Lying Behavior: The Effects of Dual-Task Performance and High Cognitive Load

by

Andrew Schade

A Dissertation Submitted to the Faculty of

The Chicago School of Professional Psychology

In Partial Fulfillment of the Requirements

For the Degree of Doctor of Psychology

April 16, 2014

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Unpublished Work

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2015

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Acknowledgements

I would first like to extend my gratitude toward my committee, Dr. Linda Gomberg and Dr. James Earnest. Dr. Gomberg, your support, insight, and continuous willingness to help encouraged me to succeed and complete this project. Dr. Earnest, you were part of this project from its inception to its completion, providing excellent guidance along the way.

I would like to send a special thank you to Jason Forgash, who volunteered much of his time to assist me during this experiment. You were an integral part of this design and the study would not have been what it was without your help. I could not have asked for a more genuine and selfless person to fill that role.

This project was such a major undertaking; I am very lucky and grateful for my friends and fellow colleagues who were so willing to provide their assistance and support, helping me reach my goals. Finally, I would like to thank my family for their unconditional support. Without them, I would never have achieved this goal. They have helped be become the person I am today.

Abstract

Lying is sometimes more difficult than telling the truth because it requires more cognitive resources or "cognitive load." Implementing high cognitive load has been suggested to help facilitate the observation of deceptive behavior. Research suggests that people can correctly judge when individuals are lying only about 50% of the time when observing their nonverbal behavior. Individuals tend to restrict movements in their legs and feet when they are lying, perhaps in an effort to avoid giving off any nonverbal cues that might be interpreted as possible guilt. In the current study, it was hypothesized that participants would have significantly less movement in their legs and feet when lying than when telling the truth, as measured by total duration of time. Fifty-five participants were recruited from the University of California, Irvine and The Chicago School of Professional Psychology at Irvine. Participants were asked to respond to a total of 4 questions, in which 2 of their responses were truths and 2 were lies. They simultaneously played a game on a computer with the intent to increase cognitive load and decrease available cognitive resources to create a believable lie. Analyses of data were conducted using repeated-measures ANOVA. The results revealed some significant differences in the amount of time participants moved their lower body, but for only 1 of the lie questions. The results of the study support the idea that more research is needed to determine how to detect deception via nonverbal behavior more accurately, especially when implementing high cognitive load.

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Chapter 1: Introduction

People lie every day (DePaulo & Kashy, 1998; Kashy & DePaulo, 1996). Deception or lying is an artificial form of social communication (DePaulo & Kashy, 1998; Walczyk et al., 2005), which can be characterized as intentionally misleading or deceiving someone (Kashy & DePaulo, 1996). The type of lies that people tell can be separated into four categories (Gneezy, 2005): To benefit themselves, such as falsifying their credentials during a job interview; to benefit another person, such as giving someone a compliment; to harm another person, such as spreading nasty rumors out of revenge or spite; and to benefit both sides, or at the very least, to do no harm to either, such as pretending to like an unwanted birthday gift.

There are a variety of situations in daily living where lying becomes necessary in order for people to get along with one another (Karpman, 1949). If deception did not occur in social interactions and people always told the unfiltered truth of what they were thinking, society would not be able to function efficiently. In fact, conflict and chaos would likely ensue.

Deception is just another form of communication that people use to interact with each another. Imagine if people told each other the truth every single time they spoke, such as if an overweight woman asks her husband if she looks unattractive in the outfit she is wearing. If he were to be brutally honest with her, providing an answer his wife did not prefer to hear, it could easily result in conflict and perhaps even the dissolution of the marriage. Lying is sometimes required in order to maintain pleasant interactions with others and reach desired goals.

When people lie about their age or height, these insignificant lies are unlikely to have a large impact on peoples' lives. However, when the stakes are much higher, even meaning the difference between life and death, the consequences of deceit suddenly become much greater.

Thus, it is important to be aware of the implications associated with lying and lie-detection in various settings, such as in forensic contexts and psychotherapeutic settings.

Criminals may be more motivated to lie than the average person, given the high stakes of getting caught for their purported crime. In the forensic setting, detecting deception becomes essential towards finding out the truth and detaining the right suspect. If jurors rely on false stereotypical deceptive cues exhibited by defendants, then they may decide that the defendants are lying about their innocence and ignore evidence that contradicts their guilt. Relying too much on nonverbal behavior may lead people to fixate on that which they think is deceptive behavior rather than on actual deceptive cues backed by empirical research. If innocent people are detained or convicted for a crime they did not commit, then the integrity of the justice system can be called into question.

There are times when the case is more serious, such as when there is concern that an individual might be suicidal. When questioning the person about these ideations, he or she may give off some signs indicating their suicidal intentions. These may verbal, using their words to disclose their motives, or nonverbally, such as rubbing a capped stick of lip balm along their wrist in a cutting motion during unrelated conversation (A. Client, personal communication, 2010). If a life is potentially on the line, psychologists, law enforcement, and other professionals must be aware if there is in fact intent for people to want to harm or kill either themselves or someone else. In life-threatening situations, accurate lie-detection is imperative.

When detecting lies, there are a number of things that can be considered, including the type of lie, how important or harmful the lie is, and the motivations behind why the person might be lying. Further, lies must be interpreted as intention to deceive. For instance, certain individuals might claim they exercise because their occupation involves a lot of walking or

lifting, whereas another person might label exercise as an event that only takes place in a gym or with exercise equipment. Therefore, statements are not actually deceptive if that person subjectively believes it is the truth. Another challenge is bias, as generally people are inclined to believe that they are being told the truth they are interacting with others (Bond & DePaulo, 2006; Mann, Vrij, & Bull, 2004).

People who experience psychotic disorders or other delusions will perceive their own experience as being real (Langleben, Dattilio, & Guthel, 2006). Although an event may not have actually occurred, these individuals are convinced that it did. This means that sometimes truth and lies cannot be differentiated on the cognitive level, which can significantly impact the accuracy of detecting a lie (Langleben et al., 2006).

When there is easy access to memory of real events, telling the truth is effortless. Lying can be more difficult than telling the truth, as it generally uses more cognitive resources (Gombos, 2006; Vrij, Fisher, Mann, & Leal, 2008). Deceptive individuals must create and describe of an event that never actually existed. When the mind is mentally taxed, there is an increased use of cognitive resources, also known as cognitive load. Under stressful or difficult conditions, people must divide their attention between multiple stimuli, which leaves few cognitive resources available per task. As fewer cognitive resources are available for each task, performance might then be negatively impacted for each of those tasks given that a finite supply of cognitive resources need to be distributed.

As lying generally uses more cognitive resources than telling the truth, inducing high cognitive load can help facilitate the observation of deceptive behavior (Vrij et al., 2008). For instance, people tend to have more speech disturbances when they are lying (Depaulo, Rosenthal, Rosenkrantz, & Reider Green, 1982). Additionally, individuals tend to restrict movements in

their hands, legs, and feet when they are being deceptive (Sporer & Schwandt, 2007), perhaps in effort to prevent any behavioral movements from being interpreted as possible guilt.

When it comes to judging nonverbal behavior, it turns out that everyone from college students to those in law enforcement are highly inaccurate. In fact, peoples' judgments of deceptive behavior are not much better than 50%, the same as if they flipped a coin to make their decision or completely guessed altogether (Bond & DePaulo, 2006). It appears that people do not know what to look for when judging deceit, frequently interpreting available information incorrectly.

In Anderson's (1968) study examining 555 personality traits, having characteristics of a liar was deemed the least desirable trait by college students. When difficult situations arise, people are more likely to lie in attempts to avoid uncomfortable circumstances (Karpman, 1949). Thus, telling a lie has the benefit of making the current situation more preferable or tolerable than the reality of it. It has the power to change or distort reality, in the sense that it can create the impression of something that is not actually there.

Presenting a false impression to others by acting deceptively is not always an easy task, as telling a lie can sometimes be more difficult than telling the truth (Gombos, 2006; Vrij, 2004). Barring any memory disturbances, people are able to accurately recount events that they have previously experienced when they are being honest. When people tell a lie, they must construct fabricated events that never actually occurred. In doing so, there may be a number of different elements that the deceiver may consciously attempt to control at one time in order to appear more believable (Sporer & Schwandt, 2007). For instance, they must give the impression that their story is believable, consistent with other known information, and that they are not displaying any behavioral cues that may potentially indicate deception. Additionally, they might

pay careful attention to the interviewer's reactions to ensure their lie appears convincing; they must put on an act to deceive the interviewer and also refrain from revealing the truth. These are all behaviors that increase cognitive demand (Vrij et al., 2008), which are all things that truth-tellers do not necessarily have to be concerned about. But just like the suspected liar, the lie-catcher must also be attentive to all available factors related to possible deception.

It is not easy to detect deceit, as available information must be interpreted to be associated with dishonest behavior. Furthermore, current available research on lying and deception must be critiqued and examined for applicability to real-world scenarios. A study conducted in a laboratory, a controlled environment under precise circumstances, may not generalize to real-life, everyday settings. Simply put, research findings may not apply to everyone across all situations.

There are a few available studies on the lie-detection abilities of professional lie-catchers, as well as criminals, but research is sparse. Deception studies on real criminals are even scarcer. This can be problematic because having participants act out a lie based on the researcher's scripted scenario will not have the same effect as when individuals are highly motivated to conceal truths about themselves spontaneously. But the knowledge gained from deception research can still help contribute to the improvement of lie-detection skills that so many people, including law enforcement professionals, lack (Bond & DePaulo, 2006).

Chapter 2: Literature Review

Methods of Lie-Detection

Having the ability to detect lies accurately can have an impact for a number of occupations, as well as for individuals in everyday life. Examples include a cheating spouse who vehemently denies being unfaithful to his or her partner; a suspect lying to the police about his whereabouts during the time that a horrific murder was committed; or a potential juror falsely claiming to be unbiased during the selection process of an upcoming high-profile criminal trial. At the extreme end of the spectrum, it can even mean the difference between life and death, with individuals who are homicidal or suicidal. There are an infinite number of scenarios where accurate lie detection can dramatically affect the lives of others.

There are a number of different methods that can be used to detect deception, including the polygraph, brain imaging devices, and observation of verbal and nonverbal behavior. But regardless of the method used, this information must still be interpreted to be associated with deceptive behavior. These methods may assist in making deception judgments, but they never result in perfect accuracy. In other words, each method of lie-detection has its own set of limitations. Detecting deception is not easy by any means and can have significant implications when errors are made, including destroyed relationships, inaccurate arrests or convictions, and even death. Therefore, it is paramount to find ways to improve the accuracy in order to detect its occurrence.

Polygraph

By 1921, the modern polygraph was introduced. It assessed a person's blood pressure, pulse rate, and respiration. Accuracy rates have been noted to be quite high, as correlations up to 91% were reported between lying and systolic blood pressure in the early 1900s (Thovillo,

1939). Leonarde Keeler refined the polygraph machine in 1939, adding galvanic skin response as a measure of detecting deception. Keeler asserted that a person who is lying would sweat more than a truthful individual and therefore have decreased skin resistance. Later, researchers would find skin conductance, or galvanic skin response, one of the most reliable physiological measures to detect guilty subjects (Waid, Orne, & Orne, 1981), even among those diagnosed with psychopathy (Raskin & Hare, 1978).

By the 1960s, polygraph examinations were regularly practiced by law enforcement agencies, including the FBI. The National Academic of Sciences (as cited in Grubin & Madsen, 2005) reported accuracy rates that ranged from 81% to 91%. As an instrument that was supposedly able to accurately detect when a person was lying, it became a useful tool in aiding law enforcement. Currently, the admissibility of the polygraph varies from state to state (American Polygraph Association, 2010), suggesting limitations in its application.

