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The Development of the Determining and Evaluating Truth through Explicit Cue Testing (DETECT) Model to Detect Deception: Verbal and Non-Verbal Cues

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School of Security and Global Studies

Intelligence Studies Program

This thesis for the master's degree submitted by

Eugenie de Silva

Under the title

The Development of the

Determining and Evaluating Truth through Explicit Cue Testing (DETECT) Model to

Detect Deception: Verbal and Non-verbal Cues

Has been read by the undersigned. It is hereby recommended for acceptance by the faculty with credit to the amount of 3 semester hours.

(Signed, first reader) _____*Dr Joseph DiRenzo III*_____ (date)__05/01/2014__

(Signed, second reader, if required) _____ (date) __—__

Recommended for approval on behalf of the program

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Approved by Dean of Security and Global Studies

The Development of the

Determining and Evaluating Truth through Explicit Cue Testing (DETECT) Model to

Detect Deception: Verbal and Non-verbal Cues

A Master's Thesis

Submitted to the Faculty

of

American Military University

by

Eugenie de Silva

in Partial Fulfillment of the

Requirements for the Degree

of

Master's of Intelligence Analysis

April 2014

American Military University

Charles Town, WV

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Dedication

       I dedicate this thesis to my dad, Professor Eugene de Silva who first introduced me to the fields of intelligence and law enforcement. His love, guidance, and continuous support enabled me to further my education and for that I am forever grateful.

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I wish to first express my thanks to the American Military University for providing me with an opportunity to continue my higher education at such a fast pace. The university has upheld the highest of educational standards and this has been vital in my academic progression.

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I also must finally extend my heartfelt thanks to Professor Joseph DiRenzo who went above and beyond to provide me with support and guidance in the completion of this research.

ABSTRACT OF THE THESIS

THE DEVELOPMENT OF THE

DETERMINING AND EVALUATING TRUTH THROUGH EXPLICIT CUE

TESTING (DETECT) MODEL TO DETECT DECEPTION: VERBAL AND NON-

VERBAL CUES

by

Eugenie de Silva

American Military University, April 30, 2014

Charles Town, West Virginia

Professor Joseph DiRenzo, Thesis Professor

The presented research work examined the ways in which six verbal cues and

fourteen non-verbal cues could be utilized as a means of detecting deception in

individual-level cases. The focus of this research was the development of a model that

would be useful for law enforcement and intelligence personnel who must detect

deception on a timely, constant basis without reliance on technology. Through this

research, a novel model "Determining and Evaluating Truth through Explicit Cue Testing

(DETECT)" was developed. The work utilized a mixed-methods approach to analysis;

thus, an analysis of the thirty participant interviews, in addition to a further non-

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parametric statistical analysis was conducted. Accordingly, it was recognized that the DETECT model was able to correctly identify deception/truthfulness in twenty-eight of the thirty cases. The research received explicit approval from the Institutional Review Board (IRB) prior to the commencement of the research. The work further proved that the model is statistically acceptable at a 5% significance level. Therefore, there is a 95% confidence interval for this model. This means the power of this model is 95%. The work concluded with the determination that whilst the model can be used without a background in the detection of deception, the undergoing of a six-week training course may help to raise the statistical probabilities of correctly determining the truthfulness of an individual's statements.

"There is nothing more deceptive than an obvious fact."

- Sir Arthur Conan Doyle

Introduction

It seems counterintuitive that deception could be detected, since the very act is executed to mislead others. Yet, this thesis expands upon the notion of utilizing verbal (e.g. spoken) and non-verbal (e.g. body movements) cues to detect deception to precisely explicate the extent to which deception can be detected through an analysis of individual-level case studies. Accordingly, the work takes into consideration the Denial and Deception (D&D) activities by investigating smaller scale individual interactions.

D&D is an all-inclusive term with regard to denial and deception that commonly refers to activities that involve distorting information, manipulating facts to establish a false story, or even withholding data from an adversary. Whilst denial and deception can be utilized as two individual terms, they are undoubtedly interlinked and can be used to strengthen operations aimed at feeding false information to adversaries. In 2000, Roy Godson and James Wirtz explicitly reinstated this information by denoting that denial and deception are intertwined terms that work uniquely as a blend to essentially pull wool over the eyes of opponents or enemies (2000, 5). The denial of information results in a misinformed perception of an event, whereas deception can result in a completely distorted view of a scenario or the distortion to various degrees of specific aspects of cases. Accordingly, when used in combination, an individual can relay a completely false story to a targeted opponent to whom it would seem completely feasible and truthful. The use of realistic characteristics is what makes D&D such a dominating tool.

