GRAMMATICAL DIFFERENCES BETWEEN TRUTHFUL AND DECEPTIVE WRITTEN NARRATIVES

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Grammatical Differences Between Truthful and Deceptive Written Narratives

by

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ABSTRACT

This study examined the predictive value of grammar structures to differentiate truthful written narratives from deceptive written narratives. Native English speakers watched a digital presentation of a person shoplifting an item from a convenience store and wrote truthful and deceptive narratives regarding the shoplifting event. The three criteria examined were total words, text bridge ratio, and spontaneous negation ratio. The results of the study showed that the combination of the three variables total words, text bridge ratio, and spontaneous negation ratio correctly predicted deceptive written narratives 67% of the time and truthful written narratives 89% of the time. The results of the cross-validation study showed that the three variables total words, text bridge ratio, and spontaneous negation ratio predicted deceptive narratives 76% of the time and truthful narratives 85% of the time.

Content Analysis of Written Statements

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CHAPTER ONE

INTRODUCTION

Identifying deception indicia remains a difficult task. People generally rely on verbal and nonverbal cues to detect deception (DePaulo et al., 2003; Kraut, 1978; Miller & Stiff, 1993; Riggio & Friedman, 1983). Researchers have reported accuracy rates for detecting deception using verbal and nonverbal cues from as low as 45% (Kalbfleisch, 1985) to as high as 86% (Ekman, O'Sullivan, Friesen, & Scherer, 1991); however, the bulk of the research clusters slightly above the 50th percentile (Burgoon, Buller, & Woodall, 1996; DePaulo et al., 2003; Ekman, 1992; Feeley & Young, 1998; Gordon & Fleisher, 2002; Kassin, 2000; Miller & Stiff, 1993; Walters, 2000; Vrij, 2000; Zuckerman DePaulo, & Rosenthal, 1981). Several researchers have attempted to develop a comprehensive index of nonverbal and verbal deceptive indicators (DePaulo et al., 2003; Vrij, 2000; Zuckerman, DePaulo, & Rosenthal, 1981); however, no one verbal or nonverbal cue has been shown to be a sole indicator of deception.

One theory of deception detection focuses on the cognitive processes that occur during deception (DePaulo et al., 2003; Zuckerman, DePaulo, & Rosenthal, 1981). Truthful people simply convey facts. Liars not only have to remember facts, but they also have to monitor their verbal and nonverbal behaviors as well as the verbal and nonverbal behaviors of the target of the lie to

ensure that the target has not become suspicious. Due to the increased cognitive processing, liars often emit verbal, nonverbal, and paralinguistic deceptive indicators (DePaulo et al., 2003). Another theory of deception detection focuses on physiological changes that typically occur in people who lie such as increased skin conductance, increased blood pressure, and changes in respiratory patterns (DePaulo et al., 2003). Since the thresholds that induce physiological changes in liars differ with each person, developing a more stable platform to examine mendacity may produce more conclusive deception indicia.

Focusing on grammar structures reduces the dependence on cognitive processing and physiological cues that detect deception. The advantage of studying grammar structures is that in both stressful and nonstressful environments deceptive people and truthful people use the same grammar rules to construct sentences. The only difference between truthful narratives and deceptive narratives is the omission or obfuscation of the truth. Focusing on grammar structures reduces the necessity to attend to cognitive processes or physiological arousal to detect deception. Words are the building blocks for sentences and grammar rules serve as blueprints for sentence construction. People construct sentences according to a predetermined set of grammar rules, which are relatively stable in native English language speakers and only vary slightly despite a wide variation in intellect,

language competence, and vocabulary strength (Chomsky, 1972; Labov, 1992). The stability of grammar rules within the English language provides a more stable platform to study the similarities and differences of grammar structures in truthful and deceptive conditions. This study will focus on liars who lie by omission rather than lie by obfuscation.

Liars who lie by omission typically do not fabricate entire stories but rather tell the truth up to the point where they want to conceal information, skip over the concealed information, and then tell the truth again (Ekman, 1992). In written narratives, grammar structures are the only mechanisms liars have to bridge the truth gap. Since words make up sentences and sentence construction follows a predetermined set of grammar rules, then a careful examination of grammar structures may identify specific grammar structures that portend deception. This study examines the predictive value of grammar structures to differentiate truthful written narratives from deceptive written narratives and posits that the grammar structures of people who tell the truth differ from the grammar structures of people who lie or deliberately withhold information.

Studying the grammatical differences between truthful and deceptive written narratives requires three measurable conditions: the objective truth, a truthful written narrative describing the objective truth, and a deceptive written narrative

describing the objective truth but omitting some element of the objective truth. In this study, the participants will be asked to watch a digital video of a shoplifting event and pretend that they are the person depicted in the digital video. The participants will write truthful narratives describing their actions in the store. After writing truthful narratives, the participants will write deceptive narratives describing their actions in the store, omitting the fact that they shoplifted. The truthful and the deceptive narratives will then be analyzed for grammatical differences.

Definition of Terms

Deception

Intent forms the infrastructure of deceptive communication (Ekman, 1992; 1996; Miller & Stiff, 1993; Vrij, 2000). A lie cannot be formulated without intent. People who communicate false information under the assumption that the information is true are not defined as liars. Likewise, mentally ill people who cannot form the intent to deceive are not defined as liars. This study will not address self-deception because self-deception often involves unconscious intent.

Knowledge constitutes another element of deception (Zhou, Twitchell, Qin, Burgoon, & Nunamaker, 2003). Ekman (1992) defined deception "as a deliberate choice to mislead a target without any notification of the intent to do so (p. 41)." No

deception occurs when people voluntarily acquiesce to deceptive communication. Actors and magicians do not meet the definition of deception because their audiences voluntarily suspend reality in exchange for entertainment. Deceptive communication also excludes social pleasantries. No one expects an honest answer to the greeting, "Hi, how are you?" Social pleasantries merely acknowledge the presence of other people and are not meant to communicate information. Social pleasantries are harmless and, in fact, necessary to maintain social relationships (Bok, 1978). Deceptive communication also excludes satire and sarcasm because the tone of voice and mannerism of the communicator ensure that the recipients of the communication understand the true meaning of the message.

Vrij (2000) expanded Ekman's definition of lying to incorporate unsuccessful attempts to tell the truth. For example, a suspicious wife asks her husband, who unbeknownst to her engaged in an adulterous affair the previous evening, why he came home so late. The husband playfully told his wife that because of his animal magnetism, the newly hired secretary lured him to her apartment and seduced him with fine wine and a gourmet meal. The husband told the truth but his wife did not believe the truth because the context within which her husband told the truth appeared outrageous. Therefore, the husband's unsuccessful attempt to tell his wife the truth resulted in a lie.

Actions can deceive. Faking illness to avoid attending an unpleasant social gathering constitutes deception. Temporal distortions constitute deception. For example, a teenager goes to the library for 5 minutes on his way to a party deceives his parents when he reports the following day that he was at the library the previous evening. Acts of omission constitute deception. Deliberately withholding information to cause the recipients of communications to believe something is true when it is not, constitutes deception. True statements juxtaposed can form a lie. For example, a person attempting to cash a forged check might say, "I just spoke to your manager. I'd like to cash this check" to mislead the cashier into thinking that the manager authorized the transaction. These two statements are true. The forger did speak to the manager about the availability of a certain product and the forger does want to cash the check.

For the purpose of this study, deception is defined as any intentional act that creates in another person a belief that the communicator knows to be untrue and is done so without prior notification of the intent to deceive.

Written Narrative

Sentences in a written narrative must relate to one another and to the event described (Franzosi, 1998). Two sentences such as “John went to the restaurant” and “Mary went to the restaurant” do not form a narrative unless John and Mary share a

logical connection to the event described. For example, the sentences “John went to the restaurant,” “Mary went to the restaurant,” and “They celebrated their 50th wedding anniversary” form a narrative. Narratives also contain movement or a disruption in the equilibrium of the events described (Franzosi, 1998).

Text Bridges

Text bridges constitute grammatical structures that circumvent withheld information. Text bridges include adverbial conjunctives, transitional words, and subordinating words. Adverbial conjunctives, transitional words, and subordinating words are grammatical devices used to smoothly transition from one idea to another idea and from one sentence to another sentence (Forlini et al., 1990).

Adverbial Conjunctives

Adverbial conjunctives encompass eight categories and transition from one idea to the next idea (Table 1). For example, Mary went to the store and then she went home. The adverbial conjunctive, *then*, connects the first complete idea, Mary went to the store, with the second complete idea, she went home.

Transitional Words

Transitional words connect themes and ideas or establish relationships (Forlini et al., 1990). For example, “It rained on

Table 1

A Comprehensive List of Adverbial Conjunctions and Their Functions

Addition	again, also, then, besides, equally important, finally, first, further, furthermore, in addition, in the first place, last, moreover, next, second, still
Comparison	also, in the same way, likewise, similarly
Concession	granted, naturally, of course
Contrast	although, yet, at the same time, despite that, even so, even though, for all that, however, in contrast, in spite of, instead, nevertheless, though, notwithstanding, on the contrary, on the other hand, otherwise, regardless, still
Emphasis	certainly, indeed, in fact, of course
Example or Illustration	after all, as an illustration, even, for example, for instance, in conclusion, indeed, in fact, in other words, in short, of course, namely, specifically, that is, to illustrate, thus, truly
Summary	altogether, finally, in brief, in conclusion, in other words, in short, in simpler terms, in summary, on the whole, therefore, to put it differently, to summarize
Time Sequence	after a while, afterward, again, also, then, as long as, at last, at length, at that time, before, besides, earlier, eventually, finally, formerly, further, furthermore, in addition, in the first place, in the past, last, lately, meanwhile, moreover, next, now, presently, second, shortly, simultaneously, since, so far, soon, still, subsequently, thereafter, too, until, when

Saturday; *therefore*, the picnic was canceled." The transitional word, *therefore*, connects the idea that it rained to the idea that the picnic was canceled. Transitional words group into four basic categories: time, contrast, result, addition, or example (Forlini et al., 1990); (Table 2).

Transitional words indicating time include *after, afterward, before, during, earlier, final, first, later, meanwhile, since then, and until* (Forlini et al., 1990). For example, "The class went on break at 10:00 a.m. During the break I drank a cup of coffee." The transitional word *during* draws a relationship between the idea of going on break and the idea of drinking a cup of coffee. Transitional words indicating contrast include *however, in contrast, indeed, instead, nevertheless, on the contrary, on the other hand, and yet* (Forlini et al., 1990). For example, "We went bowling instead of going to the movies." The transitional word, *instead*, contrasts the act of going bowling and the act of going to the movies. Transitional words indicating result include *as a result, because, consequently, on account of, so, then, therefore, and thus* (Forlini et al., 1990). For example, "Tom had no money, so he borrowed ten dollars from

Table 2

A Comprehensive List of Transitional Words and Their Functions

Time	after, afterward, before, during, earlier, final, first, later, since, meanwhile, then, until
Contrast	however, in contrast, indeed, instead, nevertheless, on the contrary, on the other hand, yet
Result	as a result, because, consequently, on account of, so, then, therefore, and thus
Addition or Example	also, besides, for example, furthermore, in addition, moreover

his brother." The transitional word, *so*, connects the idea that Tom had no money with the result of borrowing money from his brother. Transitional words indicating addition or example include *also, and, besides, for example, furthermore, in addition, moreover, and too* (Forlini et al., 1990). For example, "Sue read the novel *War and Peace* before she saw the movie." The transitional word *before* connects the idea of reading the book "War and Peace" with the action of going to see the movie.

Subordinating Words

Subordinating words connect independent clauses and dependent clauses. Independent clauses stand alone; dependent clauses cannot stand alone. For example, "After I went to the library, I went home." The dependent clause, "After I went to the library," cannot stand on its own. However, the independent clause, "I went home," can stand on its own. Subordinating words signal dependent clauses. Subordinating words include *after, although, as if, as long as, because, before, even though, if, in order that, since, so, that, than, through, unless, until, when, whenever, where, wherever, where, whenever, and while.*

Summary

This study examines the grammar structures people choose when they intentionally withhold information. Grammar structures may be more stable than nonverbal, verbal, or paralinguistic deceptive cues in that truthful people and deceptive people use

the same grammar structures. Comparing the grammar structures of truthful written narratives with the grammar structures of deceptive written narratives may yield more conclusive deception indicators.

CHAPTER TWO

LITERATURE REVIEW

Research Overview

Early researchers have identified several physiological variables that correlate with deception such as breathing irregularities (Benusi, 1914), vacillations in systolic blood pressure (Larson, 1932; Marston, 1917), and increased galvanic skin response (Summers, 1939). Based on these observations, the polygraph machine was developed. The polygraph machine measures physiological arousal during a series of structured questions based on the premise that when people lie, their physiology changes (Gordon & Fleisher, 2002). The polygraph does not detect lies but rather measures physiological arousal (Gordon & Fleisher, 2002).