During the polygraph test, subjects are presented with various questions where they must answer either *Yes* or *No*. When questioning suspects, some questions are relevant to the present crime while others are control questions that are irrelevant to the crime and are used to create a baseline of the subject's normal behavioral response. The assumption is that guilty subjects would show greater physiological arousal for questions related to the crime since they actually experienced that event. Innocent subjects, on the other hand, would either show a greater physiological response to control questions unrelated to the crime or no measurable differences between the two types of questions (Grubin & Madsen, 2005; Honts & Kircher, 1994). If they were not involved in the crime in any way, such questions would not be relevant and therefore should not have any effect on their level of arousal.

A person tends to experience arousal when he or she is being untruthful. This is due to

the emotions one feels when attempting to cover up the truth (Vrij & Mann, 2001). But determining the meaning behind the type of emotion one is experiencing can be easily misinterpreted. People may experience heightened arousal in situations other than when they are lying. Kahneman (as cited in Sporer & Schwandt, 2007) has suggested this to include situations that are unusual, threatening, or complex. Elevated arousal may also occur when one is very excited or even exercised recently (Bouton, Mineka, & Barlow, 2001). Therefore, from an internal physiological standpoint, the same reaction is happening within the body in these different situations.

It is also possible that the state of heightened arousal developed from as early as birth. As an infant, a child becomes dependent on its attachment figure as a base of safety and security. The developing child is uncertain as what to expect from the outside world, only heightening his or her level of fear. As the infant becomes more independent and explores on its own, these behaviors can cause changes in both affect and physiology, which can mimic symptoms of heightened arousal (Bandelow et al., 2001; Diamond, Hick, & Otter-Henderson, 2008).

Associating arousal and deception can become problematic when it comes to lie-detection, especially with the polygraph. The polygraph does not detect lies, but is rather a device that only measures physiological arousal. It is based on the false assumption that all people are aroused only during times that they are lying (Grubin & Madsen, 2005; Honts & Kircher, 1994; Waid et al., 1981). As already mentioned, heightened arousal can occur during times other when one is being deceptive.

Surely some individuals are likely to be aroused when taking a polygraph test, but the source of that arousal is not always known. For instance, a suspect may feel excited that he is fooling the police. Other people may experience nervousness or anxiety because they are afraid

that standard control questions might somehow indicate they were being untruthful. There is no way to know with absolute certainty the cause of one's arousal.

Though the polygraph is used by some law enforcement agencies, some argue that it is not a valid or reliable device to detect deception accurately (Injodey & Joseph, 2007). Even though this machine was developed for the purpose of detecting when someone is lying or being dishonest, it does so indirectly. Whereas a blood test can be directly inspected in order to determine whether someone has a disease, the polygraph cannot detect deception in a similar fashion. That is, the polygraph can only assess the subject's arousal, which is then interpreted as being associated with deceptive behavior. Advocates of the polygraph may fail to recognize that increased arousal can occur for reasons completely unrelated to deception. In addition, there are also a number of countermeasures that people can employ to deceive the polygraph and the examiner into thinking they are telling the truth when they may, in fact, be lying the entire time.

As the polygraph cannot directly measure lying behavior and instead must rely on physiological measures to make inferences about the subject's heightened state of arousal, subjects have devised ways to deceive this purported deception-detection device. Prisoners who were aware of this methodological fallacy used this knowledge to their advantage by striking their elbows on the cell floor to vary their pulse (Thovillo, 1939), affecting their physiological response.

Physical and mental countermeasures can be used to manipulate the polygraph. For instance, subjects might press their toes to the floor or bite their tongue, altering their physiological response. Or they might do cognitive tasks, such as counting backwards by seven from a large number (Honts & Kircher, 1994), which leaves fewer cognitive resources available to react to and process their response.

In one study, about half of the subjects in each countermeasure condition were able to successfully pass the polygraph test when utilizing these strategies even after very little time practicing these techniques. Additionally, the physical countermeasures were noticed by the polygraph examiner only 12% of the time, while none of the mental countermeasures were identified (Honts & Kircher, 1994). These results indicate that not only can guilty subjects effectively pass the polygraph using physical or cognitive countermeasures, but use of these strategies is highly unlikely to be noticed by observers.

By asking questions during the polygraph where Yes or No are the only possible responses, determining guilt can be even more of a challenge. For example, if an individual is asked during the examination "Have you ever committed a crime before?" their responses are limited to only Yes or No. These answers do not allow the opportunity for further elaboration or clarification; they are absolute and prevent specific details from being revealed.

There is a huge discrepancy between shoplifting and committing a murder. *Sometimes, most of the time,* or *only once* are not acceptable answers for the polygraph. Essentially, asking questions that elicit Yes/No responses gains the least amount of information possible. These brief responses may also leave a very narrow window of opportunity to observe nonverbal cues during the subject's response to that particular question. And only through further questioning will exact details be revealed. Even then, the question must be specific enough in order to elicit the details about which the subject was lying.

An alternative line of questioning is to use open-ended questions. These questions can generate an endless amount of possible answers for subjects to choose from, providing the opportunity for them to reveal more information and give observers a greater amount of time to recognize nonverbal behavior during their elaborated response. However, this is not a technique

that is used for the polygraph as only brief Yes/No responses are required.

Another problem with the polygraph is that it has a high rate of false positives, incorrectly identifying someone as lying when he or she is actually telling the truth (Injodey & Joseph, 2007). For instance, control questions may lead to no change in arousal for honest subjects if they cannot remember the truth. Innocent subjects might also find certain questions about a crime more salient, creating an increase in physiological arousal (Waid et al., 1981). Simply put, if subjects are more attentive to particular questions, such as those related to the crime, they may experience heightened arousal regardless of whether they are guilty or innocent. Furthermore, certain words during questioning may trigger strong emotions in the subject and increase physiological arousal, mimicking a lying response when they are in fact actually telling the truth (Injodey & Joseph, 2007).

For people who are habitual liars, lying may come just as easily as speaking the truth. That is to say, they may show the same consistent level of arousal or lack thereof. A number of factors can impact a subject's verbal and physiological response, leading a guilty individual to successfully pass the polygraph. These can include a variety of things, such as nervousness, morals, intelligence, use of sedatives, and training of the polygraph examiner (Injodey & Joseph, 2007).

A strong benefit of the polygraph, however, is that it may act as a deterrent for criminals. If they are under the impression that their secrets will eventually be revealed during the test, this may encourage them be honest right from the start. But given that the polygraph is an indirect measure of assessing deception that relies on interpretation and can potentially lead to false-positives, these drawbacks imply that it is not the best way to detect deception.

Brain Imaging

Advancements in technology have led to more sophisticated ways to detect lies and hidden information. Neuroimaging techniques, such as Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI) can be used as alternatives to the polygraph (Bles & Haynes, 2008; Kozel, Padgett, & George, 2004). These devices measure the flow of blood and oxygen in the brain, signaling activity in the brain when a subject is allegedly being dishonest. Certain areas of the brain are more strongly activated when people are lying, including the ventroletral (VLPFC) and dorsolateral prefrontal cortex and the anterior cingulated cortex (Bles & Haynes, 2008; Kozel et al., 2004).

The VLPFC has been suggested to be associated with response inhibition (Kozel et al., 2004). When an individual is attempting to refrain from disclosing the truth, this inhibited response is signaled in the brain. Visual comparisons of brain activity can be made then between times when someone is telling the truth and when he or she is being suspected of being deceptive. Accuracy rates in detecting deceit using these neuroimaging techniques have been reported to be as high as 90% (Kozel et al., 2004).

In contrast to the polygraph, brain imaging allows lying behavior to be measured directly. However, even when the subject appears to be dishonest, it is important to note that the content of those lies are still unknown. These brain-imaging devices can assist in determining when someone is lying, but not exactly what he or she is lying about. Bles and Haynes (2008) reinforced the fact that these devices can recognize patterns, but not interpret them.

Although brain-imaging devices can potentially reveal when someone is lying, one concern is how ethical it is to use such techniques to extract private information from people. Information relevant to a purported crime may be exposed as a result, but obtaining consent

likely would be needed. On the upside, it may be used to confirm a person's innocence (Bles & Haynes, 2008), preventing him from being deemed guilty of a crime he did not commit.

Nonverbal and Verbal Cues

Most people do not have immediate access to a polygraph machine or brain-imaging device. When a suspect is being interrogated in a police station, for example, access to such a machine to assist in detecting deceptive behavior may not always be possible at a moment's notice. Instead, there is a much more convenient way to judge deception that is readily available at any given time: directly observing the subject's behavior when he or she is lying.

Nonverbal cues, such as body movements, can be assessed by anyone in order to detect when someone is thought to be deceitful. Since deception is generally associated with physiological arousal, people will typically display either an increase or decrease in body movements (Porter, Campbell, Stapleton, & Birt, 2002; Sporer & Schwandt as cited in Taylor & Hick, 2007). These behavioral movements may reveal more honest information, as Frank and Ekman (1997) acknowledged that liars are in control of the verbal information they decide to present to others. That is, people can easily describe a believable story using choice words; but just as people sometimes have verbal slips of the tongue, these same slips can occur in the subject's behavioral movements. The leakage of these movements may potentially reveal hidden information about the suspected liar's true thoughts and beliefs (Ekman & O'Sullivan, 2006).

When people decide whether someone is telling the truth or not, they tend to make these determinations based on that person's demeanor (Bond & DePaulo, 2008). However, many people do not necessarily know what to look for if they think someone is being dishonest with them. Suspicious individuals may rely on stereotypical cues to discern when someone is being deceptive, such as avoiding eye contact or eliciting anxious, nervous behavior (Bond & DePaulo,

2006; Hartwig, Granhag, Strömwall, & Andersson, 2004; Mann et al., 2004; Sporer & Schwandt, 2007). Surprisingly, these are the same cues that police officers are incorrectly taught to look for, as described in some police training manuals (Mann et al., 2004). Though these cues are used by professional lie-catchers, including those in law enforcement agencies, they are inaccurate and rather misleading.

Research has not supported the popular notion that eye contact, a stereotypical cue used by many to judge deceit, is at all related to deception (Sporer & Schwandt, 2007). One explanation for this is that good liars will be aware of this common stereotype and might then purposely maintain eye contact with whom they are deceptively interacting. Rather, empirical research has suggested that there are more reliable signs to look for when judging deception.

Research on facial expressions has shown a few clues to deceitful behavior. Visual differences can be observed in the face during a real smile when one is happy and a fake smile, such as when someone is placed in a disappointing or uncomfortable social situation. True smiles can be identified by the pulling-up the cheeks, slightly lowered brows, and producing crows' feet around the eyes (Ekman & O'Sullivan, 2006). To showcase this difference, one study asked participants to observe each smile they saw and determine whether it was a true smile or a fake smile. When they were shown each smile one at a time, observers were correct in 56% of their judgments. However, once they were shown two smiles of the same individual to compare and contrast, with one depicting a true smile and the other a fake smile, their accuracy was significantly higher at 74% (Frank, Ekman, & Friesen, 1993). This suggests that in order to differentiate accurately between a true and fake smile, it is important to know what each type of smile looks like on that specific individual.

A baseline of normal behavior must first be created in order to detect more accurately

when someone is departing from his or her typical response. This is supported with other research stating the importance of first being exposed to a person's baseline behavior for comparative purposes (Bond & DePaulo, 2006; Porter & Brinke, 2010; Vrij & Mann, 2004). Without doing so, a behavior is observed in isolation and cannot be placed into context of that person's normal response.

When it comes to interpreting facial expressions, caution must be exercised in making a concrete determination regarding deception. Though people can display nonverbal signals through their facial movements, facial muscles can be activated unintentionally and may be unrelated to deception. There may be a variety of reasons for why this behavior would occur, including feelings of uncertainty, experiencing multiple emotions, or trying to conceal one's current emotional state (Ekman & O'Sullivan, 2006).

As it is natural for many to look at people's faces when conversing with them, people become more aware of their ability to control their facial expression and movements since this is where attention is generally focused during these interactions. As a result, they might be more cognizant of how they are behaving and may make appropriate adjustments by refraining from making any atypical movements that may be interpreted as possible guilt. This leaves their legs, feet, and hands more available for accurate observation of potentially deceptive motives.