It was Bacon Donald who notably recognized that during World War II the United States (U.S.), in addition to other countries, such as the United Kingdom (U.K.),

was able to improve and form a strong grasp of the art of D&D activities (1998). Researchers have even suggested that as most countries left the war, their D&D techniques underwent vast improvements and their comprehensive D&D structures were significantly enhanced (Bacon, 1998). Upon this basis, D&D activities have continually improved and adapted to the dynamics of the twenty-first century. Whereas D&D operations employed by the U.S. government can be particularly convenient, it is also imperative to take into consideration that law enforcement officials and intelligence personnel are constantly at risk of becoming victims of adversarial D&D. This risk is certainly heightened by the lack of knowledge by those in the field in charge of detecting deception on a timely basis. With regard to the disciplines of law enforcement and intelligence, deception must be identified at its earliest stages in order to avert any possibly dangers aimed at damaging the national security of the U.S. This being the case, it is imperative to recognize that a successful deceptive story will commonly take advantage of the opponent's weaknesses and/or known perceptions of the world. Through the recognition of these weaknesses, an opponent may specifically tailor a deception activity to ensure that the false story is believable to his/her adversary. As a result, if one seeks to identify deception, then one should not be oblivious to facts that may seem acceptable based on the given set of data. Further, as history has shown, it is necessary to take into consideration all activities as they relate to other on-going operations.

Indubitably, officials who have daily interactions with individuals will encounter acts of trickery and guile. For an officer specialized in the recognition of deception there is assuredly a higher probability of detecting duplicity at a faster rate than may otherwise be the case for an untrained individual. Thus, there is a necessity to establish a model that

would aid in the prediction and/or identification of deception solely by observing, and then analyzing an individual's actions or inactions, in addition to their spoken words. For the purpose of distinguishing the truth from lies without requiring an in-depth background in the field, any proposed model must not necessitate any outside or previous knowledge. Thus, the proposed model herein has been written and formatted in laymen terms to ensure that there is no ambiguity or any confusion about what is to be expected or analyzed during an interview.

It has been reported that for average individuals and even specialists, detecting deception can be a strenuous challenge (Da Silva & Leach, 2013, 116). For instance, it has even been established that for average individuals without a background in the field the "accuracy rate [of detecting deception for laypersons] […] was 54%: 61% of truths and 47% of lies [that] were correctly identified." (Da Silva & Leach, 2013, 115). In this research, it was established that the detection of deception for specialists was only marginally higher than those without a background in the discipline. Accordingly, although it can be a struggle to recognize deception, there have been researchers who have taken the initiatives to establish and verify a list of verbal and non-verbal cues that have been explicitly linked to deceptive practices. These lists, as illustrated later in this project, have been utilized as the exhaustive lists of cues for personnel who are interested in detecting deception. Biometrics has also been a major point of focus for other researchers in the field. According to the Federal Government's biometrics website, the term biometrics can be used to refer to either a process or a characteristic. A biometric as a process is defined as, "an automated method of recognizing an individual based on measurable biological (anatomical and physiological) and behavioral characteristics"

("Biometrics," 2006). On the other hand, as a characteristic, a biometric is also a measurable biological characteristic that may be utilized for "automated recognition" ("Biometrics," 2006). Accordingly, whereas there has been research elsewhere that specifically focuses on the study of biometrics through advanced technology, such as live-scan facial recognition systems, voice recognition, and retina recognition, this proposed model was primarily focused on the detection of deception without a reliance on such resources. These technologies can certainly be practical for officers who wish to conduct concrete analyses of individuals, yet these resources do not aid in the timely identification of deception on a daily basis for personnel without access to these systems.

Take for instance a police officer who must monitor a major highway and stop individuals who are driving over the limit, driving with faulty brake lights, failing to follow legal regulations, etc. This officer must, within a few minutes, determine whether the individual at-hand is trying to establish a deceitful story or is actually telling the truth. In such instances, it may be impractical to expect the law enforcement officer to utilize advanced technologies. The process of detecting deception should be made easier, not complicated for those who have dedicated their lives to ensure the safety of the nation.

Since the 9/11 attacks of 2001, there has been a progressive shift in threats aimed at the U.S. Whereas al-Qaida and other religious/politically motivated terrorists groups may have been at the forefront of intelligence and law enforcement analyses in 2001, one of the most prominent threats in 2013 were cyber-attacks ("Cyberattacks," 2013). However, amidst these threats are two specific forms of terrorism that could render U.S. virtually victim to countless domestic attacks; homegrown and lone-wolf terrorism. For those who are radicalized within the nation, their goals are made easier by the civil rights,

protections, and constitutional guarantees that are provided to those in the U.S. Accordingly, these individuals do not have to be concerned about issues that would have otherwise been raised had they been based in another country and wanted to enter the U.S. to initiate an attack, such as gaining security clearances and passing through border control. Thus, U.S. law enforcement personnel at the local, state, and federal levels are explicitly accountable for protecting the nation from these individuals who have been radicalized. Of course, the utilization of the intelligence cycle to gather, analyze, and then disseminate reports can be a useful tool; yet, it does not always foster the necessary protection to predict, and then prevent such attacks. In addition, placing high reliance on technology is a less personal means of handling intelligence issues, which may not always allow the government to attain their intelligence goals.