Verbal and nonverbal indicators of deception rely on cognitive processes and physiological arousal. Liars typically experience guilt and anxiety, which induce cognitive stress and physiological arousal (Gordon & Fleisher, 2002; Hirsch & Wolf, 2001; Knapp, Hart, & Dennis, 1974; Kraut, 1980; Miller & Stiff, 1993; Rudacille, 1994; Walters, 2000; Vrij, 2000; Zuckerman, DePaulo, & Rosenthal, 1981). Physiological arousal causes the intentional or unintentional emission or leakage of verbal and nonverbal behaviors that may portend deception (Ekman, 1992; Miller, 1983; Miller & Stiff, 1993). Observing nonverbal and

verbal indicators of deception requires the establishment of a behavioral baseline during which there is some certainty that no deception is taking place and against which behaviors observed during deception can be compared.

The research supporting verbal and nonverbal cues to deception is inconclusive and, therefore, not very reliable, especially in practical applications (DePaulo et al., 2003; Hazlett, 2006; Vrij, 2000). DePaulo et al. (2003) conducted a meta-analysis of 1,338 estimates of 158 nonverbal and paralinguistic cues contained in 120 deception studies. The results of the meta-analysis showed that liars were more nervous than people who told the truth, included fewer annunciated flaws, more unique content, and made more negative impressions than did truthful people. The meta-analysis also showed that an increase in the motivation to lie successfully amplified nervousness and inhibition.

Notwithstanding, few nonverbal cues predict deception with any degree of certainty (DePaulo et al., 2003; Vrij, 2000). Pupil dilation has good predictive value (DePaulo et al., 2003); however, pupillary responses are difficult to detect without specialized equipment. The nonverbal cues typically associated with lying are not good predictors of veracity (DePaulo et al., 2003). These nonverbal cues include lack of eye contact; fidgeting; increased or decreased hand, arm, leg, foot, and head

movements; torso shifts; blocking and covering gestures; positional shifts; and self-touching (DePaulo et al., 2003). The inability to recognize the more accurate nonverbal cues to deception may contribute to the poor ability of people to detect deception (Ekman & O'Sullivan, 1991; DePaulo et al., 2003; Vrij, 2000).

Like nonverbal cues to deception, paralinguistic cues are poor predictors of deception. Paralinguistic cues relate to the actual production of speech but not specific speech content (Hazlett, 2006). Paralinguistic cues include the tonality, inflection, latency, pitch, tension, and duration of speech (Hazlett, 2006). When liars speak, they tend to use a higher voice pitch (DePaulo et al., 2003); however, the change in voice pitch is difficult to detect without the aid of specialized equipment. The remaining paralinguistic deception cues are not good predictors of mendacity (DePaulo et al., 2003).

One reason for the mixed results in the DePaulo et al. (2003) meta-analysis may be the socio-economic composition of the studies' participants. Over 80% of the 120 deception studies that were reviewed used college students as participants. College students are typically better educated than the general population, have fewer real-life experiences, and are less motivated to lie. The stresses college students face when they are asked to lie are substantially less than the stresses

criminals face during police interrogations. Liars who are highly motivated to succeed may emit clearer deceptive cues than college students who are given permission by researchers to lie or are given insufficient inducement to succeed. Of the 120 studies reviewed by DePaulo et al., (2003), only 52 studies offered incentives.

Another reason for the mixed results may be the small sample size of the studies. The average number of participants in the 120 studies reviewed by DePaulo et al., (2003) was 40. The smaller sample sizes can only account for the most powerful deception cues and may not detect moderately effective deceptive cues (Hazlett, 2006). Further, the effect size of deceptive cues is small and may not provide an accurate indication of the effectiveness of the most powerful deception indicators (Depaulo et al., 2003). Instead of focusing on verbal, nonverbal, or paralinguistic cues to deception, the examination of the grammar structures people choose to use when they deceive may provide additional insights into how people lie.

Early Psycholinguistic Research

Psycholinguistic research began in the early 1900s. Southard (1916a, 1916b) theorized that verb tense and mood are grammatical elements that reflect people's subjective experience with their environment. Busemann (1925) empirically supported Southard's theory by demonstrating that the number of verbs and

adjectives correlates positively with emotional stability. This correlation is labeled the Verb/Action Quotient (VAQ; Buseman, 1925). Johnson (1944) developed a research method called Type/Token Ratio (TTR). TTR represents the ratio of the different types of words to the total number of words referred to as tokens found in narratives. Subsequent research found that schizophrenics had lower TTR scores than the TTR scores of the normal population (Vetter, 1970). This early research suggests a correlation exists between grammatical structure and the words people use to communicate their thoughts and emotions and their perceptions of the outside world. These findings lend credibility to the notion that the study of grammatical structure and words may form a stable platform to examine veracity.

The behaviorist movement changed the direction of psycholinguistic research and refocused research efforts on behaviors that could be directly observed and measured (Skinner, 1957). Behaviorists did not deny the existence of mental processes such as thoughts and emotions; they simply considered thoughts and emotions as having no quantifiable measures (Skinner, 1957). Therefore, the study of psycholinguistics lapsed until Noam Chomsky posited the generative-transformational language theory.

Generative-Transformational Grammar

Generative-transformational language theory posits that a set of universal grammar principles is innate to humans and that language develops from within each person in a predetermined way consistent with environmental conditions and not learned as the behaviorists hypothesized (Chomsky, 1957/2002, 1965).

Transformational-generative grammar posits that a set of rules (transformations) regulate the interactions between the parts of a sentence with the assumption that beneath syntactic word order a fundamental structure exists, which Chomsky labeled deep structure. Deep structure consists of a syntactical phrase that is subjected to a set of constraints or rules called transformations. After the syntactical phrase has been transformed by the addition of words and punctuations, a more complex sentence forms at the surface structure (Chomsky, 1957/2002). All languages share the same deep structure (i.e., verbs, nouns, and objects) but they differ at the surface structure due to the application of various transformations.

The theory of transformational-generative grammar does not imply that all languages have the same grammar or that humans are preprogrammed with a set of grammar structures (Chomsky, 1957/2002). The theory of transformational-generative grammar attempts to explain how humans, notwithstanding varied cultural

backgrounds, construct valid sentences in their own languages without formal training.

Grammar structure is relatively stable in native English speakers and only varies slightly among same-language speakers despite a wide variation in intellect, language competence, and vocabulary strength (Chomsky, 1972). Labov (1992) supported the stability of grammar structure in native English speakers and concluded that “in the various empirical studies that we have conducted, the great majority of utterances –- about 75 percent -– are well-formed sentences by any criterion. When rules of ellipsis are applied and certain universal editing rules to take care of stammering and false starts, the proportion of truly ungrammatical and ill-formed sentences falls to less than two percent” (p. 42).

Liars Use Fewer Words

Research has shown that liars use fewer words and their statements contain less relevant information when they deceive (Connelly et al., 2006; Dulaney, 1982; DePaulo et al., 2003; DePaulo, Stone, & Lassiter, 1985; Ekman, 1992; Kraut, 1980; Knapp, Hart, & Dennis, 1974; Miller & Burgoon, 1981; Rabon, 1994; Sapir, 1996; Suiter, 2001; Vrij, 2000; Zuckerman, DePaulo, & Rosenthal, 1981; Zuckerman & Driver, 1985). In an effort to isolate verbal cues that differentiate truthful written narratives from deceptive written narratives, Dulaney (1982)

conducted a study in which 10 male and 10 female undergraduate students participated in a problem-solving exercise. Confederates presented an opportunity for the students to cheat. After the problem-solving exercise, the experimenter debriefed the undergraduates. The results of the experiment determined that the students who lied about cheating used fewer words. In support of Dulaney's findings, Knapp, Hart, and Dennis (1974) found that liars used fewer words than truthful people. Liars tend to use fewer words when describing fabricated events because a story with fewer words is easier to remember than a story with a large number of words (De Paulo et al., 2003; DePaulo, Stone, & Lassiter, 1985; Dulaney, 1982; Knapp, Hart, & Dennis, 1974; Kraut, 1980; Rabon, 1994; Sapir, 1996; Suiter, 2001; Zuckerman & Driver, 1985). Liars tend to keep descriptors to a minimum because they did not experience the event firsthand and possess fewer facts about the topic of their deception (Connelley et al., 2006; Ekman, 1992; DePaulo et al., 2003; Rabon, 1994; Sapir, 1996; Suiter, 2001; Vrij, 2000). In the event liars are asked to repeat their stories, fewer facts are easier to command than stories filled with a large amount of fabricated details (Vrij, 2000; Ekman, 1992; DePaulo et al., 2003).

Newman, Pennebaker, Berry, and Richards (2003) developed the Linguistic Inquiry and Word Count (LIWC) a linguistic computer software program that analyzes written narratives for mendacity

(Newman et al., 2003). LIWC is a linguistic database with more than 2,000 words divided into 72 categories used to examine written text for veracity (Pennebaker, Francis, & Booth, 2001). A developing profile for deceptive statements based on the LIWC suggests that liars tell stories that are less complex, use fewer self-relevant terms, and are more negatively charged (Newman et al., 2003). As more studies are conducted using LIWC, a more definitive profile of how liars use language to deceive will become more apparent.

Researchers and practitioners developed comprehensive techniques to examine the differences between truthful and deceptive narratives. The following is an overview of the major techniques of detecting deception in oral and written narratives.

Content-Based Criteria Analysis (CBCA)

In 1954, the West German Supreme Court convened a small but elite group of forensic psychologists to determine if they could devise a method to discern truthful statements from deceptive statements in child sexual abuse cases. The psychologists developed Statement Validity Assessment (SVA). The West German Supreme Court accepted SVA and mandated that the criminal justice system use SVA to determine the credibility of statements made by children in sexual abuse cases. The oral interviews of child abuse victims are typically transcribed and then analyzed using SVA criteria to determine the veracity of the victims'

statements. Other European courts subsequently accepted SVA as evidence; however, the United States courts remain skeptical as to the effectiveness of SVA.

SVA is founded on a hypothesis formulated by Undeutsch. Undeutsch postulated that statements based on actual memories differ from statements based on fabrication or fantasy (Vrij, 2000). SVA divides statements into three components: a structured interview, a criteria-based content analysis (CBCA), and an evaluation of the CBCA outcome using the Validity Check-list (Vrij, 2000). Investigators conduct a structured interview of a child using a series of open-ended questions. The transcribed interviews are then analyzed using CBCA. CBCA consists of 19 criteria divided into four categories: a) general characteristics, which include the criteria logical structure, unstructured production, and quality of details; b) specific content, which include the criteria contextual embedding, descriptions of interactions, reproduction of conversation, unexpected complications during the incident, unusual details, superfluous details, accurately reporting details, which may have been misunderstood, relating external associations, accounts of subjective mental state, and attribution of perpetrator’s mental state; c) motivation, which include the criteria spontaneous corrections, admitting lack of memory, raising doubts about one’s own testimony, self-depreciation, and pardoning the perpetrator;

and d) offense-specific elements, which include the criterion details characteristic of the offense (Vrij, 2000). Trained evaluators review statements and judge the presence or absence of the 19 criteria, which are scored on a 3-point scale: 1 point for the presence of the criteria, 2 points if the criteria are strongly present, and zero if the criteria are absent. CBCA is designed to judge statements on a truthful continuum, not a deception continuum. A score of 38 indicates that all the criteria are strongly present, increasing the probability of statement veracity.

The CBCA score is then subjected to the Validity Checklist, which consists of 11 items divided into four categories: a) psychological characteristics; which include the criteria inappropriateness of language and knowledge, inappropriateness of affect, and susceptibility to suggestion; b) interview characteristics, which include the criteria suggestive, leading or coercive questioning and overall inadequacy of the interview; c) motivation, which include the criteria questionable motives, questionable context of the original disclosure or report, and pressures to report falsely; and d) investigative questions, which include the criteria inconsistency with the laws of nature, inconsistency with other statements, and inconsistency with other evidence. Researchers have studied SVA in both the laboratory and in naturalistic settings (Boychuk, 1991; Esplin, Boychuk, &

Raskin, 1988; Lamb, Sternberg, Esplin, Hershkowitz, Orbach, & Hovac; 1997). As with all deception research, studying CBCA in the laboratory is difficult because recreating real-life situations in an artificial environment presents a formidable task. The chief advantage of a laboratory setting is that a known lie can be isolated. In the laboratory setting, studies have shown that CBCA is effective in differentiating truthful statements from fabricated statements; however, the differences are less pronounced in naturalistic settings (Landry & Brigham, 1992; Porter & Yuille, 1996; Vrij & Heaven, 1999; Zaparniuk, Yuille, & Taylor, 1995).

