 1982)

The *self-presentational theory* of social facilitation effects acknowledges impairment of complex tasks when others are present. However, Bond (1982) posited that impairment results from the performer's embarrassment at making mistakes in public. According to Bond, people generally strive to appear competent in the presence of others. When an individual is faced with a task to complete, he makes a judgment as to the degree of complexity of the task. If he perceives the task to be easy to accomplish, he can perform competently. If he perceives the task to be difficult, he recognizes the possibility that he may not be able to accomplish it and fears embarrassment before the audience. This fear and embarrassment act to impair learning. Bond (1982) first tested this theory using verbal learning tasks. Results of his study indicated that the learning of even simple tasks embedded within a complex task was impaired in the presence of an observer.

Bond, Atoum, and VanLeeuwen (1996) later designed an experiment in which the participants were judged by their task performance, their visual appearance, or both. Their hypothesis that the strongest impairments would result from the presence of an observer who could see the participant fail proved true. The mere presence of an observer had no effect on verbal learning, but the presence of an observer who could also witness the participant's failure at a task had a significant effect. Learning was impaired and the subject scored lower than he or she might have in a no-observation condition.

Meta Analyses of Social Facilitation Research

Bond and Titus (1983)

The Bond and Titus (1983) meta-analysis of 241 studies of social facilitation found effects across the majority of studies, but the effect size was very small. They concluded that social facilitation effects only accounted for between 0.3-3% of variance in performance. An additional finding, however, was that important moderators of the social facilitation effect are task complexity (simple or complex tasks) and type of performance. According to Bond and Titus, performance type may be differentiated according to quantitative performance (speed, latency, response rate) or qualitative performance (accuracy, errors, number of attempts). Bond and Titus found that the highest positive mean effect size (performance increment in the presence of others) was found for tasks rated as *simple* and measured *quantitatively*. The lowest negative effect size (performance decrement in presence of others) was found for *complex* tasks measured *qualitatively*. These findings are very similar to the early findings of Allport, who found that quantitative performance (speed) improved in the presence of others while quality of performance decreased in the presence of others. These findings have important implications for the interpretation of test results obtained in a typical litigation-type case where third-party observers are present.

Bernard Guerin (1986)

Gueran's meta-analysis of the social facilitation literature identified 85 studies that were clear tests between people behaving alone and people behaving in the presence of a passive observer. These 85 studies were further broken down into 3 conditions: 1) mere presence; 2) behaving in front of a passive experimenter compared to behaving alone; and 3) being passively observed. In condition 1, the “mere presence” condition, one non-observing person was present but had no interaction with the subject. In condition 2, a passive experimenter recorded responses but had no interaction with the subject. In condition 3, an attentive observer was present but did not interact with the subject. Further, these 85 studies met the following criteria: there was no obvious emphasis on evaluation, any inherent evaluation in the presence condition should also occur in the alone condition, the person present was not there to evaluate and was chosen to be perceived as least evaluative, and the task was not inherently evaluative such as tasks that most subjects have heard of in connection with a psychiatric diagnosis. While the presence of an observer is, at some level, inherently evaluative, these criteria attempted to control the level of perceived evaluation.

Only thirteen studies fit the mere presence criteria. Six of these showed mere presence effects and seven did not. The author concluded that Zajonc's model suggesting that mere presence is a sufficient condition for social facilitation effects did not hold consistently. In 5 of the 6 studies that showed significant effects, the observer was behind the subject and could not be monitored. In the rest of these, the observer was easily monitorable and no significant effects were found. These findings seem to most fit the monitoring model of Guerin and Innes (1982).

Thirty-nine studies fit the criteria to be included in the experimenter presence condition. Of these, thirty-four studies showed effects. The majority of studies that found effects had the experimenter watching the subject. According to Guerin, this could be due to evaluation apprehension, self-presentation, or self-attention effects.

In the remainder of the studies that used an observer, a majority showed significant effects. Only four studies did not find effects of an observer; and in these, the observer was not in a position to evaluate the subject's performance. Various methods were used to eliminate the ability to evaluate performance. For instance, evaluation was prevented by using a student observer who had no knowledge of the how the task should be done or having the task performed out of view of the observer. Finding no effect during observation without evaluation seems most consistent with notions of evaluation apprehension, but could also be due to self-attention changes, self-presentation, and conformity to public and private standards of behavior (Guerin, 1986).

In summary, Guerin concludes that the results of the observer studies showed the expected facilitation on simple tasks and inhibition on complex tasks, but points out that evaluation plays a major role in these results. According to Guerin, there are "definite effects on behavior from being watched and from being evaluated" (Guerin, 1986, p.63). These effects also apparently interact with the complexity of tasks being performed.

Simple and Complex Tasks

Confusion with the concepts of "simple" and "complex" originated early during social facilitation research. Norman Triplett (1898) originally observed racing cyclists who achieved 25% faster speeds when accompanied by a cycling pacesetter. However, his study of school children that turned a handle as quickly as possible in an alone condition and in a competitive condition produced conflicting results. Mayer (1904) and Meumann (1904), German educationalists, tested children in alone and coaction conditions doing both simple and complex tasks, including taking dictation, solving arithmetic tasks, testing memory, and using dynamometers. Moede (1920) also used a combination of simple and complex tasks, testing college students on tasks of concentration, memory, and power either alone or in the presence of others. In the United States, Moore (1917) reported on studies of persons who had to perform complex mental arithmetic tasks in front of observers.

In more recent times, Zajonc (1965) defined "simple" as well-learned tasks and "complex" as tasks-to-be-learned. Zajonc and Sales (1966) and Cottrell et al. (1968) tested models in terms of learning specific skills (retention of nonsense syllables). Zajonc, in later works, and also Bond & Titus (1983) and Geen (1980, 1991) replaced acquisition of skills with discrimination of tasks into simple and complex. Simple and complex tasks were defined arbitrarily, sometimes equated with already learned or to-be-learned tasks and sometimes defined as a feature of the subject - either expert or nonexpert performers (Strauss, 2002). As in earlier studies, different types of tasks were sometimes combined in one study (i.e. copying and power training, Beckmann & Strang, 1992). Guerin (1983) used only one task, a word association task, but within this task, word pairs were labeled either simple or complex, based on incongruent word pairs being complex and congruent word pairs being simple. Sanders, Baron, and Moore (1978) used a simple and complex copying task to test their distraction-conflict hypothesis. Huguet et al. (1999) used different facets of the Stroop task to differentiate between simple and complex.

Past studies in social facilitation effects have often used a combination of tasks, somewhat arbitrarily classified as simple or complex, and interpreted their findings under the umbrella of one theory supposed to cover all circumstances. Since the 1960s, research into social facilitation effects has focused on performance when alone or under observation, some using cognitive tasks and others using motor tasks. The theories developed to explain the effects have claimed to be valid for both cognitive and motor tasks, and researchers have reported results in terms of performance on "simple" and "complex" without agreeing on a consistent definition of either.

Simple and Complex Motor Tasks

At least one researcher has tackled the problem of defining simple and complex in regard to motor tasks. Strauss, in a review of research (2002), found evidence for performance decrements in motor tasks conflicting and confounded by conceptual confusion over the definition of simple-complex, expert-inexpert, and type of skill required (i.e. coordination, conditioning, or both). Strauss suggested a differentiation of types of motor tasks based on conditioning or coordination or, on a still more differentiated level, based on stamina/endurance, power or strength, speed, and coordination. Based on Bos' (1987) summary of motor abilities, Strauss classified stamina, power, and speed as conditional abilities, with speed also possessing coordination elements. Strauss suggested that conditional ability is determined by energy level, rather than being information based, as are coordination abilities. Coordination abilities require the integration of eye, head, and hand coordination and are determined by skill (practice or learning) level.

Using this differentiation of motor abilities allows the classification of motor tasks according to which ability explains performance - coordination ability, conditioning ability, or mixed coordination and conditioning ability. Tasks that place a high demand on conditioning are those requiring a high level of energy or physical effort, such as running or power lifting. These tasks can be said to be simple, in Zajonc's terms, because they do not require learning and because performance is most dependent on energy level (Beckmann & Strang, 1992; Worringham & Messick, 1983). Tasks placing high demands on coordination, on the other hand, are those requiring the integration of various body parts and generally require skill or improve with practice. This, according to Strauss, most accurately falls under the differentiation of tasks according to the degree of attention required that was defined by Manstead and Semin (1980).

Performance, in this case, depends on the automaticity of processing or whether the task calls for cognitively controlled processing (Strauss, 2002).

Strauss also stated that motor tasks could be discriminated according to their quantitative and qualitative aspects. On tasks requiring conditioning (e.g., weight, duration, speed) performance is often measured quantitatively. On tasks requiring coordination, (e.g., accuracy, error rate) performance is often measured qualitatively.

In his review of studies of performance on motor tasks in the presence of observers, Strauss found that there were many contradictory findings in tasks relying on coordination (complex tasks) showing both increments and decrements in performance in the presence of observers (i.e., Haas & Roberts, 1975; Hollifield, 1982; Husband, 1931; Martens, 1969; Pessin & Husband, 1933; Singer, 1965; Travis, 1925; Wankel, 1972). Studies using tasks requiring conditioning ability (simple tasks; i.e., running, dynamometer, strength, speed) showed a pattern of performance increments in the presence of an audience (Beckmann & Strang, 1992; Moede, 1920; Worringham & Messick, 1983). Other studies, however, showed a performance decrement when the task had to be learned, such as a goal pursuit task, but a performance increment after the task was learned (Landers, Bauer, & Feltz, 1978; Martens, 1969).