One scenario that explicates the necessity of a more personal approach to solving problems is the 2001 attacks. During this period, intelligence analysts in the U.S. had devoted much time to conduct research and finalize reports to determine when and where an imminent attack would take place. For those working in the Central Intelligence Agency (CIA), the identification of several suspects had already been successful. The list of these individuals had been sent to the Federal Bureau of Intelligence (FBI), yet it had not been transferred to local state troopers and the information that had been sent were not the complete lists (de Silva, 2003, 113). As a result, although the suspected terrorist was stopped for traffic violations, he was not detained due to the troopers' lack of knowledge on the topic (de Silva, 2003, 113). This should be deemed a noteworthy instance of a failure to share information among intelligence officers and law enforcement personnel, in addition to the ways in which even advanced technology did

not offer support; however, this also represents a perfect scenario in which the utilization of verbal and non-verbal cues could have been applicable. Whilst the troopers were not made aware of the suspected individuals, had they been provided information about the ways to detect deception, there could have been a higher probability that they would have at least asked the individuals more pressing questions to determine the truthfulness of their statements which would have possibly led to further inquiry, recognition, and then detainment of the terrorists prior to the attacks.

Unfortunately, there is no factually significant way in which to determine the probability of the troopers' utilizing verbal and non-verbal cues to either make an arrest or gather more information on the suspects. Nevertheless, in a concerted effort to recognize the general success rates of the utilization of the cues to recognize deceptive practices, in this research qualitative and quantitative analyses of thirty individual-level cases of deception were conducted. The work also included a non-parametric statistical analysis to further elaborate on the probabilities of successful recognition based on the project herein conducted. The question that was established for the research read, "Will the DETECT model correctly identify deception and truthfulness in the thirty conducted interviews?" Thus, the null hypothesis for this questions read, "The 'Model Prediction' results are the same as the 'Actual' results within each of the interviews."

Approval from the Institutional Review Board (IRB) was sought and granted prior to the fulfillment of this research. Accordingly, as is described more thoroughly in the methodology component of this work, the thirty individuals were undergraduate college students over the age of eighteen who provided consent to being interviewed and having their interview responses recorded.

As is conveyed by a majority of the selected articles analyzed in this work, there are various verbal and non-verbal cues that could be identified; yet, there are only a select few that are commonly utilized by law enforcement reports and analyses. Verbal cues are commonly recognized as being the words that are actually spoken by an individual, whereas non-verbal cues are recognized as physical movements or non-movements exemplified by an individual. This has been further explained later in this work. Accordingly, all analyses were based on the utilization of these cues as listed in the following section of this report. Through these analyses a model was established to provide law enforcement personnel with a description of each verbal and non-verbal cue that has been identified as having high success rates in the actual identification of deception. This model was titled, "Determining and Evaluating Truth through Explicit Cue Testing" which was thus provided the acronym DETECT. However, for the purposes of this work, DETECT is herein referred to as "the model" to ensure that there is no confusion throughout the analyses. The model was designed to be useful for those with and without a background in the detection of deception; therefore, the model could be categorized as universal in its applicability.

Of course, it is paramount that all individuals who review or seek to utilize the provided model and the analyses are aware that there are special instances in which the applicability of the model will falter. Since there are individuals across the nation who have honed their skills of deception, there are also circumstances under which detection through brief observations will be virtually impossible. This does not downplay the efficacy of the model, yet it should be utilized to recognize the feasibility of detecting deception in all cases.

To maintain the realistic nature of the research, interviews and analyses were conducted in settings that allowed spontaneity. To further expand, the interviewees were not paid to take part in the research. The only incentive the students had to take part in the research was a 5% higher grade in their mathematics class. This incentive was outweighed for some who chose not to take part, due to the fact that the research took much time to conduct and required many individuals to drive longer distances from their places of residence.

Overall, it may be crucial to place a focus on the ways in which the data and meta-analyses conducted in the literature review certify and remain in agreement with the presented conclusions and analyses. For instance, if the presented results do not remain in alignment with previously published data, then this may signify possible mistakes in the final conclusions of this work. Nonetheless, all conclusions and analyses have been rigorously reviewed to determine how the work generally fits into the existing body of knowledge on the topic. Finally, as is further clarified in the concluding section of this research, the compiled analyses could and most probably should be expanded in the future; accordingly, it has also been argued that are several points with regard to the effects of cultural norms that should be taken into careful consideration in future research.

Literature Review

As early as the 1980s, the topic of detecting deception has been investigated by researchers who have developed academic reports on the ways in which interviewing strategies can be improved to increase the likelihood of distinguishing the truth from the lies. Whereas other topics have been diligently researched for years, the detection of deception through verbal and non-verbal cues has not been at the forefront of recent

discussions in the fields of political science and law enforcement. As was previously mentioned in the introduction of this research, the recognition of deceit is a necessary and useful tactic for law enforcement personnel who must work with individuals on a daily basis.

This literature review has assessed several documents written by authors ranging from profound researchers in the field of D&D to graduate students who focused their areas of study on deception practices. To understand the nature of deception, the assessment of literature focused on a wide array of articles pertaining to verbal and non-verbal cues, in addition to detecting deception. Furthermore, the articles were selected through a systematically organized process whereby data were sought directly pertaining to verbal and non-verbal cues to identify deception, and the field of D&D in general. As has been shown through this review, the major patterns that have been identified relate to a necessity of spontaneity in the analyzed material in order to ensure the most realistic data are being analyzed.