CBCA was initially designed to test the truthfulness of statements from children; however, CBCA has been modified and tested on adult populations. The results of this research tend to support the efficacy of CBCA to discriminate between truthful statements and deceptive statements in adult populations (Dana-Kirby, 1997; Landry & Brigham, 1992; Porter & Yuille, 1996; Ruby & Brigham, 1998; Vrij, 2000; Zaparniuk, Yuille, & Taylor, 1995). Suiter (2001) found some support for CBCA using the following criteria: extraneous information, reported speech, and the participant’s mental state. Vrij (2000) conducted a review of 37 studies of CBCA and found that this method was not sufficiently reliable in court proceedings; however, he did note that CBCA could be used as an effective investigative tool. Although CBCA

shows promise as an effective investigative tool, the technique is a lengthy process and relies on trained judges. In that CBCA is subjective, two or more judges are required to make an accurate assessment of written statements and the judges must be competently trained in the use of the CBCA technique.

The effectiveness of CBCA is also dependent on the method used to acquire statements. If statements are not solicited according to CBCA criteria, then the CBCA results may be called into question. Likewise, if the CBCA rating does not take the Validity Checklist into consideration, the CBCA rating may be confounded.

Theoretical Verbal Analysis (TVA)

TVA has identified 195 criteria distributed over six categories that discriminate truthful communications from deceptive communications. The six categories are a) autobiographical memory, b) cognitive processes, c) emotional processing and expression, d) defense mechanisms, e) linguistics, and f) self-presentation and attribution. Germane to this study are TVA's truthful and deceptive criteria. The truthful criteria include actions explained in terms of the "big picture," active language when relating success, communicating statements in a logical orderly fashion, inclusion of unusual details, focusing on events, inclusion of details when relaying a story, justifying facts with past experiences, using active language, providing

less information about specific interactions with people, providing enough information for general understanding, responses that include combinations of action and state verbs, and using interpretive action verbs when relaying actions (Connelly et al, 2006).

The deceptive criteria include answering questions other than the ones asked, vague descriptions of events or situations, not discussing cause and effect, frequent use of adjectives such as honest and reliable, using more state verbs, infrequent use of adverbs, interpreting events through the people involved, a large presence of passive language, less reference to situational, social, or contextual variables shaping behavior, limiting the use of self references, no discussion of emotional states, no explanation of behavior, not convincing in relaying outcome, using passive language when relaying failure, speaking in formal language, statements that are too long or too short based on demands of the interview situation, statements focusing on objective actions not cognitive states, and statements focusing on objective actions and not evaluations of actions (Connelly et al, 2006).

In two experiments, Connelly et al. (2006) conducted mock job interviews wherein the experimental participants were instructed to either tell the truth or lie to job interviewers. The results of the first study determined that both TVA and CBCA

are effective methods to discriminate between truthful and deceptive statements; however, TVA outperformed CBCA. In the second experiment, Connelly et al. (2006) compared TVA with CBCA under three deceptive conditions: fabricated stories, concealed information, and embellishment. TVA and CBCA have proved effective in discriminating deceptive statements; however, TVA again outperformed CBCA.

CBCA and TVA may be effective methods for evaluating the veracity of written communications; however, both systems have several drawbacks. First, CBCA and TVA cannot be used effectively in real-time communications due to the extensive analysis necessary to determine truthfulness or deception. Second, the last two SVA checklist criteria, consistency with other statements and inconsistency with other evidence, require extensive investigation. Under exigent circumstances when investigators must determine veracity with minimal time and information, CBCA and TVA are not useful techniques to determine veracity due to the lengthy evaluation process. Likewise, TVA requires a lengthy examination of written statements using 31 criteria. Examiners who have the luxury of time can evaluate written statements more thoroughly than practitioners who need real-time information. Satisfying the requirements of the extensive criteria for CBCA and TVA is tantamount to conducting a full-field investigation and typically, at the end of a full

field-investigation, the truth becomes self-evident, especially if the information in written statements is examined for consistency with other statements and inconsistency with other evidence. Third, in both CBCA and TVA the criteria are subjective and more than one judge is required to make a determination of veracity. In one study judges were only trained for 45 minutes in the use of the CBCA technique (Ruby & Brigham, 1998). The amount of training necessary to make a judge competent in judging CBCA or TVA criteria is not standardized. Judges who are not competent in judging CBCA and TVA criteria may make inaccurate decisions as to the veracity of written statements. Analyzing written texts using objective criteria such as grammatical devices eliminates the need for more than one examiner to judge mendacity and provides real-time feedback to the examiner.

Reality Monitoring (RM)

Reality Monitoring was developed to study memory characteristics (Johnson & Raye, 1998). RM consists of eight criteria: clarity, perceptual information, spatial information, temporal information, affect, reconstructability of the story, realism, and cognitive operations.

The premise of RM is that real memories are based on perceptual information, contextual information, and affective information (Colwell, 2002; Zhou et al., 2003). In other words,

memories contain physical cues such as visual details, smells, tastes; contextual information such as when, where, and how an event took place; and affective information such as personal feelings that occurred during the event. Conversely, fabricated stories derive primarily from cognitive operations and tend to be vague and less detailed (Colwell, 2002; Johnson & Raye, 1998).

Clarity is present if the narrative is detailed rather than vague. Perceptual information is present if the narrative contains physical sensations such as smell, tastes, visual details, or tactical cues. Spatial information is present if the narrative contains locations of people and things. Temporal information is present if the narrative contains time sequencing of events. Affect is present if the narrative contains the personal feelings of the writer that occurred during the event being described. Reconstructability of the story is present if the event can be reconstructed using the details provided within the narrative. Realism is present if the narrative is logically constructed. Cognitive operations are present in the narrative if the writer includes the thought processes of the participants in the narrative such as “She looked as though she was afraid when...”

Limited experimental studies have been conducted to determine the validity of RM in discerning truthful statements from deceptive statements. Using the RM criteria, Vrij (2000)

obtained an accuracy rate of 71% for detecting truthful statements and 74% for identifying deceptive statements. Hofer, Akehurst, and Metzger (cited in Vrij, 2000) obtained an accuracy rate of 61% for detecting truthful statements and an accuracy rate of 70% for detecting deceptive statements. Sporer (1997) obtained an accuracy rate of 75% for detecting truthful statements and an accuracy rate of 65% for detecting deceptive statements.

The extant research seems to indicate that RM criteria are effective in detecting deception; however, these results were obtained in the laboratory. The effect of RM may diminish in field studies because memories tend to fade over time, thus limiting the ability of a person to vividly recall an event (Klatzky, 1975; Schacter, 1996). The type of questioning during the interview process may also diminish the efficacy of RM. Closed-ended questions produce fewer details than open-ended questions and the cognitive interview produces more details and information than both closed and open-ended questions. Until more research is conducted, RM should be used with caution.

Scientific Content Analysis (SCAN)

Scientific Content Analysis (SCAN) examines written statements based on their internal consistency and does not rely on outside reality to determine veracity as does CBCA and TVA. SCAN supposes three conditions: the truth, a mistake, and a lie.

The truth reflects consistency between the writer's subjective knowledge, the writer's statement, and outside reality (Sapir, 1996). A mistake reflects consistency between the writer's subjective knowledge and the writer's statement but is inconsistent with outside reality (Sapir, 1996). A lie reflects inconsistency among the writer's subjective knowledge, the writer's statement, and with outside reality (Sapir, 1996). With respect to mistakes, the writer's statement will not show deceptive indicators because the writer believes what he or she is writing is true, although the statement is contrary to outside reality (Sapir, 1996). A deceptive statement, however, should produce deceptive indicators because the writer knows that what he or she is writing is in opposition to his or her subjective knowledge and with outside reality (Sapir, 1996). SCAN purports to capitalize on the deceptive techniques used by writers to distance themselves from the events in question.

SCAN does not discern truthful statements from deceptive statements but rather highlights areas in written narratives that may indicate deception and need further clarification (Sapir, 1996). According to Sapir (1996), choice of language is constrained by grammar rules, the writer's linguistic knowledge, the writer's life experience, as well as the context within which the narrative is written. Sapir (1996) contends that examining the writer's choice of words and how those words are used in

sentences forms a unique linguistic code for the writer. Sapir (1996) further contends that the SCAN technique is not affected by intelligence or language competence, but rather relies on unique changes within the writer's language usage. Sapir (1996) posits that everything a person says has meaning.

SCAN criteria include inappropriate social introductions, improper use of pronouns, change in language, lack of memory about an incident, nonsequential information, non sequiturs, no denials of the accusation, spontaneous corrections, structure of the statements, verb tense changes, and unnecessary connections (Sapir, 1996).

Inappropriate social introductions – The writer's first reference to a person in a written statement is similar to a social introduction (Sapir, 1996). If the writer does not properly introduce a person, then something is amiss with the relationship between the writer and the person he or she introduced (Sapir, 1996). Sapir (1996) states that "before the reader/listener would be able to say that 'Lisa' is the writer's wife, the writer has to refer to her as 'my wife'" (p. 67) in the writer's written statement. If the writer does not do so, then Lisa may be the writer's wife in reality but not a wife in language. In this example, the relationship between the writer and his wife should be further explored to determine why the writer did not properly introduce Lisa.

Improper use of pronouns – Pronouns signal commitment, acceptance of responsibility, and personal relationships (Sapir, 1996). The lack of the pronoun *I* signals lack of commitment by the writer to the statement he or she wrote (Sapir, 1996). For example, a murder suspect writes "Got home and found the wife dead" portends deception. The writer should have written "*I* got home. . ." Because the writer did not commit to this statement, he may be deceptive. In the same statement, the writer wrote "and found the wife dead." The writer did not use the possessive pronoun *my* but, instead used the article *the*, which suggests the writer and his wife had a distant relationship because the writer failed to closely align himself with his wife. The improper use of pronouns in the writer's statement signals deception or, at best, an area that needs to be further explored (Sapir, 1996). Sapir (1996) stated that "pronouns produce almost 80 to 90% of the admissions and confessions within a statement" (p. 71) and specifically, 70% of all murder investigations are resolved based on pronouns that dispute possession (mine v. yours; Sapir, 1996).

Changes in language - Truthful people consistently use the same vocabulary in their statements (Sapir, 1996). Sapir (1996) stated that "a change in language reflects a change in reality" (p. 73). For example, a supposed witness initially used the word *rape* to describe what happened and then substituted the word *crime* for the word *rape*. Still later in the statement, the

writer substituted the word *incident* for the word *crime* and finally the writer substituted the word *event* for the word *incident*. This change in language suggests that the writer diminished the harshness of the crime (Sapir, 1996). The writer may have changed his language because he did not see himself as a rapist and thus diminished the harshness of the crime from a rape to an event (Sapir, 1996). The writer's change in language leaves open the possibility that the writer may have participated in the rape and is not a witness as he originally claimed (Sapir, 1996). The change in language signals the investigator to further question the writer as to his possible participation in the crime (Sapir, 1996).

Lack of memory about an incident – A lack of memory about an incident demonstrates a lack of commitment on the part of the writer (Sapir, 1996). To avoid providing information, the writer will typically write, "I don't remember" or "I don't recall." Lack of memory is also demonstrated in statements such as "I think," "I believe" "Kind of," or "I'm not sure." A lack of memory signals the possibility of deception (Sapir, 1996).

Nonsequential information – Sapir (1996) states "that nothing is ever really out-of-sequence. It is only out-of-sequence for the reader/listener, but it is 'in sequence' for the suspect. When the reader/listener understands the statement completely, everything will be in sequence" (p. 43).

Narratives are typically written in chronological order (Sapir, 1996). A truthful person simply relates the facts as they occurred in time because he or she has nothing to hide (Sapir, 1996). However, a deceptive person has difficulty writing about an event in chronological order because he or she must omit an event that is part of the chronology and replace it either with another event or skip over the information (Sapir, 1996).

Non sequiturs – Sapir (1996) contends that when a writer includes irrelevant information in a narrative, deception may be indicated. In reality, irrelevant information is really relevant to the writer, but the writer is trying to diminish the relevance of the information to the reader (Sapir, 1996). The inclusion of irrelevant information identifies a topic that requires a more detailed examination (Sapir, 1996).

No denials of the accusation – Sapir (1996) postulates that truthful people who are falsely accused often make direct denials of the accusation. Conversely, deceptive people often avoid denials of the accusations.