Sporer and Schwandt (2007) conducted a meta-analysis comprising of 54 studies that examined 11 nonverbal visual behaviors that were considered to be critical in detecting deception. The findings identified only three behaviors that were reliably associated with deception: nodding, hand movements, and foot and leg movements. Each of these three behaviors was negatively correlated with deception, meaning that as lying increased, these movements decreased. This is partly in agreement with Ekman and Friesen's (1969) theory that

people are most likely to show deception in their legs and feet because they have less motivation and ability to control them. An explanation for this might be that if people experience physiological arousal during times that they are lying, they might be trying to control and restrict their movements in hopes that they do not reveal any deceptive cues caused by their behaviors. There is some evidence to suggest that people are more accurate in judging deception when focusing more on the subject's verbal rather than nonverbal behavior.

Some studies have found that raters are more accurate in detecting deception when they are presented with audio and transcript cues, as opposed to only video of their behavior (Porter et al., 2002). A study of police officers supported the idea of speech as a superior cue to detecting deceit (Mann, Vrij, Fisher, & Robinson, 2008). Officers had to assess truth and lies when they could either only see the suspect (visual condition), only hear the suspect (auditory condition), or both see and hear the suspect (control condition). These particular officers did not have any specialized training in lie-detection. The results indicated that the police officers were least accurate in their judgments when they could only see the suspect, performing slightly above chance at 53% in their detection of deception. Furthermore, the officers also had a strong lie bias in both the visual and control conditions, believing the suspect was more likely lying even when he was being truthful. This bias was not present in the auditory-only condition. This could be due to their lack of knowledge regarding truthful behavior, being forced to rely on false stereotypical beliefs associated with deceptive nonverbal behavior (such as eye contact). But interestingly, accuracy judgments in classifying liars were similar for the both the auditory-only and control conditions at 69% and 70%, respectively. Though it seems that exposure to visual-only information hindered deception judgments in this study, high accuracy rates in the control condition suggests the possibility that access to verbal information increased the ability to

accurately interpret the nonverbal information, even though participants reported that they paid more attention to the nonverbal cues.

When it comes to using speech cues to judge deception, there is evidence to support that what people believe are deceptive cues are related to actual deceptive cues. This is in contrast to eye contact, which is a stereotypical cue that is actually unrelated to deception (Sporer & Schwandt, 2007). A study conducted by DePaulo et al. (1982) examined various verbal cues thought to be associated with deception. Included were total number of word fillers (e.g., *um's, ah's*, and *er's*), as well as speech nonfluencies, defined as sentence changes, unnecessary repetitions, stutterings, and sentence incompletions. Raters perceived both word fillers and speech nonfluencies as cues most associated with deceptive behavior. Furthermore, these cues showed the strongest association with *actual* deception. In other words, the raters' assumption about what they thought were deceptive verbal cues were actually correct. This is in accordance with the Mann et al. (2008) study, where police officers who had no specialized training in lie-detection were more accurate when utilizing only verbal rather than nonverbal cues.

Taylor and Hick (2007) also looked at people's perceptions of nonverbal deceptive behaviors, considering two types of lies: a trivial lie where there are little to no consequences for the deceiver and a serious lie, which will have severe negative consequences for the deceiver. The authors proposed the idea that once high stakes are presented, the liar will feel strong emotions (such as guilt or fear) when lying. The stronger the experienced emotions, the more likely these emotions will be revealed through their nonverbal behaviors (Bond & DePaulo, 2006; Frank & Ekman, 1997).

In Taylor and Hick's (2007) study, subjects believed that six behaviors significantly decreased during trivial lies: pauses, stuttering, grammatical errors, facial twitching, shaking, and

self-manipulations. For serious lies, a total of eight behaviors were believed to increase: pauses, hesitance, voice pitch, eye contact, swallowing, lip-biting, hand movements and tense posture. These findings suggest that people's perception and interpretation of deceptive behavior differs between the type of lie: trivial or serious. Trivial lies may appear simpler and therefore much easier to conceal, while serious lies have much greater consequences tied to them, being perceived as requiring more effort to hide.

When trying to expose a liar during an interview, DePaulo et al. (as cited in Gombos, 2006) believe that the longer the deceptive response is and the less planning that is involved, the more difficult it is to tell a lie. This is in relation to Walczyk et al.'s (2005) research, which showed that lying takes a longer amount of time than telling the truth. On average, lies took about 230 milliseconds longer than truthful statements. DePaulo et al. (as cited in Walczyk et al., 2005) noted that spontaneous lying might also occur by using more filler words, such as *ah*.

Answering open-ended questions also evoked a response time between 166 ms and 210 ms greater than answering Yes/No questions (Walczyk, Roper, Seemann, & Humphrey, 2003). The authors suggest that this is due to the subject's ability to access linguistic codes in working memory, which is not required when accessing truthful information. Therefore, verbal competency may be a factor in individual differences among liars (Walczyk et al., 2003). People with lower intelligence and verbal skills may find it more difficult to tell a convincing lie (Mann et al., 2004). Given the extra mental effort involved, this challenging task may potentially lead to a greater response time when responding to questions.

Overall, when people attempt to determine when someone is lying via observation of nonverbal behavior, research dictates that they are highly inaccurate. In a meta-analysis conducted by Bond and DePaulo (2006) using research data from 292 studies and 24,483 judges,

the overall accuracy in detecting lies across all samples was at 54%, which is only slightly better than chance. This percentage is not much higher that flipping a coin to decide a lie versus a truth or just guessing altogether. The highest accuracy found in the Bond and DePaulo's (2006) sample was at 73%, with the lowest at 31%. Finding accurate judgments of nonverbal behavior over 70% is extremely rare, reinforcing the notion of how difficult it is to accurately determining when someone is lying when observing their behavior.

When judging nonverbal behavior to detect deception, high motivation to judge correctly does not equate to higher accuracy scores. In actuality, observers who are highly motivated have lower accuracy rates (Porter, McCabe, Woodworth, & Peace, 2007). This suggests the possibility that people are influenced by their own personal biases, leading them to make errors in judgments. People may be more concerned about confirming their own beliefs of what they think is true, rather than assessing the available information from an objective perspective. Observers who are highly motivated to expose a liar also may focus too much on the subject's body language and not enough on the story (Porter et al., 2007). Thus, they fail to take in account all of the possible deceptive information available to them.

Motivation impacts the liar as well. People highly motivated to lie are not any more successful at disguising the truth than those who are less motivated (DePaulo, Lanier, & Davis, 1983). Overall, it appears that high motivation is not correlated with high accuracy in judging deception. Professional lie-catchers such as police officers are no exception.

When someone thinks about what type of person would be good at catching liars, it can be easily assumed that law enforcement officials, with their regular exposure to deceptive individuals, would be better than the average person at detecting lies. Researchers testing this hypothesis discovered detection accuracy rates between groups of 66% and 73%, respectively

(Colwell, Miller, Miller, & Lyons, 2006; Mann et al., 2004). Furthermore, almost three-quarters of the participants stated that they relied on eye contact most often to detect deception (Mann et al., 2004). This is a common cue that observers look for, as one report revealed that 84% of police officers believed that eye contact decreases during instances when someone is being deceptive (Colwell et al., 2006). As previously mentioned, research has not supported the notion that gaze aversion is actually correlated with deception (Sporer & Schwandt, 2007), meaning that these police officers were using false stereotypical cues to make their judgments.

Vrij and Mann (as cited in Vrij, 2004) conducted a meta-analysis of professional lie catchers, including police officers and CIA agents, to assess their ability to accurately detect lying behavior. The study revealed that these human lie detectors were only correct 55% of the time in discriminating between truths and lies, compared to a 57% accuracy rate for college students. Though the professional lie-catchers were not more accurate than other individuals in detecting deceit, these supposed professional lie catchers were more confident in their ability to detect truths and lies. This finding has been supported in other similar studies (DePaulo, Charlton, Cooper, Lindsay, & Muhlenbruck, 1997; Mann et al., 2004), as the confidence in their judgments was not related to their accuracy.

Though it is important to see the detection rates of those in law enforcement, it is also interesting to consider how accurate liars are in detecting deception in others. Hartwig et al. (2004) looked at the detection accuracy of prison inmates compared to university students. The inmates were exceptionally accurate at detecting deceptive statements, at 88.5%. This was in comparison to the students, who had an accuracy rate of 65%. However, the inmates had a very strong lie bias, judging the subject as being dishonest 73% of the time. These rates were quite divergent from when they judged truthful statements, as the inmates were correct only 42% of

the time. The students, on the other hand, correctly judged truthful statements 50% of the time. The inmates reported that they predominantly relied on the plausibility of the statements to make their judgments, while the students relied mostly on how confident the subject was and how consistent their statements were. Generally speaking, the inmates were significantly better than the students in detecting lies, but worse in detecting truths. Additionally, the confidence in the judgments made by the two groups and their overall accuracy were not significantly correlated.

The typical situations criminal offenders are exposed to likely play a factor in their high accuracy rates and formation of their strong bias. Hartwig et al. (2004) contended that these individuals may have more exposure to situations that involve deception, such as having daily interactions with people where deception is needed to protect themselves or being repeatedly questioned by police officers. These experiences can lead them to be generally much more suspicious than the average person and thus more aware of deceptive cues. As offenders live a lifestyle of crime, deception is a much more normal occurrence than for those who are not exposed to these types of situations. Those living the criminal lifestyle must constantly be aware of being deceived by others, while at the same time being deceitful themselves.

Low accuracy rates in detecting dishonest behavior and frequent use of false stereotypical cues can have dire implications in real-world settings. For instance, if jurors are under the impression that liars typically avert their gaze and show signs of nervousness, they may actively search for these behaviors in a defendant and use this inaccurate information to make a decision regarding his innocence or guilt. Relying too much on just nonverbal behavior as their only cue to dishonesty may lead people to develop tunnel-vision, placing too much emphasis on what they think is deceptive behavior rather than interpreting it in combination with other evidence at hand.

Judging deception by assessing nonverbal behavior involves making inferences based on

probability. This means that there may be other possible explanations for someone's behavior, as explanations for body language are never absolute. But people may fail to take all available information into account and instead prefer to confirm their own beliefs. This can be problematic during a trial, for example, when only a single suspect is being tried for a recent murder. With no other suspects apprehended, jurors may want to confirm their own beliefs that the defendant is guilty just so that someone is blamed and convicted for the terrible crime, even if the evidence shows otherwise.

Dual-task Processing

Utilization of cognitive resources has been thought of as a "bottleneck," where available resources limit the ability to successfully perform two separate tasks. With this approach, time was considered a determining factor in how cognitive resources could be allocated. In other words, more time would be required for the information to process through the bottleneck and elicit a response.

For instance, if a suspect is being interviewed by the police while the demands of another task seek his attention, the effect of dual-task processing and limited cognitive resources could lead to a delayed response given the difficulty processing that information. Wickens (as cited in Eysenck & Keane, 2010) proposed that mental processing must go through three stages: encoding, which involves processing of visual or auditory information; central processing, in which the codes are then processed; and responding, which requires a verbal or behavioral response. A more demanding task will require greater cognitive resources, causing increased interference with the concurrent task (Kemper, Schmalzried, Hoffman, & Herman, 2010). If the tasks share a similar sensory modality or response, such as an auditory task and auditory response, there should be greater interference since the same area of the brain will be activated

(Eysenck & Keane, 2010). An example might be trying to have a conversation with someone face-to-face while also talking to another person on a cell phone.

If two tasks utilize different resources, it is argued that people should be better able to perform each task, since they require different demands for information processing. A visual task requires spatial processing, whereas a vocal task relies on a verbal response (Wickens, 2002). However, there can still some disruption to performance when the sensory modalities differ, such as between a behavioral task and auditory response (Eysenck & Keane, 2010). An example can involve talking on a cell phone while driving a car.