Moving forward, it has also been identified as necessary to allow one's self to appropriately address an individual from an unbiased perspective to determine whether or not that individual is actually exemplifying characteristics of deception. One common factor amongst the work analyzed was that most authors either utilized a desk-style research approach or a case study methodology. The case study-based research provided forums inundated with data explicitly relevant to actual applications of strategies to detect deception, whereas the desk-style research further provided factual information upon which to analyze the results of the case studies.

Verbal and non-verbal cues have been analyzed in the field as early as 1987, yet a common weakness of the research has been the lack of rigorous testing of the effectiveness of the utilization of the cues as a means of recognizing deception. In addition, there has been a failure to identify the applicability and usefulness of both cues in law enforcement and intelligence environments.

For the purposes of this research, all analyses have been based on the identified cues that are listed below. Each of these cues has been derived from the following articles on verbal and non-verbal cues; accordingly, each of the cues has been included with a brief description to lessen the likelihood of ambiguity in recognizing these characteristics. Moreover, since there are cues that are specific to individuals of certain genders, each of the cues have been listed with either M to indicate it is predominately noticed in males, F to indicate it is commonly recognized in females, or M/F to highlight that it is commonly noticed in both males and females.

Verbal Cues:

1. **Speech Stumbles (M/F) = Use of filler words (e.g. "umm" or "uhh") sign of deception.**

2. **Including long pauses before answering (M/F) = High probability of deception**

3. **Evading answering the question (M/F) = High probability of deception**

4. **Beginning answers with the word "well" (M/F) = Major sign of deception**

5. **Utilizing negative statements (M/F) – Use of words, such as "no," "do not," or "cannot" are signs of deception.**

6. **Using higher tone and pitch of voice (M/F) – Associated with deception**

Nonverbal Cues:

7. **Maintaining steady eye contact (M/F) = Habitual liars believe looking away will lead the interviewer to suspect they are lying.**

8. **Rubbing nose (M/F) = Stress causes an increase of blood to the extremities which causes tingling in the nose; hence, individuals rub their nose when they feel discomfort.**

9. **Crossing/Folding arms (M/F) = A barrier in communication.**

10. **Touching/Placing hand on suprasternal notch or the base of throat (F) = Researcher Joe Navarro recognized women do this when they are stressed (2012).**

11. **Using item to cover themselves (e.g. jacket, cup, paper) (M/F) = Barrier in communication**

12. **Holding hands together or clasping hands (M/F) = Barrier in communication**

13. **Positioning feet at the closest exit (M/F) = Represents where an individual actually wants to be at the time.**

14. **Using hand gestures that do not explicitly match what is being stated (M/F) = Liars must juggle conflicting information to present a believable story; hence, hand gestures are not in synch with their statements.**

15. **Not using hand gestures (M/F) = Focus is on establishing a truthful story, so the individual forgets to use hand gestures as they would in general situations.**

16. **Fanning themselves with their hands or other items (M/F) = Stress causes individuals to feel hot, which forces them to fan themselves to cool down.**

17. **Pupil dilation increasing (M/F) = Sign of deception**

18. **More blinking (M/F) – Researcher note this as a sign of deception**

19. **Moving fingers – Identified later in research as being a common movement**

20. **Crossing legs – Sign of barrier in communication**

The above-listed cues were used as the general basis for the development of the model; however, as later sections have explicated through the use of charts and graphs, there were several cues that did not play major roles in the detection of deception in this research.

To ensure that the literature review expanded on the major facets of the research, this component has been broken down and formatted into three separate sub-sections according to the theme of the reviewed work; detecting deception, verbal cues, and non-verbal cues.

Detecting Deception

In an effort to establish a general outline of basic qualifiers of deception, John L. Waltman and Golen published "Detecting Deception During Interviews" in 1993, which pertained to the identification of deception during interviews when auditing. Waltman and Golen are both faculty members at Eastern Michigan University ("EMU Faculty Publications," 2001). The combination of their expertise and backgrounds in the field substantially aided in the establishment of a body of work focused on leakage and the common non-verbal behavioral patterns or body movements of liars. Moving forward, the work provided assessments that determined that many advanced liars have learned to control their faces; hence, the author discussed the importance of assessing situations through the analysis of other areas of an individual's body (Waltman & Golen, 1993, 61.) Furthermore, the authors also brought their work to an end by identifying that the

behavioral norms of individuals vary from person-to-person (Waltman & Golen, 1993, 63.) Based on this information, it is also important to identify the norm of an individual prior to judging their actions and assessing for deception.