Structure of the statements – Sapir (1996) divides spontaneously written statements into three sections: the prologue, the event, and the epilogue. The prologue begins with the first sentence and ends with the sentence before the writer first discusses the event (Sapir, 1996). The event portion of the written statement begins with the first sentence where the

event is discussed (Sapir, 1996). The epilogue begins after the last sentence discussing the event and continues until the end of the statement (Sapir, 1996). According to Sapir (1996), the truthful statement is proportioned as follows: prologue 20%, event 50%, and epilogue 30% (Sapir, 1996). Any significant deviations from this ratio indicate deception (Sapir, 1996).

For example, if the prologue is less than 10% of the written statement, then the writer does not want to reveal what happened just prior to the event, which may indicate that the writer does not want to take responsibility for his or her actions that lead up to the event (Sapir, 1996). People are often reluctant to lie and will put off telling the lie as long as possible resulting in a prologue greater than 10% of the statement (Sapir, 1996). Truthful people will keep their prologues at approximately 10%. Any deviation above or below 10% signals deception (Sapir, 1996).

If the event portion of the written statements is less than 50% of the statement, then the writer simply glosses over the event using as few words as possible to avoid the psychological stress of lying (Sapir, 1996). Event portions exceeding 65% often indicate deception because the writer often includes non sequiturs or irrelevant information to distract the reader (Sapir, 1996). If the epilogue portion of written statements is less than 20 percent, then the writer does not want to reveal his or her actions just after the event occurred because the writer

has finished lying and wants to immediately end the narrative to relieve the psychological stress of lying (Sapir, 1996).

Verb tense changes – Sapir (1996) postulated that truthful statements are written in the first person singular, simple past tense. Using the first person singular shows that the writer is committed to what he or she is writing and therefore is probably truthful (Sapir, 1996). Using simple past tense shows that the writer retrieved the information from memory and not from a fabrication (Sapir, 1996).

Unnecessary connections – Sapir (1996) defines unnecessary connections as any part of the sentence that can be removed without disrupting the continuity of the statement. Sapir (1996) identified words such as *left, finally, started, began, tried,* and *commence* as unnecessary connections that are used by the writer as substitute expressions to replace missing information.

The SCAN technique is gaining popularity, especially in law enforcement applications; however, little empirical research has been conducted to evaluate the effectiveness of the technique. Support for the efficacy of SCAN is divided between anecdotal evidence (Adams, 1996; Lesco, 1990; McClish, 2001; Rabon, 1994; Rudacille, 1994) and studies using more stringent research methods (Driscoll, 1994; Smith, 2001; Shearer, 1999). Smith (2001) conducted a study to determine if SCAN is a viable method to discern truthful from deceptive written narratives. Twenty-

seven statements were examined by five groups of assessors with varying degrees of SCAN expertise ranging from no experience to very experienced. The results of the study demonstrated that assessors with SCAN experience identified deceptive statements 65% of the time as compared to assessors with no SCAN experience who identified deceptive statements 45% of the time.

Smith (2001) found that the experienced assessors did not use a standardized method to apply SCAN criteria, which limits the generalizability of the results of the study. Smith (2001) concluded that investigators who are experienced in the use of the SCAN technique improved their ability to correctly identify truthful and deceptive statements. SCAN also assisted investigators in identifying areas in written narratives that require additional inquiry (Smith, 2001). Measuring the effectiveness of SCAN is difficult if the experienced assessors do not use a standardized method to apply SCAN. Experienced investigators bring a wide range of experiences and skill levels to judge the veracity of individuals. Perhaps the investigators relied on these skills to judge veracity and not the SCAN techniques exclusively. Until assessors use a standardized method to apply SCAN techniques, the effectiveness of SCAN will remain in doubt.

Driscoll (1994) enlisted 30 participants, 25 males and 5 females, to write truthful and deceptive narratives. The study

showed that the SCAN predictor variables unnecessary connections, violation of the first-person simple past tense formula, failure to deny the accusation, and changes in language were indicators of deception, failure to deny the accusation being the best SCAN predictor.

Investigative Discourse Analysis (IDA)

Rabon (1994) extended the principles of SCAN with IDA, a more organized approach to content analysis. The premise of IDA is similar to SCAN in that individual word selections are important and have meaning to the writer. Rabon (1994) posited that truthful people select certain words to convey information to the reader, while deceptive people select certain words to influence the perception of the reader rather than convey factual information. Rabon's (1994) theory states that "an individual who aims to convey rather than convince will behave differently in terms of his/her narrative development" (p.16). Deception confounds the construction of sentences because the objective truth must be suppressed and replaced with deceptive information. Rabon (1994) contends that IDA can detect "telltale traces" of deception.

Suiter (2001) compared the efficacy of IDA to CBCA. Suiter (2001) asked 46 college freshmen to write both true statements about the events in their days and false statements about events in their days. Suiter (2001) subjected these statements to IDA

and CBCA criteria. The study determined that false statements use more abjuration terms than truthful statements. Rabon (1994) defined abjuration as words that withdrew the assertion previously made. Abjuration words include: *but, yet, however, although, nevertheless, though*, and *anyway*. Suiter (2001) found that writers who wrote false statements used abjuration words twice as often as writers who wrote truthful statements, lending some support to the IDA criteria and by extension the SCAN criterion of missing connections. Suiter (2001) also found that the use of the word *when* was prevalent in deceptive statements, indicating a temporal lacuna. Other words that indicated temporal lacunae include *after that, afterwards, at that time, at that point, later on, by the time*, and *all of a sudden*. Suiter (2001) cautions that a temporal lacuna, in and of itself does not indicate deception. However, this finding supports Rabon's (1994) notion of temporal lacuna and Sapir's (1996) notion of missing connections. Suiter (2001) also found no support for statement balance. The lengths of prologues, events, and epilogues of truthful statements did not significantly differ from the lengths of prologues, events, and epilogues of deceptive statements. In a later study, Adams (2002) found some support to indicate that an unbalanced statement was correlated with deception.

Research Summary

Translating the theories and techniques of detecting deception into practical applications is difficult for several reasons. First, no one cue indicates deception; therefore, interviewers must rely on a constellation of deceptive indicators. Relying on a constellation of cues is difficult because only a few deception cues have been identified as consistently reliable.

The second reason preventing deception theories from translating into practical applications is that the arousal based theory and, to a lesser extent, the cognitive load theory relies on detection apprehension, which triggers nonverbal, verbal, and paralinguistic deception cues. Truthful people who believe that the interviewer does not believe them may exhibit the same physiological responses as do deceptive people. Each person has a different physiological threshold depending on the severity of the consequences of the deception. Some people can cope with stressors better than others, so it is difficult to judge when the physiological threshold has been crossed during deception. Additionally, each person reacts to stress differently, thus a wide range of verbal, nonverbal, and paralinguistic cues must be identified, catalogued, and subjectively judged as deception indicia. The subjectivity of judging verbal, nonverbal, and

paralinguistic deceptive cues further confounds the isolation of cues that signal deception.

Text Bridges

The proposed study takes a unique approach to detecting deception. Instead of measuring verbal and nonverbal cues triggered by physiological changes, this study will examine the grammar structures people use during deception. Deceptive people who lie by omission must use grammar structures that allow them to construct a series of sentences that circumvent or bridge the information that deceptive people desire to withhold.

Most liars do not fabricate entire stories but rather tell the truth up to the point where they want to conceal information, skip over the information they want to conceal, and continue to tell the truth (Ekman, 1992). At the point where liars want to conceal information, they use a grammar structure or *text bridge* to cross over the concealed activity (Figure 1). Text bridges are linguistic features that may provide a grammatical foundation for differentiating truth from deception or deliberately withheld information.

Grammatically bridging the withheld information is similar to bridging a river. A road is laid up to the river's edge and stops. A bridge spans the river and the road continues on the

other side of the waterway. Bridges come in a variety of designs, but each design must adhere to specific construction standards or the bridge will collapse. Likewise, sentence

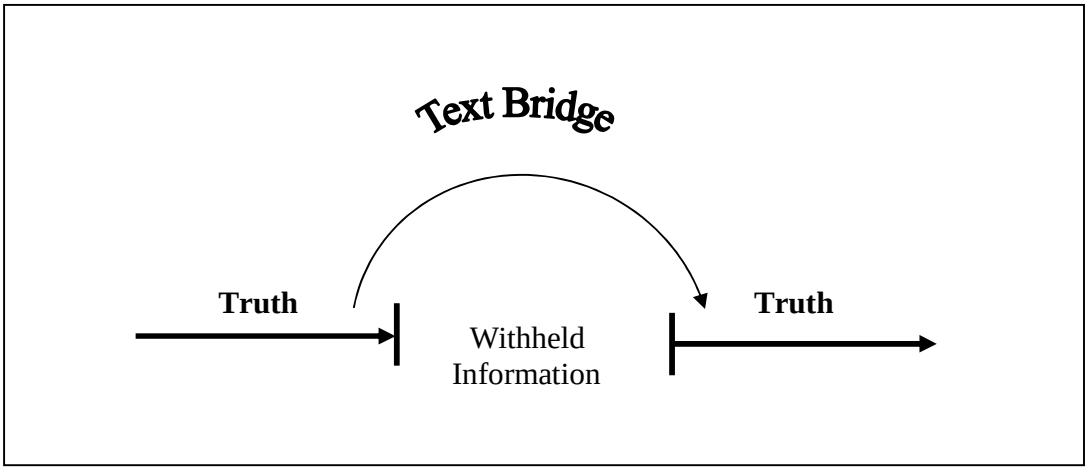

Figure 1. Diagram of a text bridge.

construction must follow certain grammatical rules. The grammar rules used by a deceptive person to construct sentences are the same grammar rules used by a truthful person to construct sentences. Identifying the grammatical structures isolates the portion of the narrative that contains withheld information.

Using grammatical rules to detect withheld information provides a standard measure against which to record changes in truthful and deceptive narratives. A review of English grammar has identified three grammar structures that function as text bridges: adverbial conjunctives, transitional words, and subordinating words (Forlini et al., 1990). Before examining text bridges in detail, a review of basic sentence construction

is essential in that text bridges are an integral part of sentence construction.

Sentences in the English language divide into four basic types: the declarative sentence, the imperative sentence, the interrogative sentence, and the exclamatory sentence. This study focused on declarative sentences. Declarative sentences further subdivide into four forms: simple, compound, complex, or compound-complex (Forlini et al., 1990). A simple declarative sentence contains a subject and a verb, for example, “Birds fly.” A compound declarative sentence contains two or more independent clauses (Forlini et al., 1990), for example, “John read a book and he wrote an essay.” A complex declarative sentence consists of one independent clause and one or more subordinate clauses (Forlini et al., 1990), for example, “Tom answered the phone when his wife called.” A compound-complex sentence consists of two or more independent clauses and one or more subordinate clauses, for example, “The car ran out of gas, and the driver walked five miles because no one could drive him to the filling station.”

Temporal-Spatial Lacunae

The simple declarative sentence structure restricts temporal-spatial lacunae. Using a simple declarative sentence, a bank robber can say either “I robbed the bank” or “I did not rob the bank.” Using a compound declarative sentence structure, the same bank robber can either say, “I robbed the bank, and John

drove the getaway car" or "I did not rob the bank and John did not drive the getaway car." By definition, compound sentences consist of two or more independent clauses and, thus, place limitations on temporal-spatial lacunae. The conjunction *and* does create temporal-spatial lacunae to some degree because the conjunction carries the implied "and then" in some instances. Complex sentence and compound-complex sentence patterns allow for gross distortions in temporal spatial lacunae. For example, in the sentence, "When I came home from work, I found my wife dead," a temporal-spatial lacuna exists between the subordinate clause, After "I came home from work"-- and the main clause, --"I found my wife dead." The writer does not explain what took place from the time he arrived home until the time he found his wife dead. Two possibilities exist. First, the writer told the truth and used the text bridge as a behavioral contraction to consciously or unconsciously withhold his activities from the time he came home until the time he found his wife dead. Text bridges do not signal deception but the presence of temporal-spatial lacunae. Second, the writer used the temporal-spatial lacuna created by the text bridge *after* to skip over the fact that when the man arrived home from work, he got into a violent altercation with his wife and killed her.

Subordinating clauses connect unequal but related ideas to form complex sentences (Forlini et al., 1990). Subordinating

clauses begin with words such as *after, although, as if, as long as, because, before, even though, if, in order that, since, so, that, than, through, unless, until, when, whenever, where, wherever*, and *while*. Because subordinating clauses create temporal-spatial lacunae, liars can secrete information. Again, truthful people can use subordinating clauses as behavioral contractions to consciously or unconsciously withhold information that they consider lesser included activities of the larger activity in which they are engaged or simply omit the information because they consider the information to be irrelevant.