One study suggested that attempting to encode verbal information has a significant negative impact on attending and performing visual tasks, especially when verbal information has to be later recalled (Gherri & Eimer, 2011). Additionally, when there are a greater number of possible responses to select during the task, the difficulty is increased (Eysenck & Keane, 2010). As difficulty is increased, impairment on task performance becomes magnified.

When participants of a small study had to encode a number and a colored dot, this process became more difficult when they had to switch their attention to encode a new number and a new dot. Response time increased the greatest when both the number and the dot were switched compared to when they only had to repeat the initial stimulus. Interestingly, this occurred even though the participants were able to practice the task numerous times (Oberauer & Bialkova, 2011). This suggests that people will still experience the costs from dual-task demands despite prior attempts to practice the tasks.

These findings may have some implications in the forensic setting when evaluating potentially deceptive behavior. For instance, if a suspect is interrogated at a police station, he may be questioned first with simple questions, creating a baseline of his normal behavior. When

he is then asked questions about the purported crime, he may need to switch his attention to create deceptive answers in order to prevent his response from being self-incriminating. Though this may be easy for the suspect the do, introducing a secondary task during the interview can increase cognitive load and therefore greatly increase the difficulty of performing each task. This can then widen the discrepancy between verbal and nonverbal behavior in truthful baseline questions and presumed lie questions, thus facilitating the ability to detect deceptive behavior.

When looking at the effect of dual-task performance on speech, research has provided some evidence for potential protective factors that may reduce impairment. For instance, superior vocabulary offered more protection for older adults in regard to sentence length. Greater working memory capacity served as a protective factor for complex grammar usage for older adults compared to younger adults. But overall, younger and older adults spoke slower, less fluently, less coherently, and used less complex language when the dual-task activity became more difficult. Even those with superior vocabulary, working memory, processing speed abilities, and inhibition control saw exposed vulnerabilities to the dual-task demands (Kemper et al., 2010). This suggests that even highly capable individuals are subject to speech disruption in dual-task performance scenarios. Despite the available cognitive resources of highly intellectual individuals, the demands of a dual-task require these resources to be divided, limiting their availability for each task. With fewer cognitive resources accessible, performance then becomes impaired.

Cognitive Load

Lying is sometimes more difficult than telling the truth (Gombos, 2006; Vrij et al., 1996). This is because it requires more cognitive resources, or cognitive load (Vrij et al., 2008). When people lie, they may find it mentally taxing. Liars must give the impression that the lie is

credible, controlling their speech and behaviors in order to prevent cues from being implied as deceitful. These individuals must actively restrain themselves from revealing details of the true event, while at the same time monitoring the interviewer's reactions to their responses. These are all actions that require deliberate control, thus increasing cognitive demand. All of these processes running simultaneously leave fewer cognitive resources available to tell a convincing lie. In fact, deceptive recall of past events was rated by observers as less plausible and less detailed than recall of true experiences (Vrij, Leal, Mann, & Granhag, 2011), with plausibility as one cue that criminal offenders primarily rely on when judging deception in others (Hartwig et al., 2004).

When an individual is being honest, a true event that has been experienced should be easy to describe if accurately recalled. These truths should require few cognitive resources, as honest recall occurs automatically (Leal, Vrij, Mann, & Fisher, 2011). However, faulty memory of an event can also increase cognitive load, especially if people must think hard about a situation when they do not clearly remember the details of the event (Vrij, 2008). Therefore, high cognitive load may be associated not only with deception, but difficulty in recalling a true event.

Gombos (2006) pointed out that there are a number of executive processes at work when one is being deceptive. Functions such as inhibition, metacognition, attention, planning, decision-making, and working memory all play a role in creating lies. At the same time, the liar must be aware of the interviewer's responses and acknowledge if adjustments in behavior are warranted in order to avoid getting caught.

Vrij (2008) suggested that lying can create observable signs of cognitive load. When individuals are deceptive, and therefore experiencing increased cognitive demand, they display fewer movements in their hands, legs, and feet (Caso, Gnisci, Vrij, & Mann, 2005; Sporer &

Schwandt, 2007; Vrij, Semin, & Bull, 1996). This is perhaps in an attempt to avoid suspicion by preventing potential deceptive cues from being observed by the interviewer. This type of self-awareness may be prominent in certain individuals, such as those who have high self-consciousness and excel in controlling their behavior. People with high public self-consciousness are good at taking another's perspective and adjusting their behavior accordingly (Vrij, Akehurst, & Morris, 1997). This allows them to create a favorable impression on others, with the intent that people will find their story more believable. However, utilization of impression management will require more cognitive resources (Vrij et al., 1997), as these individuals have to split their attention between their own actions and that of the other person.

As current lie-detection techniques have questionable validity and imperfect accuracy rates, one must wonder whether there is anything that can be done to make detecting deception more accurate and efficient. Vrij (2004) offered a few strategies for improvement. For instance, if liars give away deceptive cues because they find it difficult to lie, one suggestion is to create a challenging situation for suspected liars, making it even more difficult for them to create a lie.

One way this can be done is by asking the individual to elaborate on their story, encouraging them to provide specific details about the events that supposedly took place. Asking them to repeat previous statements also tests the reliability of their story. As individuals typically tell stories in chronological order from start to finish, another way to increase the difficulty is to ask the person to recall the events in reverse order. That is, recalling what happened at the end of the event and continuing backwards towards the beginning. Beattie (as cited in Vrij, 2006) also purported that getting a suspected liar to look at the interviewer directly in the eyes increases cognitive demand, making it more difficult for them to lie. But even as these are some unique and novel strategies, empirical evidence is needed to support their effectiveness.

As previously discussed, if a suspected liar believes that certain behaviors might be interpreted as deceit or guilt, then the liar may restrict his bodily movements in order to reveal as little nonverbal information as possible. But even when deceitful individuals have knowledge about deceptive nonverbal behaviors and are aware that they may be displaying such behaviors, it does not necessarily influence how they behave under deceptive conditions.

Participants of one study were informed before an interview that a reduction in behavioral movements was associated with lying and deception. Despite having this knowledge, these individuals still displayed fewer hand, leg, and foot movements when telling a lie. Perhaps more surprisingly, the deceptive participants actually believed they displayed an overall increase, rather than decrease, in behavioral movements. Further, the participants believed that they were actually exhibiting control over their behavior (Vrij et al., 1996). This evidence implies that some people lack awareness into their own behavior when they are lying. The researchers posited that a possible explanation for this is that the participants were experiencing high cognitive load when lying, leaving fewer cognitive resources available to consciously control their gestures and movements (Vrij, et al., 1996). As this study was conducted in a laboratory setting, these results may relate to the fact that it was a low-stakes condition lacking any severe consequences and participants were not motivated enough to tell convincing lies.

Motivation

Vrij et al. (2008) stated that motivation is a key factor in detecting deception in high cognitive load conditions. When a lie is more serious and the stakes are high, the liar might be more motivated to think up a convincing story in order to avoid being exposed as deceitful. A study conducted in a laboratory setting where participants do not experience any consequences of being caught in their lie is much different than a real-life, high-stakes scenario where there the

consequences are significantly greater.

DePaulo et al. (2003) confirmed the importance of motivation in cases of deception. When participants were motivated by being informed that they would be evaluated and even criticized about their performance, this raised the stakes of their self-presentation abilities more so than any monetary or material incentives. When their identity is at stake, people will want to give off a positive impression. Having someone's true character exposed to be that of a liar, or even a murderer in criminal cases, is something that people would want to protect. But research on real-life, high-stakes scenarios is scarce.

For this literature review, only a single study was found involving deception of a real-life convicted murderer (Vrij & Mann, 2001). Although the suspect in the case initially denied his involvement in the victim's death, he later admitted to the commission of the murder and was convicted of the crime. In this particular case, the suspect made fewer hand and arm movements when lying during the interview. He also exhibited an increase in speech errors, defined as repetition of words or sentences, incomplete sentences, sentence changes, and slips of the tongue. Though this particular study was a case study of a single individual, the results are consistent with other literature regarding speech errors and a decrease in body movements when lying.

Culture

When assessing how generalizable research findings are, culture also must be taken into account. Although research on lying and culture is extremely sparse, available data indicate some differences worth mentioning. For example, Seiter and colleagues (as cited in Ning & Crossman, 2007) suggested in their study that Chinese individuals perceived lying as more acceptable than Americans, due to their emphasis on social expectations. Americans, on the other hand, generally

viewed deception as more acceptable towards strangers than people they knew. Additionally, due to the collectivistic nature of the Chinese culture, research by Munsey (2007) indicated that Chinese children are more likely to lie to help a group, even if it means harming a friend or themselves. Canadian children, on the other hand, report that they would lie to help themselves or a friend even it meant harming a group, highlighting their individualistic tendencies.

Cultural influences may have an effect on lie-detection as well. People who hold the stereotypical view that gaze aversion is an indicator of deception may not be aware that eye contact may actually be due to cultural differences. For example, African American people typically show more gaze aversion than white Americans; looking into someone's eyes when speaking is considered polite in western cultures but rude in others (Langleben et al., 2006). Additionally, gang members may view eye contact as an aggressive, threatening behavior (B. Client, personal communication, 2010). Therefore, their lack of eye contact could be a way of them showing politeness and respect rather than deception.

Summary

Judging deception is not a simple task, as there is no single verbal, nonverbal, or physiological cue directly related to deception (Frank & Ekman, 1997; Vrij, 2004). The polygraph does not measure deception, but rather physiological arousal that is assumed to be linked to deceptive behavior. Neuroimaging techniques signal specific brain activity during instances of deception, but the specific content of those lies is unknown. People may also give off certain verbal or nonverbal behavioral cues, but there can be numerous explanations as to why this occurs aside from deceit.

When people observe body language in others, deception detection rates are not much better than 50%, the same as if they flipped a coin or just completely guessed (Bond & DePaulo,

2006). Generally speaking, lie-detection techniques require inferences to be made based on indirect information. At the present time, there is no perfect method to accurately distinguish between truths and lies. New, more efficient techniques need to be developed in order to improve its accuracy. Testing the effects of high cognitive load and dual-task performance on deceptive behavior may be one key to solving this puzzle.

Chapter 3: Research Design and Methodology

Purpose of Study

Judging deceptive behavior is no easy task. It is not so simple to decipher between when someone is lying and when he or she is telling the truth. The reality is that judgments of deception via nonverbal behavioral movements are not much greater than 50% (Sporer & Schwandt, 2007). Such a low accuracy rate suggests that people simply do not know what to look for when judging deceit, as perhaps they are misinterpreting cues available to them. Therefore, the purpose of the present study was to examine behavioral movements associated with lying and deception. More specifically, the duration of lower body movements (e.g., legs and feet) was measured in order to assess behavioral differences between when people are lying and when they are telling the truth.

Hypothesis

The hypothesis for the current study was that participants would have significantly less movement in their legs and feet when lying than when telling the truth, as measured by mean duration of time. Generally speaking, people tend to restrict their nonverbal behavioral movements in their extremities when being deceptive (Sporer & Schwandt, 2007), maybe in efforts to prevent any nonverbal cues from being revealed to observers and interpreted as possible guilt. Ekman and Friesen (1969) also theorized that people are most likely to show deception in their legs and feet since they have less motivation and ability to control them.

Variables

The independent variable in the present study was categorical; the type of participant response, consisting of two levels: Truth or lie. The dependent variable was the mean duration of time the participants moved their legs and feet during their responses, measured in seconds.

Participants

To recruit participants, flyers requesting volunteers were distributed at the campuses of The University of California, Irvine and The Chicago School of Professional Psychology in Irvine, California. The age range of the participants was 18 to 49 years (M = 27.8). Fifty-five participants were included in the study (38 females, 17 males). Twenty-eight identified as European American (50.9%), 11 were Asian American/Pacific Islander (20.0%), seven were Latino/a (Mexican American, Chicano, Central/South American) (12.7%), seven were Mixed/Other (12.7%), and two were African American/Black (3.6%). Participation in the present study was on a volunteer basis. Given that subjects were required to provide verbal responses to different types of questions, participants were excluded if English was not their primary language. Additional exclusion criteria included participants who had a history of delusions or hallucinations, determined by self-report. This was in order to prevent any cognitive alterations or distortions from potentially influencing their truth and lie responses during the study. As an incentive to participate in the study, all subjects received their choice of a $5 gift card for either In-N-Out® or Subway® restaurants following their participation in the experiment.