In considering the theoretical implications of the reviewed studies, Strauss suggested that the activation models of Zajonc and Cottrell may partially explain the performance of tasks requiring physical effort and measured quantitatively. He goes on to suggest that on coordination tasks, however, attention-relevant processes are involved and that it is possible that the information-processing approach may explain increments in performance on tasks requiring "automatic" processing and decrements on tasks requiring complex, coordination-type performance.

Simple and Complex Cognitive Tasks

If motor tasks can be classified as simple and complex, can cognitive tasks be likewise classified? One answer might be in the number of brain systems involved in task performance. Luria (1973) identifies three principal functional units of the brain which are hierarchical in structure: a unit for regulating tone or waking; a unit for obtaining, processing, and storing information; and a unit for programming, regulating and verifying mental activity. Units 2 and 3 have a hierarchical structure that consists of at least three cortical zones built one above each other. In Unit 2, the primary area receives impulses from or sends impulses to the periphery, the secondary area processes incoming unimodal information, and the tertiary area cross-modally integrates the participation of several secondary cortical areas. In Unit 3, this order of processing is reversed, going from tertiary to secondary to primary.

Unit 1. The structures that maintain cortical tone are in the subcortex and brain stem and both influence the tone of the cortex and receive its regulatory influence. One such structure found in the brain stem is the reticular formation, which is involved in maintaining a waking state. Excitation spreads gradually over this nerve formation changing its level little by little, rather than by reaching a threshold in the manner of an on and off circuit. The fibers of the ascending reticular formation then extend up into the thalamus, caudate body, archicortex, and into the structures of the neocortex, playing a role in activating the cortex and regulating the state of its activity. Other fibers of this formation, called the descending reticular system, run from the higher nervous structures of the neocortex and archicortex, caudate body, and thalamic nuclei and descend into lower structures in the mesencephalon, hypothalamus, and brain stem. This structure forms a single self-regulating mechanism for changing the tone of the cortex, while at the same time being regulated and modified by changes taking place in the cortex, thereby adapting itself to the environment.

Unit 2. The unit for receiving, analyzing, and storing information is the second functional unit of the brain. Located in the lateral regions of the neocortex, it includes the visual, auditory, and general sensory regions. These neurons work according to the all or nothing rule, receiving discrete impulses and relaying them to other groups of neurons. These areas receive stimuli from the peripheral receptors, which are analyzed into a large number of very small component elements, and combined into whole functional systems. Reception of visual, auditory, and tactile/proprioceptive stimuli travel to the primary areas of the occipital, temporal, and parietal cortices, respectively. These neurons are highly specific, so that no cells that respond to sound will be found in the primary occipital cortex and vice versa. In the secondary and tertiary cortical zones, increasingly complex synthesis of incoming information takes place, which allows organization and integration in the more specific areas.

Unit 3. The third functional system of the brain is responsible for programming, regulation, and verification of incoming information. Processes of conscious activity work to initiate intentions, form plans for actions, analyze performance, regulate behavior, and compare the effect of one's actions with the original intention. According to Luria, the system for this third functional unit is located in the regions of the hemispheres anterior to the central sulcus. This unit's output courses through the motor cortex, specifically layer III, which contains the pyramidal cells of Betz, fibers that run to the spinal motor nuclei and then to the muscles, forming part of the pyramidal tract. In man, extracellular grey matter made up of dendrites and glia control the motor impulses generated by the giant pyramidal cells of Betz. Again, secondary and tertiary zones involved in this functional unit are also governed by hierarchical organization and specificity, but in this system operate from less specific to more specific, moving from tertiary zones to primary zones. In terms of response planning, organization, and regulation, the most important part of this third functional unit of the brain is the prefrontal area, also known as the granular frontal cortex. In these tertiary zones of the cortex, formation of intentions and regulation and verification of complex forms of human behavior occurs. This prefrontal area makes up to one-quarter of the total mass of the brain and has two-way connections with the lower structure of the brain stem and diencephalon and virtually all other parts of the cerebral cortex. Destruction of the prefrontal cortex leads to a profound disturbance of complex behaviors, an inability to inhibit orienting reflexes to distracting stimuli, and prevents orientation of behavior to both the present and the future.

The brain may be further organized by the individual brain systems responsible for human abilities. These are the occipital region responsible for visual perception, the temporal regions responsible for auditory perception, the parietal region responsible for organization of complex simultaneous (spatial) synthesis, the sensorimotor and premotor zones responsible for the organization of movement, and the frontal lobes responsible for the regulation of mental activity.

It is critical to understand that any form of conscious activity is part of a complex functional system and takes place through the combined working of all three brain units. This complex functional system is involved in all information processing that occurs between stimulus and response. An example of this would be in considering visual perception. Visual stimuli does not just imprint itself on a passive eye; perception occurs through the use of active, searching movements of the eyes, picking out small essential clues. This information passes through the primary, secondary, and tertiary units of the brain in a series of complex networks that end in the final integration of information. A reversal of this process determines output in relation to the information originally perceived. While some types of visual tasks seem simple on the surface, from a neuropsychological point-of-view, deficits can occur at any of several physiological or functional levels. Despite the complexity of information processing within the brain, there are tasks that are relatively more “simple” than others.

At least two noted scientists comment on the separation of simple and complex cognitive activity. Luria distinguishes between elementary components of a mental activity and a more complex level of the activity as primary and secondary. An example of a simple cognitive activity, according to Luria, is visual memory, a direct memorizing closely connected with the process of perception that is the direct consolidation of impressions reaching the subject. A more complex cognitive activity is indirect verbal memory, which requires auditory perception of a word that symbolizes a concept. Such concept formation is a complex activity. Luria also points to reading, writing, speech, and calculation as complex cognitive processes. In speaking of calculation or math problems, Luria again differentiates between simple addition or subtraction and more complex math tasks that require intermediate steps to reach the required solution.

Lezak, as well, refers to the simplicity and complexity of tasks involved in neuropsychological assessment (1995). According to Lezak, highly automatic behaviors such as reciting the alphabet, counting, or days of the week are effortless tasks, recalled unthinkingly and accurately. These kinds of verbal automatisms are patterned material, learned by rote in early childhood and used frequently throughout life. Tasks to-be-learned, on the other hand, are more complex, requiring the conscious allocation of effort and attention.

So what constitutes a simple or complex cognitive activity? From a basic Lurian point-of-view, simple cognitive activity requires the least amount of brain processing at the least number of levels. Given that even the simplest cognitive activity works within a complex system, Lezak would add that those cognitive tasks that are most automatic are the most simple. Can these be integrated to provide an explanation of the different results found in performance of neuropsychological tasks? All mental activity requires the integration of various brain areas and functional units and is, therefore, complex. Having said that, a simple motor behavior, such as tapping the finger, requires very little attentional allocation. If cognitive tasks are divided, as are motor tasks, by the amount of attention required to perform them, we have a consistent definition of simple and complex that might better predict performance on both types of tasks. There is also consistency in predicting that, within complex tasks, the degree of automaticity available is an important influence on performance.

Assessment of Neuropsychological Functioning

A thorough assessment of neuropsychological functioning should include the following: evaluation of attention, concentration, and arousal level; sensory, perceptual, and motor function; visuospatial, visuoperceptual, and visuoconstructional function; language, executive, and intellectual function; academic achievement; learning, memory, reasoning and problem solving; and emotional function (Gouvier, O'Jile, & Ryan, 1998). Of these, attention and arousal level are critical because these provide the background for higher cortical functions (Gouvier, Webster, & Blanton, 1986). Assessment of attention, in particular, is critical because of the important role it plays in other neuropsychological abilities (Cullum, Kuck, & Ruff, 1987). Tasks that assess basic attentional abilities include digit repetition, number/letter cancellation tasks, and serial addition tasks (Cullum et al., 1987).

Impairment in highly developed but automatic abilities such as language may affect performance on other tests; therefore, its evaluation is also critical. Examples of tests used to assess language function are vocabulary tests, aphasia screening tests, confrontational naming tests and tests measuring expressive abilities, such as the Controlled Oral Word Association Test (Spreen & Benton, 1969, 1977). These tests allow the evaluation of both receptive and expressive verbal ability.

Sensory, perceptual, and motor functions are vital to assess, again, because deficits in these functions can be mistaken for deficits in cognitive functioning. Vision and hearing tests are necessary, but the neuropsychologist tests peripheral sensory perception through the use of such tests as the Reitan-Klove Sensory-Perceptual Examination, Speech Sounds Perceptions Test, and Seashore Rhythm Test (Reitan & Wolfson, 1993). Basic motor functioning tests include the Finger Tapping Test (Reitan & Wolfson, 1993), Grip Strength Test (Reitan & Wolfson, 1993), and Grooved Pegboard Test (Matthews & Klove, 1964).

Executive functioning may be described as regulatory activities such as planning, initiating, and execution of goal-directed behavior. Although a modicum of executive functioning is required for even the simplest of motor movements, it is critical for higher-level activities such as monitoring one's behavior, suppressing prepotent responses, thinking critically, assessing errors, and emotional reactions. Tests such as the Stroop Test (Stroop, 1935), Trail Making Test (Reitan & Wolfson, 1993), and Controlled Oral Word Association Test (Spreen & Benton, 1969, 1977) are frequently employed in revealing deficits in executive functioning.

Both intellectual and academic functioning are important parts of the neuropsychological examination, used in determining options for vocational rehabilitation. Verbal subtests as a whole have been found to be very resistant to effects of brain damage and some versions are even used as estimates of premorbid functioning (North American Adult Reading Test, Blair & Spreen, 1989). The gold standard in measuring intelligence, of course, is the Wechsler scale for assessment of intelligence. Performance subtests, in part due to their motor component, are more vulnerable to disruption in the presence of brain injury. Premorbid and current intelligence, as well as motor ability, are often measured to determine the effect and amount of brain injury, an important consideration in litigation and settlement determinations. Assessing achievement, as well as current intellectual functioning, is important in determining a claimant's potential to perform future work-related tasks. Various achievement tests can be used although the Wide Range Achievement Test (Jastak & Wilkinson, 1984) is often used as a screening measure.