Transitional words create temporal-spatial lacunae wherein liars can conceal information. As with subordinating words, truthful people can use transitional words as behavioral contractions to consciously or unconsciously withhold information that they consider lesser-included activities of the larger activity in which they are engaged or simply omit the information because they consider the information to be irrelevant.

Adverbial conjunctives connect two complete ideas (Forlini et al., 1990). Adverbial conjunctives include *accordingly, again, also, besides, consequently, finally, furthermore, however, indeed, moreover, nevertheless, otherwise, then, therefore*, and *thus* (Forlini et al., 1990). Adverbial conjunctives create temporal-spatial lacunae wherein liars can conceal information. As with subordinating words and

transitional words, truthful people can use adverbial conjunctives as behavioral contractions to consciously or unconsciously withhold information that they consider lesser-included activities of the larger activity in which they are engaged or simply omit the information because they consider the information to be irrelevant.

Text bridges do not necessarily indicate deception, but text bridges do indicate where writers intentionally or unintentionally withhold information. In many instances, temporal-spatial lacunae are logically explained. For example, in the sentence, “I got up and then I took a shower and then I ate breakfast,” the adverbial conjunctive *then* signals temporal-spatial lacuna. This temporal-spatial lacuna is logically explained. The writer did not want to bore the reader with the lesser-included activities of taking a shower or eating breakfast. Text bridges serve as behavioral contractions to bridge the lesser included activities of turning on the water, soaping, rinsing, drying off, donning clothes, walking to the kitchen, taking a bowl from the cupboard, filling the bowl with cereal, going to the refrigerator to get milk, and so on. Likewise, liars devise similar grammatical or lexical devices to circumvent an event they desire to keep secret. Text bridges serve as indicators to locate withheld information in written narratives. In some instances, the withheld information is

germane to the inquiry. In other instances, the withheld information is of little interest to the reader.

Since the idea of text bridges is a new concept, no research directly addresses the efficacy of text bridges. The following illustration demonstrates how text bridges function. A student wrote a statement in response to allegations that she took $20 from her instructor's office during the first class break. Pursuant to an informal investigation, the student wrote a narrative account of her activities from the time she entered the building until the end of the first break. The following is a copy of her statement:

> I arrived at 7:45 a.m. with Jenna. I came into the room, put my bag at my desk and Jenna and I went to the little snack area to get some coffee. I returned to the classroom and sat at my desk. At 8:50 we went on a break. Jenna and I went to the bathroom. After that I came back to the classroom and Jenna stayed in the bathroom. She came back to the classroom soon after. We sat at our desk and waited for our class to continue.

The critical time in the narrative is at the first class break when the $20 was taken. The section of the narrative that addressed the break is, "At 8:50 we went on a break. Jenna and I went to the bathroom. After that I came back to the classroom and Jenna stayed in the bathroom. She came back to the classroom soon after." The student used the text bridge *after* which created a temporal-spatial lacuna between the time she went to the bathroom and the time she came back to the classroom. This

temporal-spatial lacuna in the student's narrative was sufficient time for her to walk down the hall to the instructor's office and steal the $20. After a more detailed interview, the student admitted taking the $20. The student used a text bridge to conceal the fact that after she went to the bathroom and before she came back to the classroom she walked down the hall to the instructor's office and stole $20.

Text bridges are important in that interviewers can review an interviewee's written statement and determine where the interviewee created temporal-spatial lacunae. The temporal-spatial lacunae do not indicate deception but do indicate that the writer intentionally or unintentionally withheld information. Text bridges used at critical junctures during interviews or written narratives signal interviewers that the interviewee intentionally or unintentionally withheld information. The interviewer must decide if the withheld information is important to the inquiry. If the withheld information is of no value, then the investigator can ignore the text bridge. For example, if the crime occurred at 8:00 p.m., the suspect may be directed to write a narrative relating his activities from the time he woke up until the time he went to sleep. If the suspect began his narrative with the following sentence, "I got up, I took a shower, and then I ate breakfast," the text bridge *then* signals withheld information. The withheld information does not

constitute deception. The suspect chose not to bore the interviewer with the lesser-included activities of taking a shower and eating breakfast. Since this information is not significant, the interviewer should ignore the text bridge. If, on the other hand, the suspect wrote, “At about 7 o’clock that night, I went to a friend’s house for a while and then I went directly home,” the text bridge *then* is significant because the writer created a temporal lacuna between 7 o’clock and the time the writer arrived at home. In this case, the suspect probably committed the crime after he left his friend’s house but before he arrived home. By using a text bridge, the suspect avoided telling a lie. The suspect did go to his friend’s house at 7 o’clock and the suspect did go directly home. The suspect failed to mention the fact that he committed the crime between the time he left his friend’s house and the time he went home. Interviewers who are not aware of the temporal lacunae created by text bridges may not conduct more detailed inquiries to obtain the withheld information. Text bridges signal missing information. If this study demonstrates that liars use text bridges to intentionally withhold information, then interviewers will know the portions of the interviewee’s statement that contain spatial-temporal lacunae in which information can be intentionally hidden.

Text Bridge Ratio

Differentiating truthful written narratives from deceptive written narratives requires an additional element. In experimental conditions a person's truthful statement can be directly compared to his or her deceptive statement. In real life, however, side-by-side comparisons of truthful written narratives and deceptive written narratives are rarely possible because deceptive statements are written in such a manner as to mimic truthful written narratives. If liars use fewer words in their written statements, then text bridge ratios may be a predictive indicator to determine the veracity of written statements when no direct comparisons can be made between truthful written narratives and deceptive written narratives. Dividing the total number of text bridges in a written narrative by the total number of words in the same written narrative produces a text bridge ratio. Since liars use fewer words, then the ratio of text bridges to the total words in a written narrative may provide a reliable indication of deception. A text bridge ratio might prove useful in determining the veracity of written statements in that readers must judge the veracity of written statements without the benefit of having truthful narratives against which to judge the deceptive narratives.

Spontaneous Negation

Negations are defined by words such as *no*, *not*, and all contractions of *not* (Adams & Jarvis, 2006). Negations constitute responses to open-ended questions as opposed to closed-ended questions (Adams & Jarvis, 2006). The concept of negations should be further delineated as negations and spontaneous negations. In response to the closed-ended question, “Did you rob the bank?” a deceptive person as well as a truthful person would answer, “No, I did not rob the bank.” A negative answer to a direct question is classified as a negation, not a spontaneous negation. When people are presented with open-ended questions, they should relate the actions they took versus the actions they did not take (Sapir, 1996; Rudacille, 1994). For example, when a tourist was asked to list the states he visited during a recent trip to America, he replied, “I visited California, Utah, and Texas, but I never visited New York.” The phrase “but I never visited New York” constitutes a spontaneous negation. Of the 47 states the tourist did not visit, he singled out New York as a state he did not visit for a reason. The person making the inquiry must determine the reason why the tourist mentioned New York as a state he did not visit. Commonly used spontaneous negations include “I don’t mean to interrupt,” “I’m not trying to be obnoxious,” and “I don’t mean to rain on your parade.”

Spontaneous negations also serve the same function as text bridges by allowing a deceptive person to bridge the information gap. When deceptive people use spontaneous negations, they fail to state what specific actions they did take. When people are presented with open-ended questions, they should relate the actions they took versus the actions they did not take (Sapir, 1996; Rudacille, 1994). Spontaneous negations used during open-ended questions may provide additional cues to differentiate truthful narratives from deceptive narratives, especially when they are used in conjunction with text bridges.

Pilot Study

The author conducted a pilot study to test the efficacy of text bridges to differentiate truthful statements from deceptive statements. Twenty-three Caucasian participants, 22 males and 1 female, ranging in age from 21 to 46 participated in the study. Twelve of the participants graduated from high school, 8 participants graduated from college, and 3 participants earned postgraduate degrees. The participants watched a digital video of a shoplifting event that occurred in a convenience store. The participants were instructed to pretend that they were the person depicted in the digital video and write truthful and deceptive narratives describing their actions in the store.

The truthful and deceptive written narratives were scored using the variables total words, the total number of sentences,

and the total number of text bridges. The word count feature in Microsoft Word calculated the total number of words in each narrative. The search feature in Microsoft Word calculated the total number of text bridges (adverbial conjunctives, transitional words, and subordinating words) in each narrative. Using the Microsoft Word word search feature, each narrative was searched for the following adverbial conjunctives: *accordingly, again, also, besides, consequently, finally, furthermore, however, indeed, moreover, nevertheless, otherwise, then, therefore*, and *thus*. Each narrative was searched for the following transitional words: *after, afterward, before, during, earlier, final, first, later, meanwhile, since then, until, however, in contrast, indeed, instead, nevertheless, on the contrary, on the other hand, yet, as a result, because, consequently, on account of, so, then, therefore, thus, also, besides, for example, furthermore, in addition, moreover*, and *too*. Each narrative was searched for the following subordinating words: *after, although, as if, as long as, because, before, even though, if, in order that, since, so, that, than, through, unless, until, when, whenever, where, wherever*, and *while*. A text bridge ratio was calculated by dividing the total number of text bridges in a written narrative by the total number of words in the narrative.

Pilot Study Results

A repeated measures ANOVA was conducted to test for significant differences between the variables total words, text bridge ratio, and spontaneous negation in the truthful and deceptive written narratives. The repeated measures ANOVA revealed a significant difference between the truthful and deceptive narratives (Greenhouse-Geisser = 86748.296, F (1.015) = 295.400, $p < .001$). The repeated measures ANOVA showed that deceptive narratives contained fewer total words ($t = 4.362$, $p < .001$), higher text bridge ratios ($t = -2.177$, $p = .035$) and more spontaneous negations ($t = -4.580$, $p < .001$).

Logistic regression was conducted to assess whether the three predictor variables total words, text bridge ratio, and spontaneous negation significantly predicted deceptive written narratives. The model using the three predictor variables total words, text bridge ratio, and spontaneous negation significantly predicted veracity in written statements $X^2 = 37.887$, $df = 3$, $N = 23$, $p < .001$. The Nagelkerke pseudo r square was .748, which means that the three predictor variables explain 75% of the variance. The variables total words, text bridge ratio, and spontaneous negation correctly predicted deceptive written statements 83% of the time and truthful statements 87% of the time with an effect size of .54, .31, and .56 respectively.

Pilot Study Conclusions

The pilot study found that the variables total words, text bridge ratio, and spontaneous negation were viable predictors of deception. Although the effect sizes were small to moderate, a larger population may increase the strength of the predictor variables to differentiate truthful narratives from deceptive narratives.

CHAPTER THREE

STATEMENT OF THE PROBLEM

To date, researchers have failed to identify universal verbal or nonverbal cues that reliably portend deception (Connelly, et al., 2006). Replicating the psychological pressure necessary to trigger a physiological response during deception is difficult to reproduce in a laboratory because each person has a different stress threshold. This study examines deception by cataloguing how deceivers bridge the truth gap when they construct sentences. Examining sentence construction eliminates the need to induce a change in physiology because truthful and deceptive people use the same grammar structures to write narratives.

Theoretical Foundation

The hypotheses posited in this study are based on Chomsky's (1957) linguistic theory of transformational-generative grammar, which postulates that all languages share the same grammar principles. Chomsky (1957) postulated that a set of universal principles of grammar is innate to humans. Chomsky's theory supports the notion that grammar structures are relatively stable in native English speakers and only vary slightly among same-language speakers despite a wide variation in intellect, language competence, and vocabulary strength (Chomsky, 1972; Labov, 1992). In written narratives, grammar structures and words are the only

means liars have to bridge the truth gap. Since words make up sentences and sentence construction follows grammar rules, then a careful examination of words and grammatical structures may identify specific words or grammar structures that predict deception. This study examines the differences in the words and grammar structures people use to write truthful and deceptive written narratives.

Hypotheses

The following hypotheses examine the efficacy of discerning truthful written narratives from deceptive written narratives using grammatical structures:

Hypothesis 1: Deceptive written narratives contain fewer words than do truthful written narratives.

Hypothesis 2: Text bridge ratios of deceptive written narratives will be higher than text bridge ratios of truthful written narratives.

Hypothesis 3: Deceptive written narratives contain higher spontaneous negation ratios than truthful written narratives.

CHAPTER FOUR

METHODOLOGY

Design Statement

The participants were divided into two groups, Group I and Group II. Groups I and II watched a digital video of a shoplifting event that occurred in a convenience store. Groups I and II were instructed to pretend that they were the person depicted in the digital video and write truthful and deceptive narratives describing their actions in the store. Group I participants were instructed to write their truthful narratives first and then write their deceptive narratives. Group II participants were instructed to write their deceptive narratives first and then write their truthful narratives. To compensate for individualistic writing styles, education levels, age, ethnicity, and gender each person served as his/her own control. The grammar structures used in the truthful written narratives were compared to the grammar structures used in the deceptive written narratives and the differences were objectively measured.