The data offered by these authors will act as the guiding factors when analyzing the interviews that have been conducted. Moreover, it was also necessary to take into consideration that by being objective and not generalizing each individual, one can improve the chances of successful detection of deception. The work was aimed at providing details about the ways to detect lies during audit interviews; however, this issue was only briefly discussed within a few sentences at the beginning of the work. Additionally, Waltman and Golen did not make clear how they arrived at their conclusions; thus, it was assumed that the authors gathered their data and established analyses through classical desk-style research. However, had the problem been approached through a case-study analysis, it is presumed that the analyses would have been more thorough and useful. Accordingly, no literature related to the issue was assessed in their research; thus, it is difficult to establish the accuracy of the statements. Of course, as can be recognized in this literature review, Waltman and Golen did essentially provide information that had been confirmed as valid by other research; however, the authors did not structure their argument in a manner that allowed for a more detailed analysis. The work contributed to the understanding of the field by ideally presenting a short list of verbal and non-verbal cues that could be analyzed and were later determined to be useful by other researchers in the field

In 2000, Barton Whaley and Jeffrey Busby developed "Detecting Deception: Practice, Practitioners, and Theory," which provided readers with an introduction to

deception, a description of the practitioners of deception, and how deception can be detected. Whaley and Busby's work significantly contributed to the field by making known that although experts are the individuals who commonly have more success in detecting deception due to the organized manner in which they approach situations, non-experts could also be deemed detectives since every individual uses skills of detection to identify deception (2000, 73). The authors also placed a priority on individuals having an adequate understanding of the definition of deception and the nine categories of detectables, which include pattern, payoff, strength, players, place, style, intention, time, and channel (Whaley and Busby, 2000, 81). While the work did not ponder on verbal or non-verbal cues in the detection of deception, it did provide a great deal of information that can be used as an underlying foundation of the research. Whaley and Busby's work was largely qualitative, yet it did incorporate basic quantitative analyses with regard to the cost-effectiveness of deception. Unlike Waltman and Golen, Whaley and Busby wrote the article for the purpose of expanding on their selected topics based on research that had been previously conducted. Waltman and Golen failed in this aspect by providing an article that solely presented data without any real analyses or evidence to help validate the concepts. Nevertheless, Barton and Whaley subtly incorporated information about the field without including an explicit literature review component. Their work took into consideration data from within the field to test and more thoroughly develop analyses; thus, the work itself added to the current body of knowledge by enhancing and expanding research that had already been conducted. Their work utilizes the grounded theory research method; hence, the authors did not have any major predetermined notions that would have largely influenced their arguments.

Overall, Barton and Whaley were able to organize their study design in a systematic manner. The only problem with the work, from a personal opinion, was that the authors had a tendency to draw out stories and analyses in manners that could possibly lead the readers to feel as though the objectives of the work have been abandoned for short periods of time. The discussions were lengthy, but in their entirety they did adequately allow readers to gain context about the scenarios without providing one-sided or biased details. Thus, their arguments did seem to be valid and they were appropriately structured to provide readers with a background of the case studies, in addition to various data that would be necessary to understand about the project. Finally, the conclusions were presented in an easy-to-understand manner, yet they were not as easy to identify as those reflected in Waltman and Golen's article. In its entirety, various aspects of this research can be applied to the proposed research of this work on verbal and non-verbal cues, since the authors expressed detailed discussions of the origins of deception and deceptive practices, in addition to the common practitioners of deception.

With regard to this subject-content, Hermann published her work, "Assessing Leadership Style: A Trait Analysis" in 2005 pertaining to the assessment of leadership styles through at-a-distance assessments. While the research project with regard to the proposed DETECT model will not focus on this topic, Margaret's work did place an importance on the use of spontaneous information when analyzing the background or characteristics of an individual (Hermann, 2005, 179). Hence, this could be derived, and then applied to the current research by placing an emphasis and forcing individuals into answering questions for which they do not have a great deal of time to spend developing an answer, since this could aid in the detection of any deceptive acts. Hermann based her

analyses on desk-style research and reports of observations from major political leaders. The work also briefly took into consideration several short case studies of the contexts in which leadership styles could be assessed through trait analyses. Her work was seemingly written as a supporting document of the use of trait analyses through spontaneous materials; thus, her work primarily focused on her research, rather than expanding to include other research that had been conducted in the similar field.

As more research was conducted, it was found that in 2007, Kevin Colwell published an article known as "Assessment Criteria Indicative of Deception (ACID): an integrated system of investigative interviewing and detecting deception." Colwell's background as a professor of psychology specialized in detecting deception clearly aided in the development of a foundation for the work ("Kevin Colwell," 2014). Consequent to providing a brief overview of the extent to which content analyses have been conducted to determine patterns in deceptive statements during interviews, Colwell further explicated that interviewing strategies that can increase the cognitive load of the individuals being interviewed can improve the effort to detect deception (2007, 168).

Colwell's main argument was clearly that the ACID system, which analyzes individuals' responses for investigative purposes, had gained support from many researchers for good reasons (2007, 168). By testing interviews through the ACID method, the results were concluded as being true and correct (2007, 170). Such testing further set the basis for the proposed research by strengthening the argument that it is in fact possible to identify deception. The major drawback of this work was that it failed to analyze the ways in which the method could be carried out in a timely manner for law enforcement who wish to evaluate the behavior of an individual in a short period of time.

Through a case study analysis, Colwell put forth a persuasive argument in support of the ACID system, yet it seemed to lack a completed structure in that he did not expand his arguments to recognize the possible utilization of other forms of similar models. Of course, Colwell's work differs to the presented research on detecting deception in that he focused on a model that had already been established; however, it further differed in that Colwell did not essentially add any novel information to the field, but rather reinstated and provided more information about a previously developed model. He did include a plethora of data, yet failed to add data that would disagree with his points. Therefore, the work seemed to lean toward proving his ideas, rather than bearing in mind the situation in its entirety. Nevertheless, the work did provide a solid foundation upon which further analyses can be based and data can be tested.