Past Studies of Observation During Neuropsychological Evaluation

Despite the controversy surrounding the presence of third-party observation during neuropsychological evaluation, very little research addresses this specific problem. A review of past research on the effects of third-party observation found only four studies that could be described as specifically neuropsychological in nature. The focus of this research was not on differentiating performance on simple versus complex tasks, but did provide some insight into the differences that could be expected.

Seta, Seta, Donaldson, & Wang (1988)

Seta et al. (1988) demonstrated that an individual's ability to categorize information is reduced in the presence of an audience. While recognition of words in text is highly automatic, comprehension of complex ideas requires relating concepts across discrete units of information and depends on the availability of adequate processing resources. The encoding of semantic features can produce good memory performance and should lead to better memory for semantically related material. If, however, attention is diverted by the presence of an observer, adequate processing resources may not be available to efficiently categorize and memorize. In a task designed to place a set of instances within categories, Seta et al. (1998) demonstrated that groups under observation showed a significant deficit in ability to cluster similar items. This complex task is similar to the demands of the Controlled Oral Word Association Task (COWAT; Spreen & Benton, 1969, 1977), which requires the generation of words beginning with a certain letter.

Binder & Johnson-Greene (1995)

In a single case study, Binder and Johnson-Greene (1995) found that the performance of an epileptic woman decreased when her mother was present in the exam room. During a comprehensive neuropsychological battery, portions of the Portland Digit Recognition Test (PDRT; Binder, 1993), an effort measure, were administered in the presence of the subject's mother. She performed significantly worse when her mother was present than when she was absent, demonstrating a potentially potent effect of the presence of others on neuropsychological performance. This case study points out the possibility of significant effects of having a third-party present during testing, and also the possibility that individuals may unconsciously act more helpless in the presence of someone they are dependent upon.

Lynch (1997)

In a test of delayed recall on the Wechsler Memory Scale (WMS; Wechsler, 1945), Lynch (1997) found that the presence of an observer produced an impaired performance. Performance on motor tests (i.e. Finger Tapping Test, Grip Strength, and Grooved Pegboard Test; Reitan & Wolfson, 1993), however, was not affected by the presence of an observer. This is consistent with past social facilitation literature showing either improved performance with, or no effect of, observation on simple tasks.

Kehrer, Sanchez, Habif, Rosenbaum, and Townes (2000)

In neuropsychological tests of 30 university students being evaluated for learning disabilities, Kehrer et al. (2000) found that performance was impaired in the presence of a significant-other observer. These observers included 18 parents, 4 spouses or partners, 1 sibling, and 7 close friends. Deficits were found on tests of attention, speed of information processing, and verbal fluency, but not on tests of cognitive flexibility or motor speed. They failed to find interactions with the type of subject-observer relationship and concluded that the negative impact of third-party observation during testing may be a general effect rather than be restricted to close relationships. In addition, they suggested that issues of secondary gain, as well as the presence of an observer, may have negatively impact test performance. In this case, again, there was no effect of observation with simple tasks.

Effects of Audiotaping and Audiovisual Taping During Evaluation

The effects of third-party observation may not stop with the presence of an observing person during testing. Research shows that alternative methods of observation, including both audiotaping and audiovisual taping, also have a detrimental effect on psychological evaluation. As early as 1957, Sauer and Marcuse found differences between scores for word count, response time, and rate of speech on the TAT for those audiotaped and those not. Several studies demonstrated that mechanical recording tends to increase evaluation apprehension (Cohen, 1979; Henchy & Glass, 1968) and self-consciousness (Helmreich & Collings, 1968; Wicklund & Duval, 1971). Gelso (1973) also found that audio or videotaping during counseling sessions inhibited self-exploration in clients with self-reported educational/vocational problems. Both Cohen and Davis (1973) and Cohen (1979) demonstrated a negative impact of audiovisual taping on a series of word problems. More recently, Constantinou, Ashendorf, and McCaffrey (2002) demonstrated the effects of audiorecording on selected subtests of the Memory Assessment Scales (MAS; Williams, 1991) and a series of motor tests. They found that having the knowledge that their performance was being tape-recorded adversely affected performance on the MAS subtests but not on the motor tests. This is in line with past research showing performance decrements on cognitive tasks but none on motor tasks in the presence of observers (either a person or audiotape). This most recent study of the effect of remote mechanical observation on neuropsychological test performance extends our knowledge base, but falls short of a thorough comparison between mechanical/remote and live forms of observation.

PURPOSE OF STUDY

Neuropsychologists are sometimes called upon to conduct neuropsychological evaluations in the presence of third parties for litigation purposes. Despite ethical considerations and issues of potential invalidation of test administration, the legal system may still require the presence of observation in many cases. Because of professional concern for the validity of results, the National Academy of Neuropsychology (NAN) recommends that the presence of third parties during evaluation be avoided if at all possible. When this is not possible as mandated by the court, others have suggested that the use of mechanical means such as audiotaping or videotaping may be a useful substitute (McSweeny, et al., 1998). However, there is no empirical evidence that these methods of observation may not result in the same type of effects as seen with third-party observation.

It has been demonstrated repeatedly that third-party observation can have a negative impact on performance on some measures used during psychological evaluation, but not on others. Less research is available on the effects of mechanical recording during evaluation, but available research shows performance decrements on some tasks as well. To the best of this author's knowledge, no study has compared the effects of third-party observation to audiovisual-recording observations. Further, no study has differentiated between simple and complex tasks in interaction with the effect of different types of observation on neuropsychological testing. While social facilitation theory proposes several reasons for the facilitating and inhibiting effects found on different types of performances, the progress of research has led to the inclusion of many various tasks without clearly defining what it meant by "simple" and "complex." Review of literature encompassing the effects of third-party observation on neuropsychological evaluation does clearly indicate a dichotomy of effects depending on the complexity of tasks and method of observation.

Theoretical accounts for the reason performance is affected during observation offer several alternatives. Zajonc's (1965) seminal work pointed to the mere presence of others in increasing the activation level of the individual that results in an increase in well-learned behaviors and a decrease in behaviors to-be-learned. Henchy and Glass (1968) later proposed that evaluation apprehension caused these results rather than a general increase in activation. Weiss and Miller (1971) later tied this idea to social anxiety. Zajonc (1980) then modified his theory suggesting that the presence of an observer triggers uncertainty in the performer. Guerin & Innes (1981, 1982) proposed that the presence of an observer triggers uncertainty to produce the social facilitation effect, but only when the observer cannot be monitored (Guerin, 1983). All of these theories, though suggesting slightly different causal avenues leading to the social facilitation effect, point to the arousal of anxiety that increases well-learned responses and decreases to-be-learned responses.

Several other theories point to the importance of allocation of attention in explaining the social facilitation effect. Duval & Wicklund (1972) theorized that an individual's efforts to produce correct responses cause social facilitation effects. Carver and Scheier (1981) expanded this idea, suggesting a feedback loop theory of comparisons between actual and ideal behavior that caused a slowdown in completing complex tasks. Baron, Moore, and Sanders (1978) suggested that the presence of others simply distracts attention from the task at hand. Baron (1986) modified the distraction-conflict theory, suggesting that cognitive overload exhausts attentional capacity. And finally, Manstead and Semin (1980) pointed to the capacity model that classifies tasks into those that require cognitively controlled processing versus those that require automatic processing, which requires little attention. These attention theories suggest that simple tasks do not require as much attention as complex tasks do; therefore, complex tasks are more affected by the distraction of an observer.

Despite the seeming difference in those theories emphasizing anxiety and those emphasizing attention, it is very possible that allocation of attention, a process affected by anxiety, is at the heart of the explanation for the social facilitation effect. This would readily explain the differences in performances on tasks and offer a clear definition of "simple" and "complex" - simple being those that require little attention and are automatic, and complex being those that require more attention and are cognitively controlled. Depending upon a person's degree of automaticity in performing the task, it may or may not be perceived as "simple." Past research supports the conclusion that tasks that require the least attention will be least affected, while those that require the most attention will be the most affected by observation. Manstead and Semin's capacity model that predicts decrements in performance for cognitively controlled tasks requiring more attention and Guerin & Innes' (1982) monitoring theory which predicts more anxiety when the observer cannot be watched provide a sound explanation for the effects found in past studies. This, then, leads to an expectation for certain performances on neuropsychological tests under observation by a third party and can be a critical factor in interpreting test results.

This study examines the relationship between third-party observation, complexity of task, and performance on neuropsychological tests. Although many studies have compared observation to no-observation conditions, none have compared third-party observation to videorecording. It is important to test this observation condition to determine if mechanical observation affects performance on neuropsychological tests and may affect the validity of test findings accordingly.

Since the decision in Daubert v. Merrell Dow Pharmaceuticals, Inc., trial courts now have the role of “gatekeeper” in scrutinizing proposed expert testimony and eliminating it when the testimony falls short of the standards of reliability. This role involves determining if the proposed expert testimony is based on “scientifically valid” reasoning or methodology and determining if the reasoning and methodology can properly be applied to the facts at issue. The framework by which the reliability of expert testimony can be judged has come to be known as the “Daubert factors.” The Daubert factors established by the Court are: 1) whether the expert’s technique or theory can be or has been tested; 2) whether the technique or theory has been subject to peer review and publication; 3) the known or potential rate of error of the technique or theory when applied; 4) the existence and maintenance of standards and controls; and 5) whether the technique or theory has been generally accepted in the scientific community. The Daubert expert reliability requirement was formally incorporated into Federal Rule of Evidence 702 as of December 1, 2000. The Court specifically referenced the “scientific method,” which involves “generating hypotheses and testing them to see if they can be falsified” (Gebauer, 2004). Clearly, the effect of videotaping a neuropsychological assessment, an alternative to third-party observation suggested by the APA Division 40 Ethics Committee, requires empirical study. While this study remains analog in nature, it adds to the literature by taking the next step in the logical progression of research by including modern observational techniques suggested by experts in the field of testing.