Participants

Participants were drawn from law enforcement and military service populations. Since law enforcement and military service personnel must demonstrate minimum literacy skills upon employment, these populations ensured that the participants of this study are able to read and write in English. The

participants in the study were primarily Caucasian males. There were 304 participants, 77% males and 23% females, ranging in age from 20 to 61. The ethnic make-up of the participants was 91.3% Caucasian, 3.6% Asian, 3.3% African American, 1.2% Hispanic, and less than 1% identified themselves as having another ethnic heritage. Participants who were raised by caregivers who spoke a language other than English comprised 12.2% of the study population. Seventy-four percent of participants graduated from college or had postgraduate training (Table 3).

Measures

The independent variable, condition, has two levels--truthful and deceptive. The dependent variables are the total words, the text bridge ratio, and spontaneous negation. Due to the collinearity between the dependent variables total words and text bridge ratio, the variable spontaneous negation will be expressed as a ratio.

The truthful and deceptive written narratives were scored as follows:

Total number of words - The total number of words were calculated by the word count feature in Microsoft Word.

Text bridge ratio - Text bridge ratio was calculated by dividing the total number of text bridges by the total number of words in the same narrative.

Table 3

Demographics of Study Participants (N = 304)

Descriptors	Experimental Group	%
Age		
20 – 29	73	24.0
30 – 39	109	35.8
40 – 49	88	28.9
50 – 59	32	10.5
Over 60	2	< 1.0
Gender		
Male	235	77.3
Female	69	22.7
Ethnicity		
African American	10	3.3
Asian	11	3.6
Caucasian	277	91.3
Hispanic	4	1.2
Other	2	< 1.0
Education		
Elementary	1	< 1.0
High School	12	3.9
Some College	64	21.0
College Graduate	145	47.7
Postgraduate	82	26.9
Caregivers		
Native English Speakers	266	87.5
Non-Native Speakers	38	12.5

Spontaneous negation ratio – Due to collinearity the variable spontaneous negation will be expressed as a spontaneous negation ratio. Spontaneous negation ratio was calculated by dividing the total number of spontaneous negations by the total number of words in the same narrative.

Procedures

Participants in Group I and Group II were instructed to write two narratives describing the scene depicted in a digital video: one truthful narrative and one deceptive. Participants in Group I were instructed to write their truthful narratives first and write their deceptive narratives second. Participants in Group II were instructed to write their deceptive narratives first and write their truthful narratives second. Groups of participants were alternated in this fashion until the total number of participants required for the study was achieved. The groups were randomly assigned to statistically compensate for minor inequalities between groups.

The participants were asked to read and sign consent forms (Appendix A). The instructions for writing the narratives were provided at the bottom of each demographic information sheet provided to the participants. The top portion of the instruction sheets requested the following demographic information: age, gender, education level, native English-speaking ability, ethnicity, and if their primary caretaker was a non-native

English speaker. The bottom portion of the instruction sheets instructed Group I participants to write truthful narratives first and then write deceptive narratives (Appendix B) and Group II participants were instructed to write deceptive narratives first and then write truthful narratives (Appendix C). The participants in Groups I and II then viewed a digital video of a person shoplifting a bottled beverage from a convenience store. The participants were instructed to pretend that they were the person depicted in the digital presentation and then write truthful and deceptive narratives from the first-person perspective.

CHAPTER FIVE

RESULTS

A repeated measures ANOVA with a Greenhouse-Geisser correction was conducted to test for significant differences between the variables total words, text bridge ratio, and spontaneous negation ratio in truthful and deceptive narratives. The repeated measures ANOVA revealed that there were significant differences between the truthful narratives and the deceptive narratives (Greenhouse-Geisser = 1092104.89, $F(1) = 3471.19$, $p < .001$).

Means and standard deviations are presented in Table 4. An examination of these means indicates that deceptive narratives contain fewer words, higher text bridge ratios, and higher spontaneous negation ratios than do truthful narratives. The average number of words in the truthful written narratives was approximately 60 and the average number of words in the deceptive written narratives was approximately 44 words. Each truthful written narrative had an average text bridge ratio of .026 and each deceptive written narrative had an average text bridge ratio of .035. Truthful written narratives had an average spontaneous negation ratio of .0009 and deceptive written narratives had an average spontaneous negation ratio of .0191. Expressed in percentages, on average 2.6% of each truthful written narrative comprised text bridges and on average 3.5% of each deceptive

written narrative comprised text bridges. On average less than 1% of each truthful written narrative comprised spontaneous negations and on average 1.9% of each deceptive written narrative comprised spontaneous negations.

Table 4

Means and Standard Deviations (N = 304)

	Mean	Standard Deviation
Total words		
Truthful	59.74	22.34
Deceptive	44.11	21.08
Text bridge ratio		
Truthful	.026	.019
Deceptive	.035	.040
Spontaneous negation ratio		
Truthful	.0009	.004
Deceptive	.0191	.026

The repeated measures ANOVA showed that deceptive narratives contained significantly fewer words than truthful narratives ($t = 8.87$, $p < .001$); deceptive narratives had significantly higher text bridge ratios than did truthful narratives ($t = -3.53$, $p < .001$); and deceptive narratives contained significantly higher spontaneous negation ratios than did truthful narratives ($t = -11.81$, $p < .001$) (Table 5). The variables total words and spontaneous negation ratio had a medium

effect size of .33 and .43 respectively, while the variable text bridge ratio had a small effect size of .14. In other words, the variables total words and spontaneous negation are moderate predictors of veracity and the variable text bridge ratio is a low predictor of veracity.

Table 5

Repeated Measures ANOVA for the Variables Total Words, Text Bridge Ratio, and Spontaneous Negation Ratio (N = 304)

Variable	B	SE	*t*	p	eta
Total words	15.63	1.76	8.87	.000	.33
Text bridge ratio	-.009	.003	-3.53	.000	.14
Spontaneous negation ratio	-.018	.002	-11.81	.000	.43

Logistic regression was conducted to assess whether the three predictor variables, total words, text bridge ratio, and spontaneous negation ratio significantly predicted the veracity in written narratives. When the three predictor variables total words, text bridge ratio, and spontaneous negation ratio were considered together, they significantly predicted veracity in written narratives, Omnibus Tests of Model Coefficients X^2 = 291.67, df = 3, N = 304, p < .001. The r square statistic cannot be exactly computed for logistic regression models, so the Nagelkerke pseudo r squared was computed. The Nagelkerke pseudo r square was .508 for the model containing the three variables

total words, text bridge ratio, and spontaneous negation ratio, which indicates that this model explains about 51% of the variance. The model using the variables, total words, text bridge ratio, and spontaneous negation ratio correctly predicted deceptive written narratives 67% of the time and correctly predicted truthful written narratives 89% of the time. The odds ratio for the three variables total words, text bridge ratio, and spontaneous negation ratio are .97, 1.16, and 4.90 respectively (Table 6).

Table 6

Logistic Regression Predicting Deceptive Written Narratives Using the Variables Total Words, Text Bridge Ratio, and Spontaneous Negation Ratio (N = 304)

Variable	B	SE	Odds Ratio	p
Total words	-.032	.005	.97	.000
Text bridge ratio	.155	.048	1.16	.001
Spontaneous negation ratio	1.15	.186	4.90	.000

Logistic regression was conducted to determine the variance of each of the predictive variables. The variable total words significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 75.931$, df = 1, N = 304, $p < .001$. The Nagelkerke pseudo r squared was .157, which indicates that the variable total words explains about 16% of the variance. The model using the variable total words correctly predicted

deceptive written narratives 68% of the time and correctly predicted truthful written narratives 60% of the time. The odds ratio for the variable total words is .96 (Table 7).

Table 7

Logistic Regression Predicting Deceptive Written Narratives Using the Variable Total Words (N=304)

Variable	B	SE	Odds Ratio	p
Total words	-.035	.004	.96	.000

The variable text bridge ratio significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 18.861$, df = 1, N = 304, $p < .001$. The Nagelkerke pseudo r squared of .041 indicates that the variable text bridge ratio explains about 4% of the variance. The model using the variable text bridge ratio correctly predicted deceptive written narratives 60% of the time and truthful written narratives 60% of the time. The odds ratio for the variable text bridge ratio is 1.16 (Table 8).

Table 8

Logistic Regression Predicting Deceptive Written Narratives Using the Variable Text Bridge Ratio (N = 304)

Variable	B	SE	Odds Ratio	p
Text bridge ratio	16.19	3.95	1.16	.000

The variable spontaneous negation ratio significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 231.116$, df = 1, N = 304, $p < .001$. The Nagelkerke pseudo r squared was .422, which indicates that the variable spontaneous negation accounts for about 42% of the variance. The model using the variable spontaneous negation ratio correctly predicted deceptive written narratives 56% of the time and truthful written narratives 94% of the time. The odds ratio for the variable spontaneous negation ratio is 3.90 (Table 9).

Table 9

Logistic Regression Predicting Deceptive Written Narratives Using the Variable Spontaneous Negation Ratio (N = 304)

Variable	B	SE	Odds Ratio	p
Spontaneous negation ratio	134.99	14.67	3.90	.000

The total number of different text bridges used in both truthful and deceptive narratives was 18. The text bridges included *then*, *so*, *after, when, as, while, once, next, however, finally, eventually, upon, since, afterwards, a short bit later, as I did so, at this time,* and *on my way back*. The word strings *a short bit later, at this time, on my way back*, and *as I did so* do not fit the strict definition of text bridges but, nonetheless, served the same function. The most commonly used

text bridges in truthful narratives were *then, so, after, when, as, while,* and *once*. The remaining text bridges were each used three times or less. The text bridge *when* was used 33 (73%) times in truthful statements and the text bridge *as* was used 29 (76%) times in truthful statements. The most commonly used text bridges in deceptive narratives were *then, so after, when, as, while*, and *once*. The remaining text bridges were used three times or less. The text bridge *so* was used 99 (72%) times in deceptive narratives.

Cross-Validation Study

A cross-validation study was conducted to test the predictive value of the three variables total words, text bridge ratio, and spontaneous negation ratio identified in the first study.

Participants

Participants were drawn from law enforcement and military service populations. Since law enforcement and military service personnel must demonstrate minimum literacy skills upon employment, these populations ensured that the participants of this study are able to read and write in English. The participants in the study were primarily Caucasian males. The cross-validation study consisted of 105 participants. Males comprised 88.5% of the participants and females comprised 11.5% of the participants. Participants ranged in age from 24 to 56.

The ethnic make-up of the participants was 95.2% Caucasian, 1.9% African American, 1.9% Hispanic, and 1% identified themselves as having another ethnic heritage. Participants who were raised by caregivers who spoke a language other than English comprised 1.9% of the total study population. Sixty-seven percent of participants graduated from college or had postgraduate training (Table 10).

Measures and Procedures

The measures and procedures were the same as in the previous study.

Results

A repeated measures ANOVA with a Greenhouse-Geisser correction was conducted to test for significant differences using the variables total words, text bridge ratio, and spontaneous negation ratio in truthful and deceptive narratives. The repeated measures ANOVA revealed that there were significant differences between the truthful narratives and the deceptive narratives (Greenhouse-Geisser =332248.526, F (2) 1465.464, $p < .001$).

Means and standard deviations are presented in Table 11. An examination of these means suggests that deceptive narratives contain fewer words, higher text bridge ratios, and higher spontaneous negation ratios than do truthful narratives. In

Table 10

Demographics of Cross-validation Study Participants (N = 105)

Descriptors	Experimental Group	%
Age		
20 – 29	23	21.9
30 – 39	40	38.1
40 – 49	34	32.3
50 – 59	8	7.7
Gender		
Male	93	88.5
Female	12	11.5
Ethnicity		
African American	2	1.9
Asian	0	0.0
Caucasian	100	95.2
Hispanic	2	1.9
Other	1	1
Education		
Elementary	0	0.0
High School	6	5.7
Some College	30	28.6
College Graduate	57	54.3
Postgraduate	12	11.4
Caregivers		
Native English Speakers	103	98.0
Non-Native Speakers	2	2.0

other words, the mean number of words in the truthful written narratives was approximately 55 and the mean number of words in the deceptive written narratives was approximately 42 words. Each truthful written narrative had an average text bridge ratio of .028 and each deceptive written narrative had an average text bridge ratio of .037. Truthful written narratives had an average spontaneous negation ratio of .003 and deceptive written narratives had an average spontaneous negation ratio of .020. Expressed in percentages, on average 2.8% of each truthful written narrative comprised text bridges, and on average 3.7% of each deceptive written narrative contained text bridges. On average less than 1% of each truthful written narrative comprised

Table 11

Means and Standard Deviations (N = 105)

	Mean	Standard Deviation
Total words		
Truthful	55.17	19.28
Deceptive	42.30	17.55
Text bridge ratio		
Truthful	.028	.0217
Deceptive	.037	.0234
Spontaneous negation ratio		
Truthful	.003	.023
Deceptive	.020	.021

spontaneous negations, and on average 2% of each deceptive written narrative comprised spontaneous negations.