Materials and Procedure

Prior to beginning the study, participants were given a consent form to review and sign (see Appendix A). The consent form indicated that they were volunteering to participate in a study on lying and that at certain times during the study they will be asked to provide truthful statements as well as false information on their opinions, experienced autobiographical events, and hypothetical scenarios. After providing their consent, they were given written instructions explaining their participation in the experiment (see Appendix B) and completed a brief demographics questionnaire (see Appendix C). Participants were also asked to provide their

email address so that they can be debriefed following the completion of data gathering for the entire study. Participants were informed that their participation will be kept strictly confidential and they have the option to leave the study at any point in time.

To begin the experiment, one participant entered the study room to be seated at a laptop computer. The research participant interviewed each participant individually. The laptop was placed on a small, round table, to the right-hand side of the participant's chair so that it was not covering their lower body. Once the study began, each participant interview was recorded using a video camera.

The consent form indicated that their participation during the study will be filmed and the video clips will be shown to outside observers so that they can determine whether they think the participants are lying or telling the truth. Once their participation has been fulfilled for the experiment and the questioning period has completed, the participants left the room and the next person entered. Participation was kept confidential, though the subjects were told that identifiable information and their responses may be revealed to possible known associates who are viewing the videos to make truth/lie judgments about them. All video recordings were stored on a password-protected computer.

During the experiment, the camera faced the front of the participants so that their whole body was in view and the entirety of their behavioral movements could be clearly captured. Participants were instructed to keep their legs and feet facing the front of the camera at all times. The purpose of this was so the video camera could clearly capture their lower body movements. The consent form disclosed that prior to beginning the study, all participants will be required to wear long pants as a requirement for their participation because they will be filmed and their entire body will be in view of the camera. Any subject wearing shorts, skirts, or dresses were not

given the opportunity to participate in the study. This was in order to protect the privacy of the participants and prevent any invasiveness due to the filming of their lower body movements during the study. Additionally, omitting skirts or long dresses while requiring all participants to wear long pants allowed their legs and feet to be clearly viewed for any movement.

My dissertation advisor and I constructed a questionnaire comprising a total of four interview questions that was asked to each participant during the study (see Appendix D). Each participant was asked the same four questions. For two of the questions, participants were instructed to tell the truth. For the other two questions, they were instructed to lie. This format has been used prior by Depaulo, Lanier, and Davis (1983) in their study of judgments in deceptive individuals.

To increase the difficulty of the interview (Oberauer & Bialkova, 2011), the type of question alternated each time (truth/lie/truth/lie) until the participant had given responses to all four questions. The questions were always presented in the same order for each participant. Additionally, each question was designated as a truth or lie question and remained the same for the duration of the study. The interview questions consisted of various topics regarding demographics and personal experiences or opinions, with the intention that the participants would provide answers that were easier to recollect.

The questionnaire was developed using open-ended questions. This was to encourage participants to expand on their answers, as opposed to giving a simple Yes/No response. DePaulo et al. (as cited in Gombos, 2006) believed that lying is more difficult when deceptive responses are elaborative and involve less planning. This idea is associated with Walczyk et al.'s (2005) research, which suggested that a lying response takes a slightly longer amount of time compared to telling the truth. In the current study, the participants did not have any knowledge of the

interview questions prior to beginning the experiment. That is, they did not have the opportunity to plan their responses in advance.

When being interviewed, participants in the present study had to complete a secondary task while providing their verbal response. This task was a visual recognition activity that took place on a laptop computer, occupying the participant's focus and attention. Participants engaged in the activity for the duration of their response for each of the four questions. This attention task had a preset time limit of 45 seconds. Therefore, participants were asked to elaborate on their answers for 45 seconds on each of the four questions. This duration of time is similar used in other deception studies, in which participants had between 30 seconds to one minute to elaborate on their honest or dishonest responses (Arrieta, 2011; DePaulo et al., 1983).

During the study, the interviewer sat to the left of and slightly behind the participant. This was so that the interviewer could see exactly when the computer task began and immediately begin questioning the participant. Also, the participant was not able to see the interviewer directly during the question period in case the interviewer unintentionally elicited any nonverbal cues that may potentially influence the participant's behavior or verbal response.

The distraction task on the computer was a visual recognition game called *Lost in Migration* from the internet website www.lumosity.com (Lumos Labs, Inc., 2008), which assesses cognitive abilities. In the game, a flock of birds appeared in formation onscreen. Participants were required to press the arrow key on the computer keyboard that coincides with the direction that the bird in the middle of the flock is facing. For instance, if the middle bird was facing the direction to the right, the participant should press the right arrow key on the keyboard. With each button press, the flock would automatically change to a random formation, as did the direction of the central bird. In order to become familiar with the rules of the game, participants

were given the opportunity to read the onscreen instructions before beginning the activity and complete one practice round where they were not required to provide a verbal response.

Once seated at the computer and completing one practice round, participants were instructed by the interviewer to select one of four index cards placed face-down on the table to their left. Each of these four cue cards were labeled in order with the numbers *1, 2, 3,* or *4* (DePaulo et al., 1983). To begin the study, the interviewer told the participant to pick up the first cue card and read it to him- or herself. After the participant had selected and turned over the appropriate card, instructions were written on that cue card informing the participant either to lie or tell the truth. Only the participant saw those instructions, as the interviewer was blind as to whether the participant was lying or telling the truth during the experiment. This was to control for any bias on the part of the interviewer, in which his verbal or nonverbal behavior might have potentially influenced participants' responses. The participants were also informed prior that the interviewer will not know whether they were lying or telling the truth. As soon as the participant started the visual recognition task on the computer, the interviewer began asking the question related to the corresponding cue card. This same procedure occurred for each of the four interview questions, with the next numbered cue card being selected after the participant had completed providing their 45-second response to the designated interview question.

The interviewer asked each participant a total of four questions consisting of various topics regarding their personal experiences and hypothetical situations. The type of reply required by the participant, either truth or lie, alternated after the completion of each response. The use of questions requiring a truth response was to help establish a baseline of normal behavior, which was then compared to their behavior when they were telling a lie.

For the first question, the index card instructed the participant to tell the truth. As soon as

the visual recognition task began on the computer, the interviewer asked the participant "Where are you from? Tell me about where you grew up" (Arrieta, 2011). For the second question, the index card instructed the participant to lie. The interviewer asked "How often do you do physical exercise and why do you choose to do it that often?" For the third question, the index card instructed the participant to tell the truth. The interviewer asked "What type of qualities or characteristics do you look for in a person you would consider marrying or having a relationship with and why?" For the fourth and final question, the index card instructed the participant to lie. The interviewer said "Tell me what you do to volunteer or help charitable organizations." If at any point during the response the participant paused or hesitated, the interviewer provided him or her with a verbal prompt (see Appendix D). When necessary, the interviewer also encouraged them to elaborate on their answer by saying "please tell me more" or "please continue" (Arrieta, 2011). These prompts were used so that participants would have to provide an immediate response without being given a considerable amount time to think about their answer. This was intended to make it more challenging for them to create a believable lie, since they had to come up with their answer on the spot.

As mentioned, participants were concurrently working on a visual recognition task on the computer requiring their constant attention while they provided a verbal response to the interviewer's questions. As lying is typically more difficult than telling the truth due to a greater use of cognitive resources (Vrij et al., 2008), the dual-task activity was implemented to further increase cognitive load and enhance the difficulty of creating a lie. This is in accordance with research suggesting that performance on one task will cause interference on a secondary task, even when the sensory modalities differ (e.g., audio and visual; as cited in Eysenck & Keane, 2010). This, in turn should leave fewer cognitive resources available to create a believable lie,

thus enhancing the discrepancy between honest and dishonest behavior.

After the completion of data gathering, the lead researcher scored the video clips by using a stopwatch to time the duration of leg and foot movements of each participant. Additionally, the participants were debriefed (Appendix E) via email on the true nature of the experiment after all of the data gathering had been completed for the entire experiment. This was to prevent subjects from revealing the details of the experiment to other potential participants, which could have possibly influenced their behavioral responses if they chose to later participate.

Participant Motivation

Each participant was told prior to the questioning period to act as convincing as possible when giving his or her responses. In order to motivate the participants to lie convincingly, multiple strategies were employed. The inclusion of motivational strategies was intended to amplify the differences between truth and lie behaviors in the participants (DePaulo et al., 2003). These strategies were based on research revealing that motivation is enhanced when it is associated with identity, as opposed to monetary rewards or material items such as gifts (DePaulo et al., 2003). This increases the stakes for the subjects, prompting them to protect potentially incriminating or embarrassing information about their character from being exposed. As such, interview questions were developed and selected to ask about the participant's personal experiences or opinions, rather than having him or her memorize a hypothetical scenario they were never involved in. Participants in the present study were also told that "prior research has shown that people with successful careers tend to be better at deception" (DePaulo et al., 1983). As an additional effort to increase motivation, deceptive techniques were implemented into the experiment as well.

Use of Deception

A number of deceptive techniques were implemented into the study's methodology in order to motivate the participants to lie convincingly and elicit more natural behavior in the experimental setting. For the present experiment, participants were told to complete the visual recognition computer task as fast as they can during each 45-second span while also responding to interview questions. In order to motivate the participants to work quickly, subjects were told that comparisons will be made between the male and female participants to see which gender can attain an overall higher score on the computer task. Competition and comparison to others were intended to increase the likelihood that the individual would want to perform well on a task or activity (Murayama & Elliot, 2012). Emphasizing focus on the computer task was used as a deceptive strategy with the intent of drawing attention away from the fact that their nonverbal behavior will be observed directly. Initially, they were also told that they were taking part in an experiment on gender differences in lying ability. However, gender differences were not actually assessed in this study, as this was only a deceptive technique to disguise the true nature of the experiment as well as to motivate participants to lie convincingly through competition (Murayama & Elliot, 2012).

Participants were also told that the clips of their video responses will be later rated by outside observers in order to determine whether they think the participants are telling the truth or lying. However, none of the video responses were viewed by anyone aside from the lead researcher; truth/lie judgments were not be made by any other outside observers. Subjects were given this false information as a means to explain why their participation in the experiment was being video-recorded, since they were kept unaware of the study's true purpose.

Data Analysis

The current study hypothesized that participants will have significantly less movement in their legs and feet when lying than when telling the truth, as measured by mean duration of time. Data analysis required a repeated measures ANOVA to be performed, which tested for differences within subjects of a single group. The experiment was a preexperimental design, consisting of a one-group ex post facto. There was no control group for the present study, as each subject was exposed to both conditions (truth and lie) as well as the secondary computer task that occupied their attention during the question period. Flyers requesting volunteers were distributed to university campuses at The University of California, Irvine, and The Chicago School of Professional Psychology in Irvine, California. As the sample was a simple random probability sample, it was not representative of the general population.

Quantitative data was gathered for the experiment, with the total duration of lower body movements for each participant measured four times in total (two truth and two lie responses). The mean durations of time were then compared to assess for significant differences between conditions. Upon completion of data gathering, the lead researcher viewed the video recordings and timed the duration of foot and leg movements in seconds for each participant. An a priori power analysis was conducted prior to data gathering, yielding a minimum sample size of 36 participants to reduce the likelihood of committing a Type I or Type II error. The effect size was estimated at .25, with a power level of .95. The alpha level was set at .05.

Summary

The present study examined participants' lower body movements when they were lying and when they were telling the truth. Comparisons were made between the two conditions, assessing for behavioral differences in the lower body as measured by mean duration of time in

seconds. The addition of a secondary computer task occupying participants' focus and attention was implemented to increase cognitive load and make it more difficult to create a lie, enhancing behavioral differences between the two response conditions.