In addition, prior results have been obscured by the nonsystematic inclusion of arbitrary variations of “simple” and “complex” tasks. This study clearly defines simple tasks as those that require the least attention or which are under automatic control and complex tasks as those requiring more attention and which are under active, cognitively controlled processing. This functional division of tasks is based on past literature substantiating the domain being tapped by each task. It further fits past researchers' theoretical frameworks suggesting why performance differs when being observed.

Research Questions and Hypotheses

Question 1. Does observation during neuropsychological evaluation negatively affect performance of simple tasks?

It is hypothesized that subjects being observed during testing with simple tasks will perform as well as those not being observed.

Question 2. Does observation during neuropsychological evaluation negatively affect performance of complex tasks?

It is hypothesized that subjects being observed during testing with complex tasks will perform significantly more poorly than those not being observed.

Question 3. Do different types of observation affect performance on neuropsychological tasks differently?

It is hypothesized that the presence of a third party will negatively affect performance on complex tasks significantly more than the presence of audiovisual recording equipment.

Question 4. Does self-report of arousal level correlate significantly with observational method?

It is hypothesized that levels of arousal will be higher for subjects in the observer and audiovisual conditions.

METHODS

Participants

A power analysis was done to determine the number of subjects needed for 0.80 power at an alpha level of 0.05. Based on reviewed literature (Constantinou et al., 2002; Huguet et al., 1999; Kehrer et al., 2000;) showing a medium effect size, 75 total subjects were needed to yield enough power for statistical significance.

Seventy-nine undergraduate psychology students at Louisiana State University at Baton Rouge volunteered to participate in this study for class extra credit. Subjects responded to notification on the LSU research website. Consecutive subjects were accepted for participation until total number was reached. Subjects were screened for eligibility to participate. Inclusion criterion was age 18 years or older. Exclusion criteria were history of moderate or severe brain trauma, illiteracy, neurological disease, clinically elevated level of anxiety, current psychological diagnosis, and current use of psychotropic medications. Of the 79 students who volunteered, 4 did not meet inclusion criteria due to having current psychological disorder diagnoses.

Materials

Demographic Questionnaire

A demographic questionnaire was administered to all participants in order to collect the following information: age, sex, race, education, socioeconomic status (SES), neurological status, history of psychological disorder, and current use of psychotropic medications (See Appendix A).

Digit Span (Wechsler, 1997)

Digit Span, a subtest of the Wechsler Intelligence Scale, was used as a measure of very short-term auditory memory and attention and is considered to be an immediate memory task.

Digit Span Forward involves sequencing, but relies mainly on rote repetition of a sequence of numbers in the order given. As such, it is said to "hold" when administered to persons with brain damage. In other words, it is not sensitive to the effects of brain injury and is among the tests least sensitive to dementia (Lezak, 1995). Digit Span Backward, on the other hand, requires repeating a series of numbers in reverse order, which involves transforming the stimulus input prior to responding. This task is more complex and requires mental flexibility, stress tolerance, and excellent concentration. Previous studies have found that anxiety reduces the number of digits recalled (Mueller, 1979; Pyke & Agnew, 1963), as does brain damage (Lezak, 1995).

Vocabulary Subtest - Wechsler Adult Intelligence Scale-III (Wechsler, 1997)

The Vocabulary subtest of the WAIS-III was administered to each participant. It is widely accepted that Verbal IQ is relatively stable in individuals with acute brain injury (Mandleberg,1975, 1976; Mandleberg & Brooks, 1975). Verbal subtests as a group tend to be less sensitive to brain injury in adults and are considered to be "hold" tests (Gouvier, O'Jile, & Ryan, 1998). Defining words, although a complex cognitive activity, involves overlearned or "crystallized" cognitive abilities that are less susceptible to the effects of trauma (Cullum et al., 1987). The Vocabulary subtest of the Wechsler scale is one of the least affected by brain injury and holds up relatively well in early dementia. It is very much affected by educational level, but little affected by age or sex. Because of these factors, tasks dependent on vocabulary are often used as estimates of premorbid intellectual functioning (i.e., NAART: Blair & Spreen, 1989).

Finger Tapping Test (Halstead, 1947; Reitan & Wolfson, 1993)

The Finger Tapping Test, also known as the Finger Oscillation Test, was administered to each participant as a measure of motor ability (See Appendix D). This simple motor task involves tapping a key on a device that enables recording of the number of taps within a time limit. This task is simple in that it depends only on the motivation of the person and his/her ability to move the index finger rapidly. Simple motor tests of this type have been found easy to accomplish by individuals, with slowing effects typically found only in those with brain damage. In past studies comparing observation conditions with no-observation conditions, such simple motor tasks have been found to be unaffected.

Controlled Oral Word Association Test (COWAT: Spreen & Benton, 1969, 1977)

The COWAT requires that the subject produce, within a one-minute time limit, as many words as possible that begin with a given letter of the alphabet. The letters "f," "a," and "s" are given in that order, and the number of words produced for each are recorded for a score. The total score is the number of words produced overall during the three minutes of controlled word association. The COWAT was administered to each participant as a measure of verbal fluency. This task is complex and considered to be "don’t hold." Although the COWAT is relatively resistant to education and age differences, it is a very sensitive indicator of brain dysfunction (Lezak, 1995). It is considered to be a test of abstract mental operation and requires mental flexibility, semantic processing, recall ability, and lexical-phonological function. The reduced capacity to generate words has been associated with every dementing process.

Trail Making Test; Trails A & B (Army Individual Test Battery, 1944)

Each participant completed Trails A and B as a measure of visual search and sequencing. Deceptively simple, the Trail Making Test requires connecting, by drawing lines with a pencil, between 25 encircled numbers (1-25) randomly arranged on a page, in proper order (Part A) and of 25 encircled numbers and letters in alternating order (Part B). Scoring is determined by the number of seconds required to complete each part. Trails A requires connecting numbers in order from 1 – 25. Trails B requires alternating between numbers and letters, in numerical and alphabetical order, and relies on more complex mental set shifting. Overall, this test looks like a simple "connect the dots," but requires speed, attention, sequencing, mental flexibility, visual search, and good motor function. It is very fast and easy to administer and is considered to be a “don’t hold” test since it is highly sensitive to brain damage (Dodrill, 1978; Leininger, Gramling, & Farrell, 1990; O'Donnell, 1983). It is, additionally, sensitive to closed head injury (desRosiers & Kavanagh, 1987), and independent living after head injury is significantly predicted by tests including Trails A and B (Acker & Davis, 1989).

Lezak calls the Trail Making Test a test of complex visual scanning with a motor component, with speed and agility making a strong contribution to success on the tasks. Both Parts A & B are very sensitive to progressive cognitive decline in dementia. Its usefulness is also found in the ability to differentiate severity of head trauma by length of time taken to complete the tasks (Leininger et al., 1990).

Stroop Color Word Test (Stroop, 1935)

The Stroop Color Word Test was used because of its ability to measure both divided and focused attention. The Stroop is particularly valuable in the assessment of attentional problems in head injury and very useful in studying the effects of observation during testing. This well-known test first requires naming the colors in which symbols are printed as quickly as possible in 45 seconds. Then the subject is required to read from a list of color words (i.e., "red", "blue", "green") printed in black as quickly as possible in the same amount of time. Finally, the subject is required to name the colors in which words (that are themselves color words) are printed in the same time limit. The first trial is relatively automatic and does not use conscious attention to name the colors. The second trial is again automatic insofar as reading is highly automatic. In the third trial, the subject must suppress the more automatic or well-trained tendency to read the word and instead name the color of the word, requiring much more time. The magnitude of the difference between trials is an index of the interference effect. The major distinction between conditions is that when automatic processing occurs, the subject doesn't have to use conscious attention and has no capacity limitation; whereas controlled processing requires conscious attention, which has limited capacity and rate.

The Stroop has been effective in distinguishing between normal controls and brain-damaged samples (Golden, 1978; Trenerry et al., 1989), with head injured people typically taking increased time on all subtasks (McLean, Temkin, Dikmen, & Wyler, 1983; Ponsford & Kinsella, 1992). It has also been found sensitive to the severity of dementia (Koss, Ober, Deles, & Friedland, 1984). Still another group of researchers (Bohnen, Twijnstra, & Jolles, 1992) found that interference scores discriminated between two groups of mild head-injured groups based on persistence of post-concussive symptoms. Patients with continuing post-concussive symptomatology were slower on the interference condition than were well-recovered patients.

State-Trait Anxiety Inventory (Spielberger, 1983)

The State-Trait Anxiety Scale, a self-report measure, is a standard index of clinical arousal (Anastasi, 1991) for which robust psychometric properties have been reliably documented. Part A, the State Anxiety Scale, was administered to each participant prior to testing to ascertain his or her pre-evaluation level of transitory anxiety. It was administered again after testing to indicate level of anxiety and allow observation of the impact of testing and observation condition on anxiety level.

Procedure

The primary investigator and three research assistants collected data at the Psychological Services Center on campus. Undergraduate students registered for PSYC 4999 were trained as research assistants (RA’s). All researchers involved were certified in the Human Participant Protections Education for Research Teams, as recommended by the National Institute of Health, prior to beginning work on the study. RA's were trained by the principal investigator, a Master's level graduate student, in clinical interviewing skills and followed a research protocol developed by the same, ensuring that all critical information was obtained.