The repeated measures ANOVA showed that deceptive narratives contained significantly fewer words than truthful narratives ($t = 5.05$, $p < .001$); deceptive narratives had significantly higher text bridge ratios than did truthful narratives ($t = -2.69$, $p = .008$); and deceptive narratives contained higher spontaneous negation ratios than did truthful narratives ($t = -5.282$, $p < .001$). The variables total words and spontaneous negation ratio had medium effect sizes of.33 and .34 respectively. The variable text bridge ratio had a small effect size of .03 (Table 12). In other words, the variables total words and spontaneous negation are moderate predictors of veracity and the variable text bridge ratio is a low predictor of veracity.

Table 12

Repeated Measures ANOVA for the Variables Total Words, Text Bridge Ratio, and Spontaneous Negation Ratio (N = 105)

Variable	B	SE	*t*	p	Eta
Total words	12.86	2.54	5.05	.000	.33
Text bridge ratio	-.008	.003	-2.69	.008	.03
Spontaneous negation ratio	-.017	.003	-5.28	.000	.34

Logistic regression was conducted to assess whether the three variables total words, text bridge ratio, and spontaneous negation ratio predicted deceptive written narratives. When the

three predictor variables were considered together, they significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 64.47$, df = 3, N = 105, p < .001. The Nagelkerke pseudo r squared was .353, which indicates that the model using the variables total words, text bridge ratio, and spontaneous negation ratio explains about 35% of the variance. The model using the variables total words, text bridge ratio, and spontaneous negation ratio correctly predicted deceptive written narratives 76% of the time and truthful written narratives 85% of the time. The odds ratio for the variables total words, text bridge ratio, and spontaneous negation ratio are .97, 1.33, and 3.62 respectively (Table 13).

Table 13

Logistic Regression Predicting Deceptive Written Narratives Using the Variables Total Words, Text Bridge Ratio, and Spontaneous Negation Ratio (N = 105)

Variable	B	SE	Odds ratio	p
Total words	-.028	.009	.97	.002
Text bridge ratio	21.48	7.726	1.33	.005
Spontaneous negations ratio	68.66	13.48	3.62	.000

A logistic regression was conducted to determine the variance of each of the predictive variables. The variable total words significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 24.47$, df = 1, N = 105, p < .001. The Nagelkerke pseudo r squared was .147, which

indicates that the variable total words explains about 15% of the variance. The model using the variable total words correctly predicted deceptive written narratives 65% of the time and truthful written narratives 61% of the time. The odds ratio for the variable total words is .96 (Table 14).

Table 14

Logistic Regression Predicting Deceptive Written Narratives Using the Variable Total Words (N = 105)

Variable	B	SE	Odds Ratio	p
Total words	-.039	.009	.96	.000

The variable text bridge ratio significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 7.24$, df = 1, N = 105, p = .009. The Nagelkerke pseudo r squared was .045, which indicates that the variable text bridge ratio explains about 4% of the variance. The model, using the variable text bridge ratio correctly predicted deceptive written narratives 60% of the time and truthful written narratives 59%. The odds ratio for the variable text bridge ratio is 1.18 (Table 15).

The variable spontaneous negation ratio significantly predicted deceptive written narratives, Omnibus Tests of Model Coefficients $X^2 = 42.04$, df = 1, N = 105, p < .001. The Nagelkerke pseudo r squared was .242, which indicated that the

Table 15

Logistic Regression Predicting Deceptive Written Narratives Using the Variable Text Bridge Ratio (N = 105)

Variable	B	SE	Odds Ratio	p
Text bridge ratio	16.73	6.40	1.18	.009

variable spontaneous negation ratio explains about 24% of the variance. The model using the variable spontaneous negation ratio correctly predicted deceptive written narratives 61% of the time and truthful written narratives 93% of the time. The odds ratio for the variable spontaneous negation ratio is 3.09 (Table 16).

Table 16

Logistic Regression Predicting Deceptive Written Narratives Using the Variable Spontaneous Negation Ratio (N=105)

Variable	B	SE	Odds Ratio	p
Spontaneous negation ratio	64.46	12.23	3.09	.000

The total of different text bridges used in both truthful and deceptive narratives was 17. The text bridges were *then, so, after, as, when, while, once, next, finally, eventually, upon, since, before,* and *therefore*. The word strings *at that point, shortly thereafter*, and *on my way back* do not fit the strict definition of text bridges but, nonetheless, served the same function. The most commonly used text bridges in truthful

narratives were *then, so after, when, as, while, once*, and *next*. The remaining text bridges were used three times or less. The text bridge *when* was used 13 (72%) times in truthful statements. The most commonly used text bridges in deceptive narratives were *then, so, after*, and *when*. The remaining text bridges were used three times or less. The text bridge *so* was used 35 (81%) times in deceptive narratives.

The effect of the predictor variables total words, text bridge ratio, and spontaneous negation ratio are illustrated in the following examples that were excerpted from the first study. The first example demonstrates the use of variables total words and text bridge ratio and the second example demonstrates the combined use of the variables total words, text bridge ratio, and spontaneous negation. The deceptive narrative is in bold type. The underlined words represent text bridges. The double underlined words represent spontaneous negations.

Example 1 (Text bridges)

1. I walked down an aisle and looked at some cans of food on the top shelf.
2. I walked down an aisle and looked at some cans of food.

3. I picked one up and examined it pretending to be interested in it.
4. I picked up a can and looked at it and <u>then</u> put it back.

5. I put it back and turned left down another aisle.
6. I continued down the next aisle and looked around.

7. I looked from side to side at merchandise and checked to see if anyone was nearby.

8. I then walked towards some coolers to see what drinks were in them...

9. I then walked back up the aisle an [sic] opened the last cooler and grabbed a beer. I put the beer in my right pant pocket, buttoned it up. And walked out of the store.

10. ...and then left.

Words: 89
Words: 51

Text Bridge Ratio: .001
Text Bridge Percent: 1.12
Text Bridge Ratio: .003
Text Bridge Percent: 5.88%

In line 4, the writer used the text bridge *then* to withhold the lesser-included activities of picking up a can and looking at it. In line 8, the writer used the text bridge *then* to withhold the lesser-included activities from the time he continued down the next aisle to the time he walked toward the coolers. The writer used the text bridge *then* in line 9 to withhold the lesser-included activities of walking back up the aisle and opening the last cooler. The writer used the text bridge *then* in line 10 to withhold the lesser-included activities of shoplifting the bottle of beer. The text bridge *then* in line 10 is the second span of the text bridge that began in line 8. In the deceptive narrative, the writer concealed the fact that he shoplifted the beer by using a series of two linked text bridges.

The total number of words in the truthful narrative is 89 versus 51 in the deceptive narrative. The text bridge ratio in

the truthful narrative is .001 versus .003 in the deceptive narrative.

Example 2 (Negation/Text bridge)

1. I walked to the back of the store and picked up a container of a certain condiment.
2. **As I pretended to look at the condiment and read it's [sic] contents, I surveyed the store to see if anyone ~~is~~ was looking at me.**

3. As I noticed that the store was empty,...
4. **I [sic] to the condiments aisle and was searching for a particular condiment.**

5. ...I approached the back aisle and opened the door to the refrigerated sodas. I took one last glance to my left and right to ensure no one was watching me. I quickly grabbed one soda and put it in my right cargo pocket.
6. **~~I placed~~ I then went to the rear of the store and opened the door to the refrigerated sodas. I could not find what interested me so...**

7. I then immediately left the store.
8. **I left the store.**

Words: 74
Text Bridge Ratio: .029
Text Bridge Percent: 2.70
Spontaneous Negation Ratio: .00
Spontaneous Negation Percent: .00

Words: 68
Text Bridge Ratio: .044
Text Bridge Percent: 2.94
Spontaneous Negation Ratio: .014
Spontaneous Negation Percent: 1.47

The deceptive written narrative contained fewer words than the truthful written narrative. The deceptive narrative had a text bridge ratio of .044 and the truthful narrative of .029. The spontaneous negation ratio for the deceptive narrative is

.014 and the spontaneous negation ratio in the truthful statement is zero.

The writer used the text bridge *as* in line 2 to withhold the lesser-included activities of pretending to look at the condiment and read its contents. The writer used the text bridge *as* in line 3 to withhold the lesser-included activities of looking around the store to observe who might be nearby. In line 6, the writer used the text bridge *then* to withhold the lesser-included activities between the time he searched for a particular condiment to the time he went to the rear of the store and opened the door to the refrigerated sodas. In line 6 the writer used the spontaneous negation *I could not find what interested me* to circumvent the fact that he shoplifted a bottle of soda.

In line 7, the writer used the text bridge *so* in combination with the spontaneous negation to circumvent the act of shoplifting.

In line 8, the writer used the text bridge *then* to withhold the lesser-included activities from the time when he placed the soda in his right cargo pocket to the time when he began walking toward the exit.

CHAPTER SIX

DISCUSSION

The results of this study developed a predictive model for veracity using the three variables total words, text bridge ratio, and spontaneous negation ratio; clarified the previous research regarding negations; and confirmed that people who are asked to lie create narratives that use fewer words than truthful narratives.

Predictive Model for Veracity

The combination of the variables total words, text bridge ratio, and spontaneous negation ratio predicted truthful and deceptive narratives at a rate higher than chance and exceeded the predictive value of nonverbal deception indicia, which is slightly above the 50th percentile (Connelly et al., 2006; DePaulo et al., 2003; Vrij, 2000). The variable total words predicted truthful and deceptive written narratives at a rate higher than chance and predicted truthful written narratives at a rate higher than the predictive value of nonverbal indicia but predicted deception at a rate similar to the predictive value of nonverbal deception indicia (Connelly et al., 2006; DePaulo et al., 2003; Vrij, 2000). The variable text bridge ratio predicted truthful and deceptive written narratives at a rate similar to the predictive value of nonverbal deception indicia (Connelly et al., 2006; DePaulo et al., 2003; Vrij, 2000). The variable

spontaneous negation ratio predicted deceptive written narratives at a rate above chance and truthful written narratives at a rate higher than the predictive value of nonverbal deception indicia but predicted deceptive written narratives at a rate similar to the predictive value of nonverbal deception indicia (Connelly et al., 2006; DePaulo et al., 2003; Vrij, 2000).

The variable spontaneous negation ratio is clearly the most powerful predictor of veracity in written narratives. The reason spontaneous negation ratio is the most powerful predictor of deception may hearken back to the theory that liars undergo physiological changes when they lie (DePaulo et al., 2003). These physiological changes include increased skin conductance, increased blood pressure, and increased respiration, which reflect an increase in general anxiety (DePaulo et al., 2003). In an effort to avoid an increase in general anxiety, liars may use spontaneous negations in an attempt to block the anticipated increase of general anxiety caused by a potential breach of credibility. A pronouncement of what a liar did not do potentially blocks the current line of questioning and shifts the focus of the questioning to less anxiety-provoking topics; however, additional research is required to find support for this hypothesis. If this proves to be the case, then there may be some correlation between the grammar structures liars use and their physiological states.

If a narrative does not contain a spontaneous negation, then the two variables total words and text bridge ratio must be relied on to measure the veracity of written narratives. The variables total words and text bridge ratio each predicted veracity of written narratives at about the same rate as nonverbal deception indicia (Connelly et al., 2006; DePaulo et al., 2003; Vrij, 2000).

Text Bridges

The results of this study consolidated Sapir's (1996) notion of missing connections and Rabon (1994) and Suiter's (2001) notions of temporal lacunae into the umbrella concept of text bridges. Sapir (1996) identified words such as *left, finally, started, began, tried*, and *commence* as unnecessary connectors used by liars as substitute expressions to replace the truthful account of an event. Suiter (2001) found that the use of the words, *when, after that, afterwards, at that time, at that point, later on, by the time*, and *all of a sudden* created temporal lacunae. Suiter (2001) cautioned that words that create temporal lacunae do not indicate deception; likewise, text bridges do not indicate deception. In fact, the variable text bridge ratio was the weakest predictor of veracity. Text bridges only signal withheld information in written narratives. Truthful people edit information that they think is not relevant, thus unintentionally creating information gaps in their written narratives that are

not the result of deception. Conversely, liars omit information to hide the truth creating information gaps in their written narratives for deceptive purposes. If text bridges occur during a critical portion of a narrative, then the withheld information may be of value depending on the specific circumstances of the inquiry.