Moving forward from analyses of specific models to detect deception, in 2012 an FBI article written by Joe Navarro was published entitled, "Detecting Deception." Navarro briefly touched upon the necessity of law enforcement officials to have an adequate understanding of human behavior, since it would provide more opportunities to gather data and conduct assessments (2012). Subsequently, he pondered on several non-verbal characteristics that were known to be associated with deception (Navarro, 2012). However, Navarro also spoke about the importance of having an adequate setting to conduct an interview of an individual to determine deception (2012). This is a point that will surely be tested in the proposed research, since the aim is to provide law enforcement or intelligence personnel with a model that could be utilized or applied in a wide variety of scenarios. Rather than limiting officials to a specified or ideal location for an interview, the model should have the flexibility to be tailored according to the needs of individual

officers. This is yet another reason why the proposed research will add a plethora of data

to the current bounds of literature published on the topic. The work will allow law

enforcement or intelligence personnel to detect deception in a wider range of scenarios

without having to take the time to set up an ideal environment or location to conduct the

interview(s). This was the reason that, as explained in the methodology section of this

work, the environment was made to be representative of a common interrogation room.

Due to the limited funds for the research, there was no time to replicate another type of

environment; however, the model that has been presented does not require an ideal

location, which follows in the ideas and notions set forth by this reviewed article.

Verbal Cues

To gain more information about verbal cues and the ways in which previous

researchers have utilized these cues, research was conducted primarily on this topic.

Accordingly, Walter Weintraub's 2005 work "Verbal Behavior and Personality

Assessment" that was published in the same book as Hermann's article was reviewed.

Weintraub's work focused on various ways to assess an individual's personality

characteristics through verbal behavior and patterns. Weintraub is known to be a major

researcher in the field; hence, it is not surprising that his work was of high standards. His

work explored another side of political psychology that had not been identified by the

authors that were previously mentioned. His attention was focused on phonology and

semantic variables (Weintraub, 2005, 137). Additionally, Weintraub was able to provide

examples and detailed data on the ways in which grammatical variations and choices of

individuals can be used to gain an understanding of an individual (2005, 137). This would

be comparable to Waltman and Golen's ideas of first assessing an individual to determine

his/her behavioral norms. Moving forward, Wintraub also explicated that if verbal trait analyses are to be conducted, the speech samples must be collected from speech under conditions that are only moderately stressful (2005, 140). He also explained that if the verbal samples were collected from scenarios in which the stress levels were too high or too low, any analyses of the data would not be rendered useful or applicable (Weintraub, 2005, 140). Weintraub did establish his arguments within the first few pages of his work; in addition, due to the style of his writing, he was able to further establish these ideas throughout his work. Thus, it could be argued that approaching the problem from a different perspective would not have aided in the improvement of the effectiveness of the work. Au contraire, it may even be possible to argue that Weintraub's style of research and writing heightened the standards of the work.

Further, Weintraub did include information about grammatical commonalities and the utilization of verbal patterns to recognize personality norms for individuals. However, he did not relay much information with regard to previous literature that had been conducted in the field. In this manner, Waltman and Golen's article had more similarities in terms of the lack of outside research and comparisons, yet Barton and Whaley's work was more similar with regard to the academic nature and analyses of Weintraub's research.

Weintraub's work was an article included in a book that incorporated a compilation of important analyses by dominant researchers in the field of political psychology. The book itself did not place an importance on the discussion of the history of deception or the detection of deception. Nevertheless, Weintraub's main point that has been majorly taken into consideration for this research on deception was the necessity of

placing a focus on the specific ways in which individuals speak and answer questions. Weintraub explicitly focused on the grammatical ways in which sentences are structured; yet, this research on deception has already identified specific verbal cues on which to focus. Thus, the main point that has been derived from Weintraub's work was the necessity of focusing on spontaneous material that was presented by the individuals being interviewed, which was another point that was argued by Margaret G. Hermann in her work.

Later in 2011, Maria Hartwig, Par A. Granhag, Leif Stromwall, Ann G. Wolf, Aldert Vrij, and Emma Roos Hjelmsater published an article titled "Detecting deception in suspects: verbal cues as a function of interview strategy" which was dedicated to the utilization of verbal cues as a way of detecting deception. While Pozzato's work strictly focused on non-verbal cues, Hartwig, et. al. offered work much broader in scope. The aim of the proposed research work was to establish a basic model that could be used by law enforcement or intelligence personnel to raise the rate of success in detecting deception. In this respect, Hartwig, et. al. have provided necessary background data on the extent to which current law enforcement can predict deception. According to the article, in detecting deception average persons, in addition to experts on detecting lies achieve statistical rates of identifying deception that are only marginally higher than that of chance (Hartwig, et. al., 2011, 643). This also verified the notion that individuals have difficulties in detecting deception, which was a common theme identified in many of the resources researched for this work.