In addition, each RA was trained and tested in the administration of the measures used, including Digit Span, Vocabulary, Finger Tapping, COWAT, Trails A & B, Stroop, and STAI, until each RA followed proper test protocol. Each RA adhered to a script based on the publishers’ verbatim instructions to the test-taker. All administrations were conducted according to manual instructions, and RA's were randomly observed for administration integrity throughout data collection by the primary researcher. This occurred a total of 4 times for each RA, and proper adherence to established administration protocol was consistently found.

Each RA worked at different times throughout the data collection time period and had equal opportunity to work with each group condition. In addition, random assignment of participants to group condition was predetermined by using the SPSS Statistical Program that randomly ordered group condition by subject number.

Participants were interviewed in a small testing room in the campus Psychological Services Center. Two-way mirrors were covered over with posters. The following procedures were followed to obtain informed consent (See Appendix B). All participants were told that the study was designed to examine the effects of observation on neuropsychological task performance and that they would be assigned to one of three observation conditions. The nature of the tasks was explained to the participants, who were advised of the approximate time required and extra credit available for participation. Participants were informed about the limits of confidentiality and assured that their names would not be associated with their research data so that their identity would be anonymous. In addition, they were informed of their right to withdraw from the study at any time without penalty. The consent form was then presented to each participant orally and in writing, and a copy of his or her consent form was given to each (See Appendix C). An initial interview was completed to determine if the participant met inclusion criteria and the demographic questionnaire was completed. Exclusion criteria were being under the age of 18, having a history of a psychological disorder, or currently taking psychotropic drugs. If the inclusion criteria were met and there was no reason for exclusion, the participant was accepted for the study. At that point, a STAI, Part A was administered and collected.

Following administration of the STAI, Part A, the participants were advised of the observation condition in which he/she would be tested; either alone with the tester, being tested in the presence of a third party, or videotaped while tested. Participants testing alone sat directly across a small table from the test administrator. For the third-party observation condition, an assistant sat approximately two feet behind and slightly to the right side (approximately 1½ feet) of the subject so that the observer was within peripheral view but could not be easily monitored by the individual being tested. This position was selected based on past research showing increased effects in this condition (Guerin & Innes, 1982). For the audiovisual recording condition, a videocamera was positioned approximately 1 foot behind and 1 foot to the side of the examiner pointing directly at the subject. The participants could easily see themselves in the camera's small visual screen, as well as see recording indicators on the camera. This was done to insure that the participant knew they were being recorded. The participants were then administered the following measures in random order: WAIS-III Vocabulary subtest, Trails A &

B; Finger Tapping Test; COWAT; WAIS-III Digit Span, and the Stroop Color-Word Test. A second STAI was administered at the end of testing to assess heightened arousal associated with observation condition. At the end of testing, each participant was again told the nature of the study and given the opportunity to discuss the study with an investigator prior to dismissal.

RESULTS

Descriptive Statistics

Descriptive statistics were calculated for age, sex, ethnicity, and socioeconomic status. Scores on all tests were converted to standardized t-scores.

Demographic Information

Seventy-nine students signed up to participate in the study. Of these seventy-nine, four did not meet inclusion criteria due to having current diagnoses of a psychological disorder. Of the remaining 75 subjects, 80% were female (n = 60) and 20% were male (n = 15). The average age of the participants was 21.99 (SD = 5.11) and the average years of formal education was 15.27 (SD = .98). Sixteen percent were African American (n=12), 77.3% were Caucasian (n = 58), 2.7% were Hispanic (n = 2), 1.3% were Asian (n = 1), and 2.7% did not indicate race (n = 2). Eighty-eight percent were single (n = 66), 10.7% were married (n = 8), and 1.3% were divorced or separated (n = 1). Thirty-six percent had yearly incomes between $0-20,000 (n = 27), 13.3% made between $20,001-40,000 (n = 10), 17.3% made between $40,001-60,000 (n = 13), 10.7% made between $60,001-80,000 (n = 8), and 22.7% made over $80,000 per year (n = 17). Number of caffeinated drinks consumed per day was assessed as a possible factor influencing anxiety level. Seventy-seven per cent consumed 2 or less caffeinated drinks per day (n = 58). Only 17 people, or the remaining 23%, consumed 3 or more caffeinated drink per day. Of these, 6.7% drank 3 caffeinated drinks (n = 5), 8% drank 4 caffeinated drinks (n = 6), 5.3% drank 5 caffeinated drinks (n = 4), and 2.7% drank 6 caffeinated drinks per day (n = 2). Scores on the pre-test State Trait Anxiety Inventory (STAI) were within the average range (M = 46.17, SD = 8.46).

Preliminary Analyses

As discussed earlier, motor tasks and tasks of speed are relatively simple and are done automatically, with little cognitive effort. Based on reviewed literature, tests of speed and motor skill are either not affected or may be facilitated by observation. Tests of speed and motor function are Stroop Color, Stroop Word, Digit Span Forward, Dominant Hand Finger Tapping, and Non-Dominant Hand Finger Tapping. In addition, the WAIS-III Vocabulary subtest requires crystallized abilities and is little affected by brain damage. These tests (Stroop Color, Stroop Word, Digit Span Forward, Dominant Hand Tapping, Non-Dominant Hand Tapping, Vocabulary) were designated as "simple" cognitive tests. A total mean score was calculated for simple tasks (See Table 1, pg. 41).

Tests of executive functioning and attention are more complex and require conscious cognitive processing. Based on past literature, tests that require more cognitive effort show a decrement in performance with observation. Tests included in this category are Stroop Interference, COWAT, Trails A, Trails B, and Digit Span Backward. These tests were designated as "complex." A total mean score was calculated for complex tasks (See Table 1, pg. 41). Finally, a total score was calculated by adding all scores and finding the grand mean.

Multivariate Analysis of Variance (MANOVA)

Three multivariate analyses of variance (MANOVA) were conducted. First, a 3 x 6 MANOVA was conducted with observation condition (control, third-party observation, and videocamera) as the independent variable and individual *simple* tests as the dependent variables. Secondly, a 3 x 5 MANOVA was conducted with observation condition (control, third-party

Table 1.
T-Scores on all Dependent Measures by Group.

Dependent Measures	**Group 1 No Observer**		**Group 2 Observer**		**Group 3 Videocamera**		**Total**	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Trails A	47.72	7.81	53.00	12.23	46.68	10.99	49.13	10.73
Trails B	51.12	9.47	56.88	11.45	50.76	11.31	52.92	11.00
Stroop Interf.	54.24	7.82	54.68	8.24	52.52	7.15	53.81	7.70
COWAT	43.93	7.96	41.92	7.76	42.86	6.48	42.91	7.38
Digit Span B	49.30	7.57	47.61	7.79	49.51	10.21	48.81	8.53
Complex	49.26	4.11	50.82	6.44	48.47	5.28	49.52	5.38
DH Tapping	46.88	6.86	46.20	9.28	43.36	7.08	45.48	7.86
NDH Tapping	48.56	11.00	46.12	12.00	43.52	7.92	46.07	10.52
Stroop Word	48.28	4.80	49.16	6.62	48.04	6.67	48.49	6.06
Stroop Color	50.48	7.50	49.56	6.74	48.20	7.42	49.41	7.19
Vocabulary	58.80	7.32	56.27	6.89	55.73	7.79	56.93	7.37
Digit Span F	54.84	7.63	55.98	9.05	52.18	9.62	54.34	8.83
Simple	51.31	4.49	50.55	4.69	48.51	4.17	50.12	4.55
Total	50.38	3.59	50.67	4.50	48.48	4.26	49.85	4.19

observation, and videocamera) as the independent variable and individual *complex* tests as the dependent variables. Analysis of the individual simple and complex tests allowed a comparison of each test by observation condition. A third 3 x 3 (MANOVA) was conducted with observation condition as the independent variable and simple, complex, and total test scores as dependent variables. This allowed the comparison of each observation group by task complexity. Finally, a one-way analysis of variance (ANOVA) was conducted with observation condition as the independent variable and post-test STAI scores as the dependent variable. Post hoc tests were completed on each. Hypotheses were tested as follows:

Hypothesis 1

Hypothesis number 1 stated, *"Subjects being observed during testing with simple tasks will perform as well as those not being observed."* Analysis of effect of group membership on performance of simple tasks showed no difference between groups. The 3 x 6 between group multivariate effect for group (control, third-party observation, and videocamera) was not significant, F (12,136) = .831, p = .619, η^2 = .068. Observation had no significant effect on performance of simple tasks, as hypothesized. Results of the test indicate that those in the control group had a mean of 51.31 (SD = 4.49), the 3rd party observation group had a mean of 50.55 (SD = 4.69) and the videocamera group had a mean of 48.51 (SD = 4.17).

Hypothesis 2

Hypothesis number 2 stated, *"Subjects being observed during testing with complex tasks will perform significantly more poorly than those not being observed*." Analysis of effect of group membership on performance of complex tasks failed to support H2. The 3x 5 between group multivariate main effect for group (control, third-party observation, and videocamera) was not significant, F (10,138) = 1.105, p = .363, η^2 = .074. Observation had no significant effect on performance of complex tasks. Test results reveal that the third-party observation group had a mean of 50.82 (SD = 6.44), followed by the control group with a mean of 49.26 (SD = 4.12), and the videocamera group with a mean of 48.47 (SD = 5.28).

Hypothesis 3

Hypothesis number 3 stated, *"The presence of a third-party observer will negatively affect performance on complex tasks significantly more than will the presence of audiovisual recording equipment*." Analysis of effect of group membership on performance of complex tasks failed to support H3. Results of a 3 x 3 MANOVA indicated no significant differences in any test scores across the three levels of group, $F(4,144) = 1.837$, $p = .125$, $\eta^2 = .049$. The results indicated that complex task scores of those being observed by a third party ($M = 50.82$, $SD = 6.44$) did not significantly differ from complex task scores of those being videotaped ($M = 48.47$, $SD = 5.28$). Simple and combined total scores also did not differ significantly. Examination of the descriptive statistics obtained with MANOVA showed that the means are opposite that expected (See Table 2, pg. 43).