Eighteen different text bridges were used in the first study and 17 different text bridges were used in the cross-validation study. With the exception of the text bridges *before* and *therefore* and the word strings *at that point* and *shortly thereafter*, the same text bridges and word strings were used in the cross-validation study as were used in the first study, which suggests that liars rely on relatively few text bridges when they omit information.

The most commonly used text bridges in both truthful and deceptive written narratives were *then, so, after, when*, and *as*. A higher percent of truthful narratives contained the text bridges *as* and *when*. The text bridges *as* and *when* have the connotation of conveyance. The notion of conveying ideas supports Rabon's (1994) concept that truthful people simply relate the facts of their story. Conversely, the text bridge *so* is an adverbial conjunctive that denotes causation (Forlini et al., 1990). In other words, a cause-and-effect relationship exists in the sentence. Some action in the sentence caused

another action to take place. In a sense, the writer is trying to explain his actions. The attempt to explain actions supports Rabon's (1994) concept that liars try to convince people that their story is true rather than simply conveying facts. Additional research is required to determine which subgroup of text bridges may be more effective discriminators of truthful and deceptive written narratives.

Fewer Words (Hypothesis 1)

The results of this study showed that deceptive narratives contain significantly fewer words than do truthful narratives. This finding is consistent with extant research that found that deceptive narratives contain fewer words than truthful narratives (Connelly, et al., 2006; DePaulo et al., 2003; DePaulo, Stone, & Lassiter, 1985; Zuckerman & Driver, 1985; Dulaney, 1982; Knapp, Hart, & Dennis, 1974; Rabon, 1994; Sapir, 1996; Suiter, 2001).

Text Bridge Ratio (Hypothesis 2)

The results of this study showed that deceptive written narratives have significantly higher text bridge ratios than do truthful written narratives. The text bridge ratio represents the total number of text bridges in a narrative divided by the total number of words in the narrative. Text bridge ratios may be more effective in situations where several people write narratives about a shared experience. For example, if five coworkers were suspected in a theft of money from a common work

area and each of them wrote narratives describing their activities during the time of the theft, then text bridge ratios could be useful in discriminating truthful narratives from the deceptive narrative. The thief's deceptive written narrative will probably contain fewer words than the truthful written narratives of the innocent workers; however, caution is advised because other factors may affect verbal output. Calculating the text bridge ratios of the narratives provides an added predictor of veracity, thus increasing the likelihood of identifying the deceptive narrative.

Spontaneous Negation Ratio (Hypothesis 3)

The results of this study also clarified Rabon's (1994) notion of abjuration and Adams and Jarvis' (2006) notion of negations into the umbrella terms *negation* and *spontaneous negation*. Rabon (1994) defined abjuration as words that withdrew the assertion previously made. Abjuration words include *but, yet, however, although, nevertheless, though*, and *anyway*. Adams and Jarvis (2006) defined negations as responses to open-ended questions that include words such as *no*, *not*, and all contractions of *not*. A spontaneous negation occurs when a writer, in response to an open-ended question, writes down an action that he or she did not do. A negation is a response to a direct question or an affirmation of a nonverbalized question in the mind of the writer.

The model using the variables total words, text bridge ratio, and spontaneous negations in combination with text bridges has practical applications, especially in the law enforcement and military arenas. Interviewers and interrogators could use the three predictor variables to quickly assess written narratives in the field to form hypotheses as to the veracity of written narratives. The interviewers or interrogators could then examine the written statements for text bridges to locate temporal-spatial lacunae. If the interviewers or interrogators deem the withheld information as relevant, then further inquiries could be made to determine the exact nature of the withheld information. Additional research is required to determine if the three-variable model predicts veracity in verbal communications. Detecting withheld information in real-time by listening for text bridges in conjunction with the three-variable model will give interviewers an advantage, especially when this technique is used in combination with the extant nonverbal, verbal, and paralinguistic predictive cues.

Study Limitations and Future Research

One of the limitations of this study is that in practical situations narratives written in isolation typically do not have comparative values for the variables total words, text bridge ratio, and spontaneous negation ratio. Predicting deception using the variables total number of words and text bridge ratio

is more difficult without comparative values. Since liars use fewer words, deceptive narratives lack elements that are contained in truthful narratives. CBCA identified indicators that portend truthfulness in written communications. The CBCA linguistic indicators of truthfulness that associate with more text include descriptions of interactions, reproduction of conversation, unexpected complications during the incident, unusual details, superfluous details, and related external associations. Similarly, TVA identified indicators that portend deception in written communications. The TVA linguistic indicators that associate with less text include no discussion of cause and effect; less reference to situational, social, or contextual variables shaping behavior; limited use of self-references (e.g., me, I); no discussion of emotional states; and no explanation of behavior. Future researchers could examine the relationship between the variables total words and text bridge ratio in written narratives to the presence or absence of the CBCA's indicators of truthfulness and TVA's indicators of deception. The combination of the variables total words in a written narrative and the text bridge ratio of a written narrative in combination with the CBCA and TVA predictors of deception may identify a more effective model to detect deception in narratives written in isolation.

Another limitation of the study is that only one portion of a narrative was examined. Written narratives typically contain three components: a prologue, the body, and an epilogue. The body or description of the event is typically the most critical component of narratives because the body contains a description of the event or the focus of the inquiry. The variables total words, text bridge ratio, and spontaneous negation ratio may be more effective when used to examine the separate component parts of a narrative body. Using the variables total words, text bridge ratio, and spontaneous negation ratio to analyze the body of a narrative written in isolation may enhance the predictive value of the total number of words, text bridge ratios, and spontaneous negations. The present study consisted of short narratives that only asked the participants to describe the shoplifting event, which would typically comprise the body of the narrative. Another approach might be to use the prologue and the epilogue as baseline indicators against which to examine the body of the narrative. Additional research is required to confirm the effectiveness of analyzing the body of narratives using total words and text bridge ratio to evaluate veracity.

The demographics of the participants of this study limit the generalization of the findings. The majority of the participants of this study were educated, male Caucasians, who were native English speakers. Since the concept of using grammar structures

to study veracity is a relatively new technique, using participants who know how to write using correct grammar was necessary to establish a baseline. Once a baseline is established, then comparisons could be made to determine the effect of education, cultural influences, and English language competencies. The existence of text bridges, text bridge ratios, and spontaneous negations in non-native English speakers and in foreign languages merits further exploration.

Another limitation of this study is that the participants were forced to lie by omission. Most liars lie by omission because the only thing they have to leave out of their otherwise truthful narratives is the intentionally withheld information. The participants may have been forced to lie by omission, but they were free to choose the manner in which they circumvented the withheld information. Not all the participants chose to use text bridges or spontaneous negations as a means to circumvent withheld information. Of the 304 deceptive narratives, 28 (9.21%) did not contain text bridges or spontaneous negations. These participants used other means to circumvent the withheld information. Additional research is required to determine if additional predictor variables will increase the probability of discriminating truthful narratives from deceptive narratives. Once sufficient data are obtained from additional studies, perhaps a computer model could be developed to test the veracity

of written statements using the variables, total words, text bridge ratio, and spontaneous negation ratio, along with other variables that demonstrate predictive value in determining veracity.

Conclusions

The three-variable deception model developed in this study performed as well as and in some instances better than the predictive value of nonverbal deception indicia (Connelly et al., 2006; DePaulo et al., 2003; Vrij, 2000). This study demonstrated that studying grammar structures may be an effective method to discriminate truthful written narratives from deceptive written narratives. The results of this study also provide a new avenue for deception research.

ATTACHMENT A
(Informed Consent Form)

Informed Consent

Name: _____ Date: _____

Purpose: My name is John Schafer. I am a graduate student at Fielding Graduate University. As part of my graduation requirements, I am required to complete a dissertation. For my dissertation research project, I am studying the difference between truthful and deceptive written narratives. The information gathered today will be used to help in the understanding of truthful and deceptive communications. The results of this study may be published. Participants can read a summary of the study results at the Internet web site, jack@jrschafer.com after the data has been evaluated.

Confidentiality: **All information will be kept confidential.** Please do not write your name or any identifying marks on the study materials. Study results will not use any names of the participants who complete the surveys. If you choose not to participate in the study, turn in your blank consent form along with the other participants. There will be no positive or negative consequences if you choose not to participate in the study. If you choose not to participate place the unused study material in their manila envelopes at the same time as the other participants who have completed the study place their completed study materials in their manila envelopes. If you choose to participate in this study but later change your mind, you do not have to complete the study. The consent forms and surveys will be kept separately to ensure your privacy. The Institutional Review Board of Fielding Graduate University retains access to signed informed consent forms and if any participant chooses to withdraw from the study, her/his data will be removed and destroyed.

Benefits: Participants may derive some satisfaction from being part of a study to discriminate truthful narratives from deceptive narratives.

Risks: Participating in this study will have minimal or no risks for the participants.

Costs or Payment: There are no costs or payments to you for participating in this study.

Process: You will be asked to provide general demographic information and watch a digital video depicting a shoplifting event. After watching the digital video, you will be asked to write a truthful and a deceptive narrative describing the shoplifting event. The survey will take about twenty minutes to complete. John Schafer will store all original materials related to this study in a metal box secured with a lock for three years whereupon he will shred all study materials. The box will be stored at the residence of John Schafer. Only the researchers and faculty members named in this application will have access to the written narratives.

Research Team: John Schafer is the primary researcher. and Dr. Pat Hodges is the research supervisor. John Schafer can be contacted by writing to 6546 Highbluff Way, Lancaster, CA 93536 or email at jackschafer500@yahoo.com. Dr. Hodges can be contacted by writing to the Fielding Graduate University, 2112 Santa Barbara Street, Santa Barbara, CA 93105.

Voluntary Consent: I have read this form and I understand the above. My signature indicates that I have decided to participate in the study and any questions that I have about this form or about the study have been answered.

Do you agree to take part in this study? Yes □ No □

Signature: _____ Date: _____

Print: _____

APPENDIX B

INSTRUCTION SHEET
GROUP I

Hello, my name is John Schafer. I am a graduate student from Fielding Graduate University, Santa Barbara, California. I'm conducting research about truthful and deceptive written narratives. This study is part of the research I am conducting for my dissertation. The purpose of the research is to study truthful and deceptive written narratives. Your participation in this study is voluntary and all information that you provide will be kept confidential; no identifying information will be shared. The results of the study may be published.

Please answer the following questions:

1) What is your age? _____

2) Are you _____ Female _____ Male

3) What is your highest level of education?

_____ Elementary school
_____ Some high school
_____ High school graduate
_____ Some college
_____ College graduate
_____ Post graduate

4) Are you a native English speaker?

_____ Yes _____ No

5) Did your primary caregiver speak a language other than English as their first language?

_____ Yes _____ No

6) What is your ethnicity?

_____ African -American
_____ Asian
_____ Caucasian
_____ Hispanic
_____ Other _____

7) You will now be shown a digital video of a shoplifting event. Pretend that you are the person depicted in the digital video.

8) Using the ballpoint pen and the first piece of lined paper provided, write a detailed truthful narrative of your activities.

9) Using the ballpoint pen and the second piece of lined paper provided, write a detailed deceptive narrative of your activities omitting the fact that you shoplifted.

APPENDIX C

INSTRUCTION SHEET
GROUP II

Hello, my name is John Schafer. I'm a graduate student from Fielding Graduate University, Santa Barbara, California. I'm conducting research about truthful and deceptive written narratives. This study is part of the research I am conducting for my dissertation. The purpose of the research is to study truthful and deceptive written narratives. Your participation in this study is voluntary and all information that you provide will be kept confidential; no identifying information will be shared. The results of the study may be published.

Please answer the following questions:

1) What is your age? _____

2) Are you _____ Female _____ Male

3) What is your highest level of education?

_____ Elementary school
_____ Some high school
_____ High school graduate
_____ Some college
_____ College graduate

4) Are you a native English speaker?

_____ Yes _____ No

5) Did your primary caregiver speak a language other than English as their first language?

_____ Yes _____ No

6) What is your ethnicity?

_____ African -American
_____ Asian
_____ Caucasian
_____ Hispanic
_____ Other _____

7) You will now be shown a digital video of a shoplifting event. Pretend that you are the person depicted in the digital video.

8) Using the ballpoint pen and the first piece of lined paper provided, write a detailed deceptive narrative of your activities omitting the fact that you shoplifted.

9) Using the ballpoint pen and the second piece of lined paper provided, write a detailed truthful narrative of your activities.

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