After prescreening procedures were conducted prior to data analysis, a total of 55 adult participants were included in the study. Flyers requesting volunteers were distributed to university campuses at The University of California, Irvine, and The Chicago School of Professional Psychology in Irvine. The age range of the participants was 18 to 49. All participants were required to provide two truthful responses and two deceptive responses to questions pertaining to autobiographical experiences, their opinions, and hypothetical situations. They were encouraged to elaborate on each of their responses for 45 seconds. The interviewer was blind as to whether the subject was lying or telling the truth during the question period. Data was analyzed using a repeated-measures ANOVA design. Subjects were debriefed on the study via email following the completion of the entire experiment, once all of the data has been gathered for the study.

Chapter 4: Analysis of Data

The independent variable was the type of condition in which participants were directed to provide verbal responses to the questions they were asked, consisting of two levels: Truth or lie. The dependent variable was the mean duration of time the participants moved their legs and feet during their verbal responses, measured in seconds. Participants were given 45 seconds to provide each of their answers. Prior to data analysis, data was prescreened in order to address missing data, outliers, and test assumptions of normality.

Fifty-nine participants were initially included in the study, but four subjects were removed due to missing data. After removal, data for 55 participants remained for analysis. The overall means for the duration of lower body movements were calculated in seconds for each of the four questions that participants were required to answer (see Table 1). Question 1 required a truth response (M = 9.93, SD = 11.97), Question 2 required a lie response (M = 8.42, SD = 12.43), Question 3 required a truth response (M = 10.31, SD = 12.99), and Question 4 required a lie response (M = 9.16, SD = 13.29).

Table 1

Total Duration of Lower Body Movements in Seconds (N= 55)

	Mean Duration of Lower Body Movements (in Seconds)		
Condition	*N*	*M*	*SD*
Question 1 (Truth)	55	9.93	11.97
Question 2 (Lie)	55	8.42	12.43
Question 3 (Truth)	55	10.31	12.99
Question 4 (Lie)	55	9.16	13.29

Nine outliers were present in Question 2 and five were present in Question 4. Rather than

remove these items, these numbers were altered to a value that falls within the extreme tail in the accepted distribution in order to retain the data. No outliers were present for either of the truth questions, Question 1 and Question 3. A test of normality was conducted, indicating a significant nonnormal distribution that had a moderately positive skew across each of the four questions. Therefore, data for each of the four questions were transformed using a square root transformation in efforts to reach a normal distribution and improve the accuracy of the statistical analysis.

After outliers were removed and data variables were transformed, the overall means for the duration of lower body movements in seconds were re-calculated for each of the four questions that participants were required to answer in order to assess for significance (see Table 2). Question 1 required a truth response ($M = 2.36$, $SD = 2.10$), Question 2 required a lie response ($M = 1.79$, $SD = 1.64$), Question 3 required a truth response ($M = 2.37$, $SD = 2.19$), and Question 4 required a lie response ($M = 2.01$, $SD = 2.06$).

Table 2

Total Duration of Lower Body Movements in Seconds (N= 55), After Data Transformations

	Transformed Mean Duration of Lower Body Movements (in Seconds)		
Condition	*N*	*M*	*SD*
Question 1 (Truth)	55	2.36	2.10
Question 2 (Lie)	55	1.79	1.63
Question 3 (Truth)	55	2.37	2.19
Question 4 (Lie)	55	2.01	2.06

Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi^2(5) = 16.96$, $p = .005$. Therefore, the degrees of freedom were corrected by using the

Huynh-Feldt estimates of sphericity (ε = .88). The results showed that there were significant differences in duration of lower body movements based on condition, truth or lie, $F(2.65, 142.90) = 4.95$, $p = .004$. Bonferroni post hoc tests were used for additional analyses to examine the differences between conditions.

Pairwise comparisons revealed some significant differences in the total duration of lower body movements between truth and lie questions. Specifically, participants' lower body movements in Question 2 (Lie) differed significantly from Question 1 (Truth; $p = .017$) and Question 3 (Truth; $p = .032$). But interestingly, there were no significant differences when comparing Question 4 (Lie) to each of the truth questions, Question 1 and Question 3 (see Table 3). There were also no significant differences in lower body movements when comparing each of truth conditions, Question 1 and Question 3. Similarly, there were no significant differences in lower body movements between each of the lie conditions, Question 2 and Question 4.

Table 3

Pairwise Comparisons Between Conditions

Condition	Condition	Sig.
Question 1 (Truth)	Question 2 (Lie)	.017
	Question 3 (Truth)	1.000
	Question 4 (Lie)	.537
Question 2 (Lie)	Question 1 (Truth)	.017
	Question 3 (Truth)	.032
	Question 4 (Lie)	.792
Question 3 (Truth)	Question 1 (Truth)	1.000
	Question 2 (Lie)	.032

	Question 4 (Lie)	.335
Question 4 (Lie)	Question 1 (Truth)	.537
	Question 2 (Lie)	.792
	Question 3 (Truth)	.335

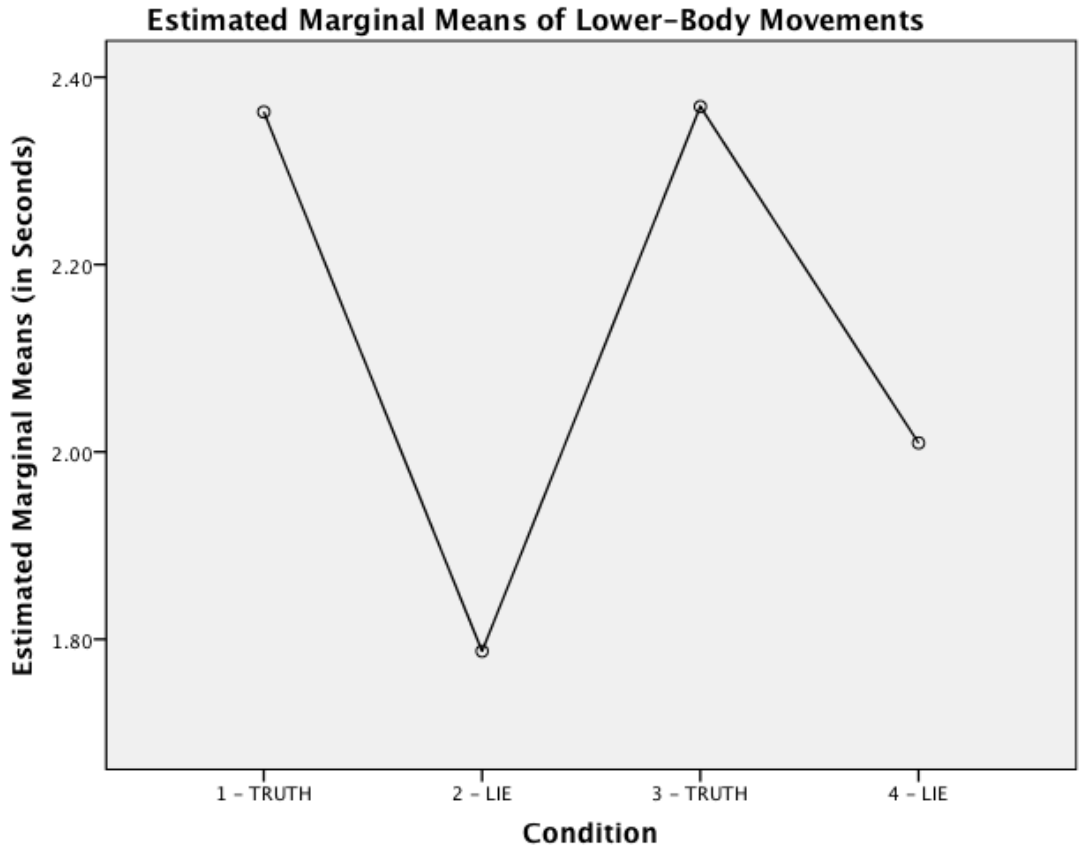

Figure 1: Participants' overall mean duration of lower body movements in seconds based on response type, Truth or Lie, after data transformations.

Chapter 5: Findings, Conclusions and Implications

Summary of the Study

Accurately judging when someone is being deceptive is no easy task. Research suggests that people can correctly judge when individuals are lying only about 50% of the time when observing their nonverbal behavior. Lying is sometimes more difficult than telling the truth, as it requires more cognitive resources or cognitive load (Gombos, 2006; Vrij et al., 2008; Vrij et al., 1996). Generally speaking, people tend to restrict movements in their legs and feet when they are lying (Sporer & Schwandt, 2007). The current study hypothesized that participants will have significantly less movement in their legs and feet when lying than when telling the truth, as measured by mean duration of time. The independent variable in the present study was the type of condition in which participants had to provide responses to the questions they were asked, consisting of two levels: Truth or lie. The dependent variable was the mean duration of time the participants moved their legs and feet during their responses, measured in seconds.

Fifty-five participants were recruited from the University of California, Irvine and The Chicago School of Professional Psychology at Irvine. The age range of the participants was 18 to 49 years (M = 27.8). Participants had to respond to a total of four questions related to their biographical history, opinions, or hypothetical scenarios, in which two of their responses were truths and two were lies. While the participants were being interviewed, they simultaneously played a game on a computer to divide their attention, with the intent that they would have fewer cognitive resources with which to create a believable lie. Participants had 45 seconds to elaborate on each of their four responses. Each of their responses was video-recorded and later timed by the lead researcher to measure the duration of their lower body movements and examine behavioral differences between truth and lie responses.

Findings

Experimental findings revealed some interesting, yet unexpected results. The major finding was that there were some significant differences in the mean duration of participants' legs and feet between truth and lie conditions. However, these differences were dependent on the particular lie question the participants answered. For instance, Question 2 required participants to lie about how often they do physical exercise. For this question, there were significant differences compared to each of the truth questions, Questions 1 and 3. That is, participants had significantly fewer movements in their lower body as measured by mean duration of time compared to their truth responses. This suggests that this particular question increased cognitive demand for the participants and was therefore more difficult to create a lie as compared to telling the truth. This finding confirms the hypothesis and is in accordance with prior research indicating that individuals display fewer movements in their legs and feet when they are being deceptive (Caso et al., 2005; Sporer & Schwandt, 2007; Vrij et al., 1996).

The results for Question 4, in which participants had to lie about their volunteering activities, unexpectedly differed from that of Question 2. For Question 4, there were no significant differences in lower body movements when compared to each of the truth conditions. This finding suggests that this particular question did not induce as much cognitive load when compared to the truth conditions. In other words, the lack of significant differences in lower body movements suggests that it was as easy for participants to create a lie response for this question as it was to be honest in the truth conditions. Button-pressing reaction time on the computer game was not significantly different between the two lie questions. That is to say, participants did not take significantly more time to react to the computer game in Question 4 than in Question 2, ruling out the possibility that this influenced the results.

Conclusions

Though there were some significant differences in the participants' lower body movements between conditions (truth or lie), this was dependent on the particular question they were required to answer. That is, there were significant differences between Question 2 and each of the truth questions. But interestingly, there were no significant differences between Question 4 compared to each of the truth questions.

There may be a number of possible explanations for this. Since telling the truth is generally easier than telling a lie (Vrij et al., 2008), cognitive load may have been reduced if participants integrated the truth into their lie responses. For instance, some participants who really did volunteer gave reasons why they do not volunteer as part of their lie response, reporting that it is too time consuming or overwhelming while also being a full-time student. These particular individuals truly may have felt overwhelmed by all of their obligations and actually believed that it is too time consuming to volunteer.

People who have considered volunteering may have provided a response about where they would prefer to volunteer if they actually did. Essentially, these responses are then not a complete lie. If it was their true motivation or interest to volunteer at a particular agency, then on a cognitive level this can be considered the truth rather than a lie. Therefore, if people were more likely to integrate truth statements into their lie response for this particular question, this can explain why there were no significant differences in lower body movements compared to the two truth questions.