By conducting observations of ninety-six undergraduates, Hartwig, et. al. were able to highlight the veracity of the extent to which verbal cues could be used to

recognize deceptive practices (2011, 654). The study concluded by also stating that many innocent suspects believed that "telling the truth is sufficient for exoneration" whereas officials mainly require corroborating evidence to determine an individual's innocence (Hartwig, et. al., 2011, 645). Furthermore, it was also made clear that the accuracy rate was not as high as predicted when the basis was the verbal cues; accordingly, the authors hinted to the possibility that the examination of non-verbal cues may have provided greater insight. The work was written in a tone that clearly proved that all aspects of the topic had been researched and taken into consideration prior to publication.

Hartwig, et. al.'s work clearly provided more data about verbal cues and their usefulness in detecting deception; however, it also strengthened Pozzato's work to the extent that the article even conveyed the idea that the identification of lies could have possibly been made easier had non-verbal cues been recognized and measured as a component of the research. When used in combination, these two articles were the primary sources for the proposed research, solely due to the fact that they explicitly provide lists of verbal and non-verbal cues that could be measured. Accordingly, each article provided the ways in which a researcher or layperson could use these signals to assess another individual to recognize deception. With this being noted, it was also of the utmost importance to recognize that many of these researchers did, however, repeat information about verbal and non-verbal cues without adding any novel cues to the list. This could be a sign that the utilized lists were the exhaustive lists in the field of detecting deception. Thus, the previously mentioned list of verbal and non-verbal cues were clearly supported by researchers in the field as being useful in the recognition of lies and deception.

On another note, the research project has been based on interviews with individuals who have been told to lie about details of an event that they created within a group of ten persons. Thus, the work of Lara Warmelink, Aldert, Vrij, Samantha Mann, and Par Anders Granhag from 2013 titled "Spatial and Temporal Details in Intentions: A Cue to Detecting Deception" was reviewed. Since the participants for the proposed research were required to determine for which questions they will lie prior to being interviewed, they must first undoubtedly establish their intentions. Warmelink, et. al.'s work specifically emphasized that research had proven that individuals have a tendency to provide a wealth of detail in describing their intentions, whereas details were minimized when one was not discussing their intentions (Warmelink, Vrij, Mann, Granhag, 2013, 105). For the purposes of Warmelink, et. al.'s work, it was hypothesized, and then verified that the individuals tested in their research offered significantly more detail in their answers to questions when being truthful about their intentions, whilst less details were provided when the individuals were lying (Warmelink, et. al., 105).

Whereas Pozatto and Colwell honed their focus on individual verbal and non-verbal cues to detect deception, Warmelink, et. al. took into consideration spatial and temporal details of deception. However, it should be made known that Warmelink, et. al. majorly contributed to the understanding of verbal cues to identify deception, since the discussions offered in their work primarily related to the extent to which individuals vary in the ways they verbally answer questions based on their intentions.

With regard to the aforementioned research, the specialists solely focused on various cues that are representative of deception. However, also in 2013, Cayla S. Da Silva and Amy-May Leach made the decision to analyze whether there were any

differences in the determination of lies in those who speak English as their primary

language or are second-language speakers. Da Silva wrote this article in partial

fulfillment of her Master's in Criminology at the University of Toronto and it was

assumed that Leach was Da Silva's research supervisor, since she worked as a member of

faculty at the University of Toronto (Da Silva & Leach, 2011, 1). Accordingly, no biases

or inherent political motivations were identified in the development of this research.

Through a case study analysis of thirty individuals, the researchers sought to test the

hypothesis that the cognitive overload for second-language speakers would make the

detection of deception an easier process. Ultimately, the research disproved the

hypothesis and it was concluded that second-language speakers have a tendency to show

less emotions when speaking, which would certainly make deceiving others simple.

Furthermore, the work also proved that the second-language speakers stated that they did

not feel any anxiety when reading the deceptive statements. Whilst Da Silva and Leach's

research did not specifically pertain to the discussed research of detecting deception

through verbal and non-verbal cues, it did provide an intricate discussion of the necessity

of discussing cognitive overload in the context of deception.

Non-verbal Cues

Lydia R. Pozzato expanded the research horizons in 2010 with her work

"Interpreting Nonverbal Communication for Use in Detecting Deception." Her emphasis

was on the ways in which lies can be detected or have been detected through physical

body attributes. Her explanations brought into consideration various non-verbal traits that

could symbolize deception by providing an image of the human body with indicators of

areas that should be assessed to determine deception; however, she also argued that

deception could actually be exposed when individuals move away from their norms (Pozzato, 2010, 92). On another note, Pozzato devoted a brief section of her work to discuss verbal cues to determine deception; however, here she merely discussed her perspective that non-verbal cues were more reliable, since liars can commonly conceal the truth easily through verbal means (2010, 95). Her work also demonstrated possible differences between male and female non-verbal cues of deception.