Table 2.
Simple, Complex, Total Task Scores by Group

Task	**Group**	**Mean**	**Std. Deviation**	**N**
Simple	Not Observed	51.3071	4.49379	25
	3rd party observer	50.5484	4.69453	25
	Videocamera	48.5060	4.16882	25
Complex	Not Observed	49.2631	4.11721	25
	3rd party observer	50.8184	6.44219	25
	Videocamera	48.4663	5.27770	25
Total	Not Observed	50.3780	3.59290	25
	3rd party observer	50.6712	4.50661	25
	Videocamera	48.4880	4.25778	25

Hypothesis 4

Hypothesis number 4 stated, *"Higher levels of arousal will occur for subjects in the observer and audiovisual conditions."* Results of a one-way analysis of variance (ANOVA) of post-test anxiety means as measured by the STAI revealed no significant difference between the three group conditions, F (2,72) = 1.175, p = .315, η^2 = .032. The mean of the control group was 50.96 (SD = 9.84), followed by the 3rd-party observation group with a mean of 49.32 (SD = 10.84) and the videocamera group with a mean of 46.60 (SD = 9.76). The presence of an observer or a videocamera did not cause an increase in anxiety in this study. In fact, the trend was opposite what was expected (See Table 3, pg. 44).

Table 3.
Post-test Anxiety Scores by Group.

Group	**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence**	**Interval**	**Minimum**	**Maximum**
					Lower	**Upper**		
Control	25	50.96	9.84	1.97	46.90	55.02	36.00	74.00
Observe	25	49.32	10.84	2.17	44.85	53.79	30.00	68.00
Video	25	46.60	9.76	1.95	42.57	50.63	35.00	73.00
Total	75	48.96	10.18	1.18	46.62	51.30	30.00	74.00

In an effort to further understand some of the unexpected results found in this study, additional analyses were undertaken. Daily caffeine consumption was one factor considered to possibly have an effect on anxiety level. Therefore, an ANOVA was conducted with group as the independent variable and caffeine consumption as the dependent variable. There was a significant difference between groups for daily caffeine consumption, F (2,72) = 4.491, p = .015, η^2 = .111. Post hoc analysis indicated that the control group consumed significantly more caffeine drinks daily (M = 2.52, SD = 1.64) than the third-party observation group (M = 1.48, SD = 1.48) or the videocamera group (M = 1.40, SD = 1.40). To ascertain whether this higher level of caffeine consumption influenced level of anxiety, an additional ANOVA was conducted to detect differences in pre-test level of anxiety. Although the control group had higher scores (M = 48.56, SD = 8.18) than the third-party observation group (M = 44.68, SD = 9.65) or the videocamera group (M = 46.17, SD = 8.47), there was no significant difference between groups in pre-test level of anxiety as measured by the STAI, F (2,72) = 1.544, p = .220, η^2 = .041.

To investigate whether anxiety level increased due to testing and whether observation condition affected this increase differentially, a mixed 3 x 2 MANOVA was conducted with observation condition (control, 3rd party observation, or videocamera) as the independent variable and pre-test and post-test anxiety level as dependent variables. Results indicated a significant within-subjects effect of anxiety, F (1,72) = 7.949, p = .006, η^2 = .099 with no significant interaction effect of anxiety and group, F (2,72) = .979, p = .381, η^2 = .026. Tests of between-subjects effect for group was not significant, F (2,72) = 1.417, p = .249, η^2 = .038. The overall mean Anxiety level increased from pre-test (M = 46.17, SD = 8.47) to post-test (M = 48.96, SD = 10.18) with the largest increase found in the third-party observation group, followed by the control group and the videocamera group (See Table 4, pg. 45).

Table 4.
Pre- and Post-Test Anxiety Level by Group

Anxiety Level	**Control**	**3rd party Obs.**	**Videocamera**	**Total**
Pre-test STAI	48.56	44.68	45.28	46.17
Post-test STAI	50.96	49.32	46.60	48.96
Difference	2.50	4.76	1.32	1.79

To determine if individuals with a higher level of initial (pre-test) anxiety might be differentially affected by being observed during testing, groups were formed based on low, moderate, and high pre-test anxiety level as determined by pre-test STAI scores. Results of a 3 x 3 MANOVA with anxiety level (low, moderate, high) as the independent variable and simple, complex, and total test scores as dependent variables indicated no significant differences in any test scores across the three levels of anxiety, $\underline{F}$ (4,144) = .625, $\underline{p}$ = .645, η^2 = .015. Test scores of those who were initially more anxious prior to testing did not differ significantly from those who were less anxious.

DISCUSSION

The present study examined the relationship between observation condition and performance on simple and complex neuropsychological tests. Specifically, it was expected that the presence of a third-party observer or videocamera would impair performance of complex tasks, while either facilitating or having no effect on performance of simple tasks. A variety of statistical tests were employed to investigate the hypothesized relationships. The following is a discussion of the research questions and interpretation of the results related to those questions. Discussion will also include how these findings relate to previous research.

Simple Tasks

Many studies have shown that performance of simple tasks is either unaffected or facilitated by observation, and this study is consistent with the finding of no significant effect of observation. The difference between simple task scores for the control (no observer) group (M = 51.31), the third-party observer group (M = 50.55), and the videocamera group (M = 48.51) was only 2.8 points, and occurred in a direction opposite that expected (See Table 2). It must be noted that the effect size was very small ($\eta^2 = .068$), and the power was also low (.467). However, there is no evidence that increasing power would affect group differences because there is little difference in means between groups on these simple tests. It can be said with some assurance that performance of simple tasks, which was expected to show either no change or an increase in performance with observation, was unaffected by the presence of observation.

The results of past research of simple task performance in the presence of an observer have been mixed, but the majority of studies have found either no effect or facilitation of performance with observation. Only one reviewed study found that simple task performance *deteriorated* in an observation condition, which the author attributed to the inability to monitor the observer (Guerin, 1989). Very few studies reported effect size, an important consideration. Bond and Titus attempted to rectify this in their 1983 meta analysis of 241 studies and found a very small, but positive, effect size for simple tasks (0.3-3%). A low effect size was also found in the present study, and even though the results were in the wrong direction with the observed and videorecorded groups having lower scores, the effect is insignificant. This is important information for psychologists asked to present neuropsychological test results in court and adds to the empirically validated knowledge base about the effect of observation on test performance.

Complex Tasks

The finding of no change in performance of *complex tasks* in the presence of third-party observation or videocamera failed to support Hypothesis 2. Observation did not have an effect on performance of complex tasks in this study. Again, the power was low (observed power = .560), and the effect size was also very low (η^2 = .074). The difference between complex test scores of the control group (M = 49.26) and the third-party observer group (M = 50.82) was only 0.56. The difference between the control group and the videocamera group (M = 48.47) was 0.79. This is a negligible difference, and, again, falls in an unexpected direction.

This finding fails to replicate a large body of research that found significant decrements in performance of complex tasks with observation. One reason for these results may be the tests chosen in this study to represent “complex” tasks. Past studies have chosen organizational tasks (Seta, Donaldson, & Wang, 1988), rote verbal learning tasks (Kehrer, Sanchez, Habif, Rosenbaum, & Townes, 2000), list learning and recall (Constantinou, Ashendorf, & McCaffrey, 2002), hidden-word problems (Cohen & Davis, 1973; Cohen, 1979); and paired associates learning (McCaffrey, Fisher, Gold & Lynch, 1996) as “complex” tasks. All of these studies found deficits in performance with third-party observation. There is no disagreement with the designation of these tasks as complex. However, these tasks represent learning and memory functioning while the tests chosen for the present study more clearly require attention and executive functioning. This was done in an effort to more closely approximate the tests routinely used in neuropsychological testing. As stated earlier, a wide variety of tests comprise a full neuropsychological battery, and memory and new learning are only part of a complete diagnostic examination.

Another reason for the finding of no significant effect of observation on performance of complex tasks may be that observation actually *does not affect* performance of complex tasks, and we need not be concerned if an observer is required to be present during testing. This is possible in light of the Bond and Titus meta analysis (1983) of 241 studies, which found very small effect sizes, accounting for only 0.3-3% of variance in performance. The Guerin meta analysis (1986) found effects only in those studies where evaluation was a factor and where an observer was not easily monitored. These are important considerations for neuropsychologists called upon to conduct an examination in the presence of an observer. If the effect size is very small, the resulting change in test performance is not significant and will not meaningfully affect assessment results. In addition, if it is known that apprehension about the observer's activities and possible evaluation of performance are factors in affecting test results, then steps can be taken to reduce these anxieties as much as possible. Testing could be arranged so that the observer sits in a place where the examinee could easily monitor him. The examiner could reassure the client that the observer knows nothing about test procedures or what constitutes a "good" performance.

Hypothesis 3, which proposed that performance on complex tasks would be significantly worse in the third-party observation group than in the videocamera group was followed by hypothesis 4 that proposed that higher levels of arousal would occur in the third-party observation and videocamera conditions. These two hypotheses are somewhat dependent upon each other in that higher levels of arousal were assumed to affect attention and to be higher in the presence of a live observer. These hypotheses also were not supported by the results of this study.

Hypothesis 3 was based, in part, on past theory that evaluation apprehension would be highest in the presence of a live observer (Henchy & Glass, 1968). It was also based on Guerin's theory (1989) that an observer who could not easily be monitored would produce the most arousal. The placement of the third-party observer at the peripheral edge of participant vision was calculated to produce the most apprehension as the participant was aware of the observer's presence but unable to see what he/she was doing. The inability to monitor the observer's behavior should have been more anxiety-producing than merely being recorded by videocamera and, therefore, result in poorer performance on complex tasks in the third-party observer condition.