If participants paused or hesitated at any point during their responses, the interviewer provided them with a verbal prompt (see Appendix D). These prompts were used so that participants had to provide an immediate response without being given a considerable amount

time to think about his or her answer. However, some participants may have still delayed their responses, reducing cognitive load when they were providing their answers.

For participants who gave brief answers to the questions, use of the verbal prompts by the interviewer may have facilitated the process of providing their response. During the experiment, the interviewer also phrased some of the prompts in a closed-ended question format, which yielded a simple Yes/No response from participants. This means that some participants did not need to elaborate on their answers, especially because the interviewer would provide them with a verbal prompt as soon as they finished responding. With fewer details and a shorter response, this likely made it easier to respond to the question. This is in accordance with DePaulo et al. (as cited in Gombos, 2006) assertion that the longer the deceptive response, the more difficult it is to tell a believable lie.

Another possible explanation for the difference in results between each of the lie questions may be due to self-consciousness and impression management. Heightened self-awareness may be prominent in certain individuals, such as those who have high self-consciousness and excel in controlling their behavior. People with high public self-consciousness are better at taking another's perspective and can adjust their behavior accordingly (Vrij et al., 1997). If similar participants divided their attention between their own actions and those of the interviewer, utilization of impression management would require a greater use of cognitive resources (Vrij et al., 1997). This can help explain why Question 2 about doing physical exercise was more difficult to provide a lie response than Question 4 about volunteering, as it likely induced greater cognitive load.

In the United States, 56.8% of people ages 18-29 exercise for at least 30 minutes, three times per week, compared to 51.2% for people ages 30-44 and 50.0% for those ages 45-64

(Cochrane, 2012). This indicates that people in their twenties are more active and partake in more physical exercise than those who are 30 or older. The mean age of the participants for the present study was 27.8 years. Participants in the present experiment were more likely to provide a response indicating that they do physical exercise, meaning that their lie was that they were not physically active. Providing such a response puts them in a negative light, which then may have increased their self-consciousness. Therefore, participants had to distribute cognitive resources to not only playing the game and creating a deceptive response but also toward how they were being perceived by the interviewer. Awareness of another's perspective should increase cognitive load (Vrij et al., 1997), making it more difficult to create a believable lie. Further, this greater self-awareness may have led participants to have greater control over their bodies (Vrij et al., 1997), resulting in a decrease in their lower body movements.

Impression management can help explain the results for Question 4 as well. Almost all of the participants provided a site or agency in their lie response when reporting their false volunteering activities. That is, if the actual truth was that these individuals did not volunteer at all, this meant that most of the participants had to give the impression that they did volunteer their time to help others. Therefore, providing this lie response made them appear in a more positive light than compared to Question 2. It is possible then that participants were not as self-conscious during their response for Question 4, since they did not have to fear that the interviewer was negatively judging their character. If they were not as self-aware duration this question, then this likely led to a diminished ability to control their body movements (Vrij et al., 1997), similar to the two truth conditions.

Another reason why Question 2 might have been more difficult to respond to could be due to memory interference. For instance, some research suggests that memory for visual stimuli

can be significantly impaired with the inclusion of a visual speeded judgment task (Nieuwenstein & Wyble, 2013). This implies that the secondary task of the computer game in the present study potentially could have interfered with the consolidation of memories from prior events.

If many of the participants produced a lie for Question 2 that they did not exercise (when in fact they did), their fabricated response likely interfered with actual memories of doing exercise. This, in turn, would explain an increase in cognitive load. This is in contrast to Question 4, where almost all of the participants provided a lie response that they volunteered (when actually they did not). As there were no previous memories of ever volunteering, there was no cognitive interference during their response. This likely resulted in decreased cognitive load, making it easier to tell a lie for this particular question.

Cultural differences are factors that need to be considered as well in explaining the results. Munsey (2007) stated that Chinese children are more likely to lie to help a group, whereas Canadian children were more likely to lie to help themselves or a friend. This research can potentially relate to the participants' lower body movements on each of the lie questions, considering that 50.9% of subjects identified as European American and 20.0% identified as Asian American/Pacific Islander. For instance, Question 2 required a lie response about how often the participant does physical exercise, which is an activity for the self. Question 4 about volunteering, on the other hand, required a response about helping others. The majority of participants may have placed more importance on Question 2, having more motivation to create a believable lie about themselves, as opposed to Question 4, which elicited a lie about helping others. If participants were more concerned about protecting the traits related to themselves rather than the impression they gave about helping others, this may have induced higher levels of cognitive load for Question 2.

Implications

The findings of the present research experiment suggest some practical implications for detecting deception in forensic, clinical, and other settings. For instance, police officers may benefit by increasing cognitive load to detect deception via nonverbal behavior when interviewing suspects. For instance, participants in the present study had to lie about how often they did physical exercise. If those participants who did not exercise were highly self-conscious about their physical appearance, this may have been a visual cue that the interviewer could have used to confirm that they were indeed lying.

First creating a baseline of normal behavior might help interrogators observe deceptive behavior by asking the suspect about a topic that they already know truth (such as the suspect's demographic information). Comparisons can then be made with questions that the suspect is potentially lying about. A change in behavior between response types (truth and lie) could potentially indicate that the suspect is indeed being deceptive.

An important note, however, is to observe and assess all possible cues to deceptive behavior, such as speech, nodding, and hand and lower body movements. Rather than relying on a single cue, the presence of multiple sources of information related to deception should increase the reliability that someone is being deceitful. Additionally, removing objects that can potentially block the observation of nonverbal behavior (such as a table covering the lower body or an individual holding an object in their hand) can help increase its detection. Finally, additional information gathered from an extensive interview, background check, and even psychological testing will further enhance the overall accuracy in detecting deception.

This study can have implications for the clinical setting as well. For example, if there is suspicion that a guarded client might be suicidal or homicidal and is not comfortable verbally

disclosing their true feelings or intentions, his or her nonverbal behavior can be observed as a potential indicator of their covert thoughts. That is, comparisons can be made between their lower body movements during times when they are telling the truth and when they are suspected of being dishonest. Further, the implementation of higher cognitive load should enhance these behavioral differences. Due to the mixed findings of the present study, this should not be used as the sole measure of deception.

Limitations and Future Research

With only partial significance of the results, there were some limitations to the present study. For instance, the secondary task may have been too easy. Some participants even reported having played the game in the past. This familiarity may have led those participants to allocate more cognitive resources to creating their lie rather than towards the game. Additionally, participants were in control of how fast or slow they pressed the button on the computer. Since there was no forced-choice, the participants could have taken as much time as they needed to press the button if they chose to do so, which would have left more cognitive resources available for their lie response. In future studies, a more challenging secondary task could be implemented to increase the difficulty of the dual-task activity.

Another way to increase the difficulty might be to make the lies high stakes. Respondents may act much differently if they had to lie about a murder they are suspected of committing versus how often they do physical exercise. Thus, conducting a study in an experimental setting does not quite compare to interviewing real-life suspects in police interrogations.

Another limitation was that the sample was not representative of the general population. Flyers were distributed to two university campuses to recruit participants. As people with lower intelligence and verbal skills may find it more difficult to tell a convincing lie (Mann et al.,

2004), higher intelligence and verbal competency of university students may have been a factor contributing towards the ease of producing a deceptive response for these participants.

Participants were prescreened via self-report for presence of psychotic symptoms such as delusions or hallucinations, but not other mental health disorders. It is possible that they may have experienced other behavioral symptoms such as those associated with depression, anxiety, or Attention-Deficit Hyperactivity Disorder that may have affected their physical movements during the study. Participants were not screened for medication or substance use either, which could have also influenced their responses.

The study could have been improved through the use of interrater reliability, using independent coders to score the data to assess for agreement and consistence. A challenge to timing the movements of the participants' legs and feet was that it was difficult to determine what was considered actual movement. For instance, some participants had one leg crossed over their other leg with their foot dangling in the air. As they pressed the button on the computer during the game, it was difficult to determine whether these miniscule movements in their lower body were simply due to the momentum of their upper-body movements rather than independent movements of their legs and feet. All observed movements of the participants' legs and feet were timed, which was a subjective determination made by the lead researcher. However, additional raters would improve the reliability of these timed movements.

It is important to note that the current study measured specifically lower body movements to detect deceptive behavior. As previously mentioned, research has supported that speech, nodding, and hand movements as cues that have been associated with deception. Therefore, it is possible that participants displayed deceptive behaviors in areas aside from their lower body, but those were not measured for the purpose of this experiment.

Future research might also benefit from controlling positive versus negative responses. Impression management, as previously discussed, might have been a significant factor in the divergent results between each of the lie responses, Question 2 and Question 4. If Question 2 elicited a response that made them appear in a negative light and Question 4 had a tendency to elicit a response that made them appear more positively by others, these lie questions could have been balanced to draw out the same type of impression management, either both positive or both negative.

If criminal offenders want to avoid getting caught for their crime, they may lie to the police in order to make themselves appear innocent. In other words, they may want to create the positive impression that they are law-abiding citizens. According to Gneezy's (2005) descriptions of different types of lies, people do not tell lies that will make themselves look bad. Thus, an interesting approach to observe nonverbal behavior via an increase in cognitive load could be to induce participants' negative impression management by encouraging them to tell lies that do not elicit a positive impression. One example could be asking them to identify something that they do not like about themselves. This type of question has the benefit of bringing self-awareness to the participant. This, in turn, will result in either the truth, which will reveal a negative response, or a lie, which should further increase cognitive load. Either way, this could potentially increase self-awareness and greater control over the participants' body (Vrij et al., 1997), resulting in a decrease in their lower body movements.

A final limitation of the present study is the potential effect of the incentive given to each participant. As each participant received a $5 gift card for either In-N-Out® or Subway® restaurants as part of their participation in the study, some participants may not have been very invested when creating their responses during the experiment. Though internal motivators were

implemented into the experiment, participants' may have relied more on the motivational factor of the gift card. If participants were more concerned about just getting through the study to earn their gift card and did not put in much effort for their responses, this may have reduced or even eliminated cognitive load during the experiment.

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Appendix A: Informed Consent

Study Title – Lying Behavior: The Effects of Dual-Task Performance and High Cognitive Load

I have been invited to participate in a research study conducted by Andrew Schade, a graduate student in the Clinical Forensic Psychology Program at The Chicago School of Professional Psychology, Irvine campus. I understand that there are certain requirements in order to participate in this study. To be included, I must (a) be between the ages of 18 to 49, (b) have English as my primary language, (c) not have any history of delusions or hallucinations, (d) be willing to provide truthful and deceptive responses to interview questions, and (e) be willing to be video-taped during my participation in the experiment. The following information is provided to help make an informed decision on whether or not to participate. I understand that my participation is completely voluntary and that after reading below, I may ask questions to clarify any information. One of the researchers named below will be available to answer my questions.

INVESTIGATORS:

Lead Researcher: Andrew Schade, M.A. – Clinical Forensic Psychology Program – The Chicago School of Professional Psychology, Irvine, CA.
Research Assistant: Jason Forgash – Clinical Forensic Psychology Program– The Chicago School of Professional Psychology, Irvine, CA.
Faculty Advisor: James Earnest, Ph.D. – Clinical Forensic Psychology Program – The Chicago School of Professional Psychology, Irvine, CA.

PURPOSE OF THE STUDY:

I understand that the main purpose of the study is to assess the impact of divided attention on lying ability between males and females and to gain information on how to improve the accuracy of judging truthful and deceptive behavior. Comparisons will be made between male and female participants to see which gender can attain an overall higher score on the computer task while being interviewed. In addition, your responses will be videotaped and later rated by outside observers to determine whether they think you are telling the truth or lying.

PROCEDURES:

If I agree to participate in this study, I will be asked to provide truthful statements as well as false information on my opinions, experienced biographical events, and hypothetical scenarios. I will be asked to be as convincing as possible in providing my answers to four questions that will require a response from me. I understand that the experiment procedure will consist of performing a cognitive task and an interview simultaneously, and will take less than 25 minutes of my time. The interview during the experiment will be video recorded for the purpose of creating video clips to be later shown to participants to test their ability to detect deceptive statements.

INTERVIEWERS:

I understand that in agreeing to participate in this study, I will be interviewed by one of two interviewers: Andrew Schade or Jason Forgash.

RISKS TO PARTICIPATION:

I understand that this study involves no more than minimal risk. However, I am made aware of the possibility of being made uncomfortable during the fabrication of events or opinions. If I feel discomfort during the study, I am free to withdraw at any time.

BENEFITS:

To the Participant: I understand that by participating in this study I will have the opportunity to learn about my ability to describe events or use my opinions to persuade others while doing multiple tasks concurrently. I will also learn about information related to lying and lie-detection. To Others and Society: I understand that the long-term goal of this research is to determine factors and procedures that affect the accuracy in detecting deception.

COMPENSATION/INCENTIVE:

I understand that as part of my participation in this study, I will receive a $5 gift card for either In-N-Out® or Subway® restaurants. I understand that my choice of gift card will depend on availability.

WITHDRAWAL OR TERMINATION FROM STUDY:

I understand that I am free to withdraw from the study at any point in time. There will be no consequences if I choose to withdraw from the study. I will still be entered into the random drawing to be eligible for a chance to win the incentive described above.

CONFIDENTIALITY:

Data Storage: I understand that:

1. All of my information concerning this study will remain confidential to the extent allowed by law.
2. All forms and participant data will be stored in a locked file cabinet.
3. The digital video recordings will be stored on a password-protected computer and deleted from the recording device upon completion of the data gathering. The video recordings will be used for data analysis and research training purposes. Future use of the video recordings will include identifiable information such as the events I describe during the interview, which may reveal my identity to known associates.
4. Research material will be kept by the lead researcher and/or faculty advisor for a minimum of 5 years as per APA guidelines. Only group averages will be used in journal articles and presentations. These averages will be kept for the purpose of future educational seminars and/or conferences.

VOLUNTARY PARTICIPATION:

I understand that participation in this study is voluntary. I may refuse to participate or discontinue my involvement without penalty or loss of benefits that I might otherwise be entitled to. My signature below indicates that I have read this consent form in its entirety and have had a chance to ask any questions I have about the study.

QUESTIONS/CONCERNS:

If you have any questions or concerns regarding your rights in this research study, you may contact the Institutional Review Board (IRB), which is concerned with the protection of subjects in research projects. You may reach the IRB office Monday-Friday by calling 312-467-2343 or writing: Institutional Review Board, The Chicago School of Professional Psychology, 325 N. Wells, Chicago, Illinois, 60654.

CONSENT:

The research project and the procedures have been explained to me. My participation is voluntary and I do not have to sign this form if I do not want to be part of this research project. I will receive a copy of this consent form for my records. **I consent to participate in this study.**

_____	_____	_____
Signature of Participant	Date	Signature of Investigator

Appendix B: Instructions Given to Each Participant Before the Interview

The goal of this study is to examine how well people can differentiate between truth and lies. Your responses will be videotaped and later rated by outside observers to determine whether they think you are telling the truth or lying. Additionally, comparisons will be made between male and female participants to see which gender can attain an overall higher score on the computer task while being interviewed. *Your goal will be to convince the interviewer that you are telling the truth at all times.*

You will be asked four questions in total about experienced autobiographical events, your opinions, and hypothetical scenarios. For two of those questions, you will be instructed to tell the truth. For the other two questions, you will be instructed to lie. The instructions of whether to tell a truth or lie will be written on each of the four index cards placed next to the computer. You will look at the appropriate index card when prompted by the interviewer. *Do not read the instructions aloud*, as the interviewer will be kept unaware as to whether your response will be a truth or a lie.

In addition to responding to the four interview questions, you will be doing a secondary task on the computer at the same time which will require your focus and attention. The interviewer will inform you when to pick up the appropriate index card, where the instructions of your response (truth or lie) will be written. After reading the instructions listed on the card, you may start the computer task and the interview will immediately begin. You will have only 45 seconds to provide a response to each question and you must be as convincing as possible for each of the four responses. Work as fast as you can on the computer task to obtain the highest score possible. You will have an opportunity to read the instructions for the computer task before the interview begins and do one practice round. If you have any questions for further clarification, please ask the researcher now.

Appendix C: Demographics

Age: _____

Gender:

- ☐ Male
- ☐ Female

Ethnicity:

- ☐ Caucasian/White/Euro-American
- ☐ Latino/a (Mexican American, Chicano, Central/South American
- ☐ Asian-American/Pacific Islander
- ☐ African-American/Black
- ☐ Other: _____

Appendix D: Interview Protocol

"You are participating in a study on gender differences in lying behavior. Comparisons will be made between male and female participants to see which gender can attain an overall higher score on the computer task while responding to interview questions. Additionally, the video of your responses will later be rated by outside observers to determine whether you are telling the truth or lying. Prior research has shown that people with successful careers tend to be better at deception. You will have 45 seconds to provide each of your responses. Your goal will be to convince the interviewer that you are telling the truth at all times. Please be as convincing as possible when providing your responses and work as fast as you can on the computer task. At the end of each question, I will write down your reaction time, accuracy, and total score listed on the computer screen."

Question 1:

Ask the participant to read the instructions for the secondary task on the computer screen. Allow them to practice the task for one round (45 seconds) without having to respond to any questions. Instruct them to use the arrows keys on the keyboard. Once the participant is ready, inform them that you will begin reading them the first question as soon as they begin the computer task.

Instruct the participant to pick up Index Card #1 and look at the instructions written on the card. Say to them "Please look at the instructions provided on the index card, ensuring I cannot see it, and DO NOT read it aloud."

As soon as the computer task begins:

Ask participant: **"Where are you from? Tell me about where you grew up."**

Wait for a response. If a short response, ask the participant about the event using the following prompts:

- What is the name of the town you grew up in? If outside the U.S., what country?
- Tell me about the house you grew up in.
- Tell me about the culture, the neighbors.

Total Time = 45 seconds

At the end of each question, record the participants' reaction time, accuracy, and total score listed on the computer screen, and then proceed to Question 2.

Question 2:

Instruct the participant to pick up Index Card #2 and look at the instructions written on the card. Say to them "Please look at instructions provided on the index card, ensuring I cannot see it. DO NOT read it aloud."

Once the participant is ready, inform them that you will begin reading them the question as soon as they begin the computer task.

As soon as the computer task begins:

Ask participant: **"How often do you do physical exercise and why do you choose to do it that often?"**

Wait for a response. If a short response, ask the participant about the event using the following prompts:

- What do you like or dislike about doing exercise?
- What made you decide to exercise that often?
- Do you prefer to exercise more or less? Why?

Total Time = 45 seconds

At the end of each question, record the participants' reaction time, accuracy, and total score listed on the computer screen, and then proceed to Question 3.

Question 3:

Instruct the participant to pick up Index Card #3 and look at the instructions written on the card. Say to them "Please look at instructions provided on the index card, ensuring I cannot see it. DO NOT read it aloud."

Once the participant is ready, inform them that you will begin reading them the question as soon as they begin the computer task.

As soon as the computer task begins:

Ask participant: **"What type of qualities or characteristics do you look for in a person you would consider marrying or having a relationship with and why?"**

Wait for a response. If a short response, ask the participant about the event using the following prompts:

- What is it about those qualities that you find attractive?
- Why are those qualities important to you?

Total Time = 45 seconds

At the end of each question, record the participants' reaction time, accuracy, and total score listed on the computer screen, and then proceed to Question 4.

Question 4:

Instruct the participant to pick up Index Card #4 and look at the instructions written on the card. Say to them "Please look at instructions provided on the index card, ensuring I cannot see it. DO NOT read it aloud."

Once the participant is ready, inform them that you will begin reading them the question as soon as they begin the computer task.

As soon as the computer task begins:

Ask participant: **"Tell me what you do to volunteer or help charitable organizations."**

Wait for a response. If a short response, ask the participant about the event using the following prompts:

- Why do you choose/not choose to volunteer?
- Why did you choose that particular organization to volunteer at?
- What do you like or not like about volunteering there?

Total Time = 45 seconds

At the end of each question, record the participants' reaction time, accuracy, and total score listed on the computer screen.

Appendix E: Debriefing Form

Lying Behavior: The Effects of Dual-Task Performance and High Cognitive Load

PURPOSE

This experiment is designed to examine the effects of dual-task performance (divided attention) and high cognitive load (high use of cognitive resources) on lying behavior. More specifically, comparisons of lower body movements (e.g. legs and feet) will be made between when participants are telling the truth and when they telling a lie. The purpose of the present study is to test a novel theory of lie-detection and help advance knowledge in the field of psychology where information is lacking (e.g. forensic and clinical psychology). The goal is to gain knowledge on how to improve the accuracy of judging deceptive nonverbal behavior.

BACKGROUND

Assessing nonverbal behavior to judge deception is no easy task. In fact, people can correctly judge deceit only about 50% of the time (Bond & DePaulo, 2006), the same as if they flipped a coin to make their decision or completely guessed altogether. It perhaps that people rely on false nonverbal cues to make their judgments and simply do not know what to look for when it comes to deceptive behavior.

Three nonverbal cues in particular tend to be reliably associated with deception: nodding, hand movements, and leg and foot movements. As lying increases, these movements tend to decrease (Sporer & Schwandt, 2007). People might restrict their movements as a way to prevent the leakage of nonverbal cues as being interpreted by observers as potential guilt. Research does not support any correlation between lying and averting eye contact. Also, as it is common to look someone in the face during an interaction, people are more aware that this part of their body is being observed. Therefore, the lower body, which is given less attention by both the suspected liar and observer (as cited in Bond & DePaulo, 2006), might be the more reliable part of the body to assess when attempting to judge deception.

However, due to individual differences, a key component in judging deception is to first create a baseline of normal behavior of the suspected liar. That is, behavior can be more accurately assessed during times when it is known that the subject is telling the truth and then compared to times when they are suspected of telling a lie. Differences in behavior should then be apparent when one is being honest and when he or she is being dishonest. To enhance these behavioral differences, one suggestion is to make the situation difficult for the liar (Vrij, 2004). The present study used a distraction task on a computer during the interview to divert the participants' attention. As difficulty is increased, fewer cognitive resources are left available to create a believable lie (Kemper, Schmalzried,

Hoffman, & Herman, 2010; Leal, Vrij, Mann, & Fisher, 2011).

HYPOTHESIS AND VARIABLES

The researcher of the current study hypothesizes that participants will have significantly less movement in their legs and feet when lying than when telling the truth, as measured by cumulative length of time. Two variables will be used in the present study: response type (truth or lie) and duration of lower body movements (e.g. legs and feet) as measured by cumulative length of time.

DECEPTION

Gender differences will not be assessed for the present study. This information was only provided during the experiment to encourage participants to lie convincingly and improve their performance during the experiment by the means of competition (as cited in Murayama & Elliot, 2012). Further, outside observers will not view any of the participants' video responses to judge their behavior as truthful or deceptive. Stating this information at the beginning of the experiment was used to explain the reasoning as to why participants were being recorded during the study and to conceal the fact that their lower body movements would be assessed.

CONFIDENTIALITY

Participation in the present study is kept strictly confidential. All video recordings of the participants during the experiment will be kept on a password-protected computer. Video clips from the present study will be deleted from the video recorder upon completion of the data gathering. Only the primary researcher and faculty advisor will view the video recordings from the experiment.

FINAL REPORT & CONTACT

The present study is sponsored by The Chicago School of Professional Psychology at Irvine. You are being provided with this debriefing form to ensure that you are comfortable with the tasks that you completed during the experiment that that you are able to learn additional information from this experience. You can contact the primary researcher Andrew Schade at aps4389@ego.thechicagoschool.edu if you have any questions regarding the present study or would like a copy of the final report of the study.

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