Although the differences found were not significant, the direction of the scores were, again, almost opposite what was expected. Mean complex task scores were only slightly higher for the third-party observer group ($\underline{M}$ = 50.82) followed by the control (no observer) group ($\underline{M}$ = 49.26) and the videocamera group ($\underline{M}$ = 48.47). Although the differences were very small between groups, it is interesting that those being videotaped had lower complex test scores than those being observed by a third-party.

Hypothesis 4 was based on the expectation that anxiety would be an important factor affecting test scores. Although anxiety levels increased overall from pre-test levels to post-test levels, there was no significant effect of observation. As mentioned earlier, it was expected that the presence of a live observer, with an implied evaluative role and who was sitting in a position not easily monitorable, would produce the highest level of anxiety. It was also expected that the videocamera condition would produce more anxiety than the control condition but less anxiety than the third-party observation condition. The placement of the videocamera ensured that the participants could easily see themselves being recorded and thus be more self-conscious. This was done based on self-presentation theory (Duval & Wicklund, 1972) that postulates decrements in performance due to awareness of a discrepancy between actual and desired behaviors. It is logical to assume that individuals performing in the presence of a videocamera would be more anxious than those not being recorded, much like having stage fright. The presence of the videocamera, however, did not cause an increase in anxiety, as expected. Although no significant differences were observed between groups, the means fall in a direction nearly opposite of what was expected. Anxiety was slightly higher in the control (no observer) condition ($\underline{M}$ = 50.96), followed by the third-party observation condition ($\underline{M}$ = 49.32) and the videocamera condition ($\underline{M}$ = 46.60).

It is difficult to say why anxiety was not increased by the presence of an observer or videocamera in this situation. As discussed above, it could be because of the characteristics of the observers, who were nearly the same age and status as the participants. The role of evaluation apprehension was expected to be a factor with the presence of a live observer, but this apparently did not occur as expected. Henchy & Glass (1968) proposed that evaluation apprehension was the source of increased activation in the presence of others. If this is so, then these participants felt no apprehension about being evaluated by an observer. This may be because the observer, in this situation, was often a same-age peer or because the experiment was conducted with college students who were very familiar with the functions of a psychology department subject pool. Had the observer been perceived as a professional or expert in the field, participants may have felt that they were being *evaluated* rather than merely being observed by a college peer. Some studies have supported the notion that participant perception of evaluation by a professional affects performance more than evaluation by a peer (Cohen, 1979; Cohen & Davis, 1973). This would be an important consideration for future research. An additional manipulation could compare the effects of an observer evaluating the participant versus an observer evaluating the examiner.

Limitations

There are some notable methodological limitations of the present study. First, the present sample consisted of college-age students taking part in a psychology experiment for course credit. Hence, this is hardly representative of all individuals who present for neuropsychological testing. Also, the restricted age range prevents generalizing to other age groups. Also, the power analysis was based on main effects rather than interaction, resulting in low power.

Another important consideration is the issue of secondary gain. These participants had nothing to lose or gain from their performance on these tests. Had the sample included individuals whose performance on testing determined whether or not he or she would receive a monetary payoff, anxiety likely would have been a more important factor. Future studies should address this issue and should also include an effort measure to assess the degree of effort put forth during testing.

In addition, in an attempt to use objective neuropsychological assessment instruments that are customarily used in clinical practice, the choice of complex tasks did not include tests of new learning or memory. The inclusion of tests of memory or learning may have changed the outcome.

Conclusion

For many years, researchers have attempted to determine if the presence of an observer alters performance on neuropsychological tests. They found that there are differences on some tests, but not others. Past investigation of this phenomenon revealed that observation either did not affect or facilitated performance of simple tasks, but impaired performance of complex tasks. However, there was no consistently clear definition of “simple” and “complex.” This study attempted to replicate previous findings while clarifying the factors that determine complexity. In addition, this study added to previous knowledge by including modern methods of observation – the videocamera. Inclusion of the videocamera and comparison to third-party observation and no observation conditions revealed the same pattern of performance on simple tasks, but not complex tasks.

There are two ways of looking at the results of this study. First, we must consider whether or not shortcomings in the study account for these results. The finding of no differences between those being observed and those not being observed in performance of simple tasks is consistent with past studies. The finding of no differences between those being observed and those not being observed in performance of complex tasks fails to replicate a large body of research that finds differences in that situation. Several factors could be responsible for the findings in the present study. One, the participants may not have perceived that they were truly being evaluated due to the age and status of the observers. Two, they did not have anything to lose by their performance; that is, there was no issue of secondary gain. Three, the population were very familiar with the function of a psychology student subject pool and felt no apprehension about his/her performance. And fourth, tests of memory and new learning, which have been shown to be affected by observation in past studies, were not a part of this study. Future research into this area should include subjects who have secondary gain at stake. Tests of memory and new learning should be included as measures of complex tasks. Finally, it may be helpful to choose an observer who is perceived to be professional and evaluative in nature.

The other way of looking at the results of this study is to conclude that observation by third-party or videocamera has no effect on test performance for either simple or complex tasks. This adds to the body of literature and is a meaningful result for neuropsychologists who are called on to testify as expert witnesses in light of the Daubert challenge. Scientifically sound principles have been used to test the hypothesis that observation alters performance on neuropsychological tests, and no effect was found for either simple or complex tasks. Further, data has been generated for individual tests that are commonly used in a testing situation.

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APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

SUBJECT NUMBER: _________________ **AGE: __________**

SEX: circle one **M** **F**

RACE: circle one

African American White Hispanic Asian Other: ___________________

Highest Grade Completed: _______________

Current Year in College: _______________

Yearly income, if independent student: **Parent's yearly income, if dependent student:**
Circle one.

0 - 20,000	0 - 20,000
20,001 - 40,000	20,001 - 40,000
40,001 - 60,000	40,001 - 60,000
60,001-80,000	60,001-80,000
over 80,001	over 80,001

MARITAL STATUS: circle one

Single Married Divorce/Separated Widowed

Do you have any neurologic conditions?
Y **N**

Have you ever had a head injury when you were knocked unconscious?
Y **N**

Have you every been diagnosed with a mental health disorder, like depression or anxiety?
Y **N**

Are you currently taking any medications? Please list:

____

____

APPENDIX B

SCRIPT TO INTRODUCE PARTICIPANTS TO STUDY

This research is designed to study the effect of observation on neuropsychological test performance. You will be assigned to one of three observation conditions, either being tested alone, being observed while tested, or being videotaped while tested. We will be giving you several brief neuropsychological tests that will take approximately 40 minutes to complete. Your identity will remain completely anonymous and no names will be associated with your test performance. After completing a short demographic questionnaire, we will determine if you meet the inclusion criteria to participate in the study. Any information we gain during this research will be confidential unless we discover that you intend to hurt yourself or others, such as abuse of an elderly person or child. In that case, we are ethically bound to contact the proper authorities. You have the right to withdraw from this study at any time. Do you have any questions? Here is a consent form for you to sign.

APPENDIX C

CONSENT FORM

Louisiana State University
236 Audubon Hall
Baton Rouge, LA 70803-5501
(225) 578-1494 *   (225) 578-4661

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1. Study Title: The Effect of Observational Method and Task Complexity on Neuropsychological Test Performance

2. Performance Site: Louisiana State University
Psychological Services Center
33 Johnston Hall
Baton Rouge, LA

3. Investigators:

The investigators listed below are available to answer questions about the research, M-F, 8:00 a.m. - 4:00 p.m.

Wm. Drew Gouvier, Ph.D. & Linda Lindman, M.S.
578-1494

4. Purpose of Study:

The purpose of this research project is to identify the effect of different observation methods on neuropsychological test performance.

5. Subjects:

A. Inclusion criteria:
- ≥ 18 years old
- Current LSU undergraduate students

B. Exclusion criteria:
- Individuals who have suffered a moderate/severe head injury.
- Current neurological disease
- Current psychological diagnosis
- Current use of psychotropic medication

C. Maximum number of subjects: 200

6. Study Procedures:

Each subject will be interviewed about their medical and psychological history, complete a demographic questionnaire and take several neuropsychological measures. Interview plus questionnaires should not exceed one hour and will occur at one scheduled appointment.

7. Benefits to Participants:

Each participant will receive two (2) extra credit points for full participation in this one (1)- hour study.

8. Risks to Participants:

There are no known risks for participation in this study. Participation will be entirely anonymous.

9. Alternatives to Participation in the Study:

Participation in this study is voluntary and any person may elect to withdraw at any time without penalty.

10. Confidentiality:

Participants' names will only be found on consent forms that will be stored separately from all other forms. All other forms will have subject number only. Only the LSU Institutional Review Board and Wm. Drew Gouvier, Ph.D. may inspect or copy the study records. In the event the results of this research are published, no names or identifying information will be included in the publication.

11. Financial Information:

There is no cost to the subjects. Subjects will receive two (2) extra credit points for participation in the study.

12. Signatures:

This study has been discussed with me and all my questions have been answered. I understand that additional questions regarding the study should be directed to investigators listed on page 1 or research assistants. If I have additional questions about participants' rights or other concerns, I can contact Robert C. Mathews, Chairman, LSU Institutional Review Board, (225) 578-8692. I agree to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

__________________________________ ____________________

Signature of Participant Date

____

Print your name here

__________________________________ ____________________

Signature of Witness Date

APPENDIX D

MANUAL FINGER TAPPING TEST

Subject Number____________ Date __________________________

Now we are going to do a test to see how fast you can tap. We will use this little key here (indicate the lever to the subject) and I want you to tap just as fast as you can, using the forefinger (point to the subject's index finger) of your right (or left, if the subject is left-hand dominant) hand. When you tap, be sure to use a finger movement, do not move your whole hand or your arm. When you tap this key, you will have to remember to let the key come all the way up and click each time, or else the number on the dial won't change.

(Demonstrate for the subject). *Now you move the board to a comfortable position for your hand and try it for practice.*

That was fine. Remember to tap as rapidly as you can. Do you have any questions? All right. Ready - Go!

Give 5 trials for 10 seconds on each trial for each hand.

Dominant Hand (right/left)
Trial 1 _____
Trial 2 _____
Trial 3 _____
Trial 4 _____
Trial 5 _____
Average:_____

Non-Dominant Hand (right/left)
Trial 1 _____
Trial 2 _____
Trial 3 _____
Trial 4 _____
Trial 5 _____
Average:_____

APPENDIX E

CONTROLLED ORAL WORD ASSOCIATION TEST

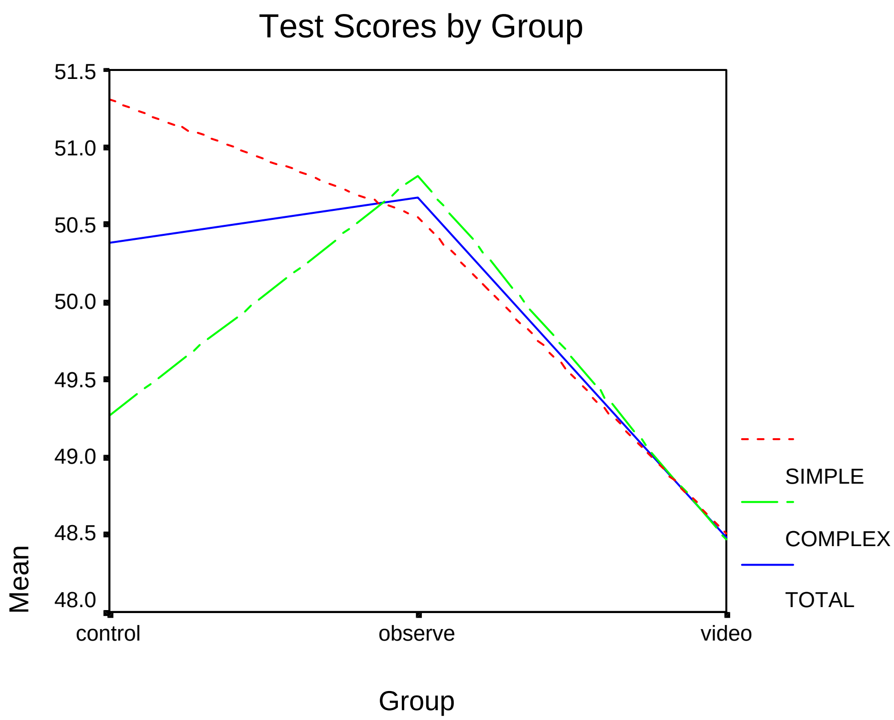
*I will say a letter of the alphabet. Then I want you to give me as many words that begin with that letter as quickly as you can. For instance, if I say "B" you might give me 'bad', 'battle', 'bed' . . . I do not want you to use words that are proper names such as 'Boston', 'Bob', or 'Brylcream'. Also, do not use the same word again with a different ending such as 'eat' and 'eating'. Any questions? Begin when I say the letter. The first letter is 'F'. Go ahead. (*Allow 60 seconds for each letter). Write each word they say under the appropriate letter.

F	A	S

Question #1. Does observation during neuropsychological evaluation negatively affect performance of simple tasks?

Question #2. Does observation during neuropsychological evaluation negatively affect performance of complex tasks?

Question #3. Do different types of observation affect performance on neuropsychological tasks differently?



*No significant difference between groups on test performance.

Figure 1. Results for Research Questions 1, 2, and 3.

Question #4. Does self-report of arousal level correlate significantly with observational method?

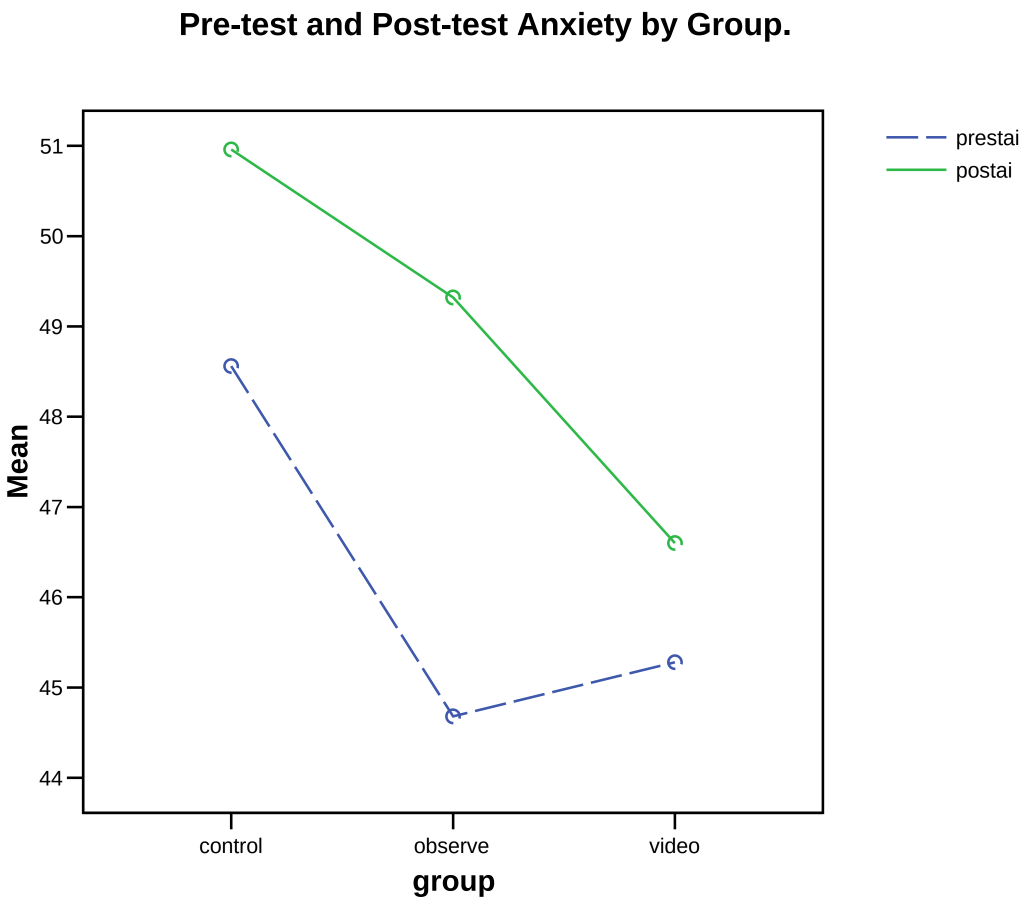


Figure 2. Results for Research Question 4.

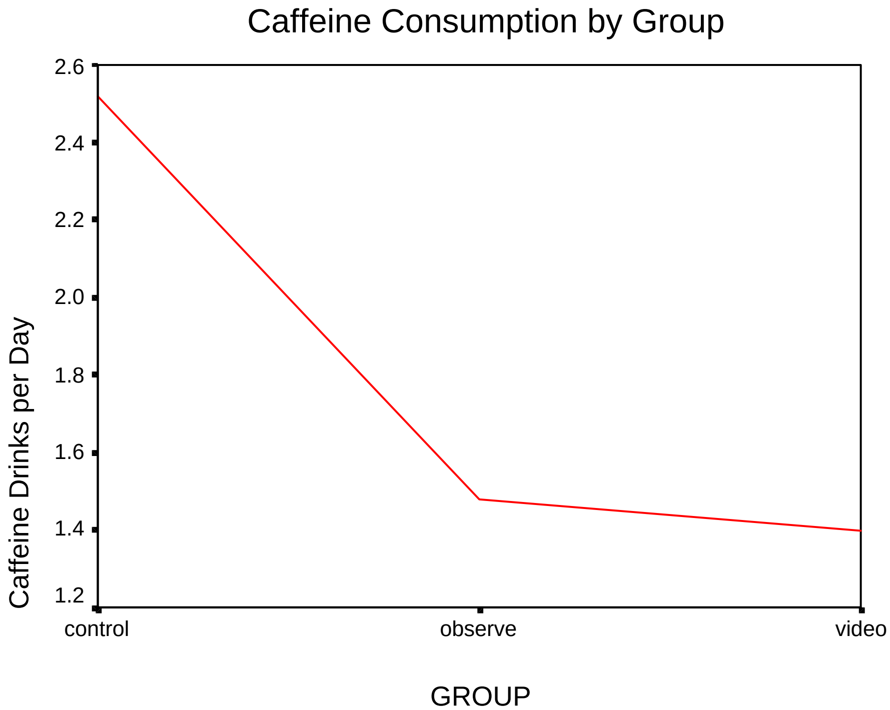


Figure 3. Caffeine Consumption by Group.

VITA

Linda S. Lindman earned her Bachelor of Arts degree with a major in English at The University of South Alabama in Mobile, Alabama, in June, 1995. She earned her Master of Science degree in applied psychology in December, 1998. Ms. Lindman is currently a Doctor of Philosophy candidate in the Department of Psychology at Louisiana State University and Agricultural and Mechanical College in Baton Rouge, Louisiana. She is in the adult clinical psychology program and is specializing in neuropsychology under the supervision of Wm. Drew Gouvier, Ph.D. Her main research interests are exposure to toxins and malingering. Ms. Lindman plans to complete her predoctoral internship at the Veterans Administration Gulf Coast Health Care System in Gulfport, Mississippi, in August, 2004.