In the same year, David Matsumoto, Hyi Sung Hwang, Lisa Skinner, and Mark Frank published an article in the Federal Bureau of Investigation (FBI) bulletin entitled, "Evaluating Truthfulness and Detecting Deception." The article relayed the ideas that law enforcement should recognize that there is not one standard, nor perfect technique or model to detect deception; however, the authors did mention that through systematic awareness of non-verbal cues, individuals could more easily recognize deception (Matsumoto, Hwang, Skinner, and Frank, 2011). For example, the authors made clear that many law enforcement officers commonly focus on what an individual is saying, rather than also being aware of how the individual is saying the information (Matsumoto, et. al., 2011). However, the work relayed the notion that the officers should not just focus on non-verbal characteristics, but should also try to multitask and take into consideration both cues, while assessing how they are working in coordination with one another (Matsumoto, et. al., 2011). The work seemed to rely on a desk-style research methodology; thus, it did not evaluate any case studies or include any results from direct observations. However, the work was mainly a report for law enforcement; thus, it should not be expected to uphold the detailed standards of an in-depth research project.

Cumulative Discussion – Literature Review

There is a considerable amount of comprehensive literature on the detection of deception. A majority of the current literature either focuses on verbal cues or non-verbal cues. In the instances where both types of cues were discussed, no research had been tested and no in-depth details were provided. Furthermore, it seems that many researchers had tested verbal and non-verbal cues without also exploring the ease at which individuals in the field of law enforcement or intelligence could utilize these cues on a daily basis. Accordingly, there is yet to be a significant research study that focuses on the development of a model whereby verbal and non-verbal cues are utilized to detect deception within a short period of time. Thus, the research will accordingly fill this lacuna in the literature by proceeding along this route.

As per the above literature review, a majority of current literature in the field essentially reinstated previously conducted research and data, while also reconfirming prior data. While such repetitiveness confirms that the identified verbal and non-verbal cues are widely accepted as being useful in detecting deception, it may also provide readers or officials with a thorough knowledge, since they are essentially retaining and reading repetitive data written in varying forms. However, the proposed work will move away from the norm by initiating a new status quo whereby intelligence or law enforcement officials can learn about deception and the detection of deception based on a model that has been statistically tested. The model that will be established will depend on published literature, yet will be further expanded based on the proposed study and analysis of thirty participants and observations of their interviews.

Methodology

The research for this project posed the question, "Will the DETECT model correctly identify deception and truthfulness in the thirty conducted interviews?" Therefore, the null hypothesis for this questions read, "The 'Model Prediction' results are the same as the 'Actual' results within each of the interviews." This hypothesis was been tested through the analysis of thirty individual cases of participants who had volunteered to either be truthful or lie about a story that the participants had developed based on an outline that they had been provided. Each of the thirty participants were from East Tennessee and were students from the Walters State Community College which is a state college that is known for being the Apple Distinguished partner for technology. The students were predominately studying in pre-med and engineering degree programs, yet they found the research on deception to be interesting and thus volunteered to be participants. Several of the students even realized upon discussing amongst themselves that they were related by marriage. The students were from areas, such as Tazewell (population: 2,218 as of 2010) and Harrogate, TN (population: 4,389 as of 2010) which each have less than 5,000 individuals in terms of population size. Therefore, the participants had been born and raised in similar environments, which may have also caused similar patterns in the ways in which they answered questions, as is described in detail in the following section of this work. The ages of the students ranged from mid-twenties to late forties; this could have also caused differences in the ways the participants answered the questions. The students were divided into three groups of ten, and then were provided the following fill-in-the-blank story:

It was **(insert date)** in **(insert location).** At around **(insert time)** local police were alerted of the death of a **(insert age)** year old **(insert male/female)** named **(insert name).** Officials were notified that the victim had been **(insert cause of death – murder/ suicide).** Victim was found **(insert standing/sitting/lying)** in **(insert specific location).** 911 call was placed by **(insert name)** who was **(insert relation to victim).** According to reports, the victim had **(insert color)** hair, **(insert color)** eyes, and weighed approximately **(insert weight)** pounds. In addition, the victim was **(insert height)** tall and was **(insert race).**

The victim **(insert was/was not)** currently enrolled in school.

IF WAS ENROLLED: Victim was studying to be a **(insert profession).**

IF WAS MURDERED: At this point, one suspect has been taken into custody. This suspect is **(insert name)** who is **(insert age)** years old. The suspect supposedly **(insert did/did not)** have any prior knowledge of the victim.

IF HAD PRIOR KNOWLEDGE: The suspect knew the victim due to **(insert reason).**

IF WAS SUICIDE: The family of the victim believes that **(insert reason)** may have been the cause of the victim's suicide. Investigators are seeking to find any and all possible motives behind the suicide. Friends of the victim believe that **(insert reason)** may have been the cause.

At this point, the victim's family which include **(insert family relations)** are offered our deepest condolences.

_____

The story was developed to ensure that the participants could include as many details as possible, whilst remaining within a set pattern that would be useful for this

research project. The participants were provided with around fifteen to twenty minutes to fill in the answers and then determine whether they would lie or tell the truth in the interview. Once they had determined this, they were instructed to write this information on the top of their story page, so that once the model analyses had been completed, the results could be compared with the actual data. The participants were asked into a room one-by-one in random order. They had stapled their stories together, so that no information could be seen prior to the analyses and placed the story on the desk as they entered the room. To mimic the general environments of interrogation rooms, the individuals were asked to sit on a basic plastic chair as they faced the interviewer and the camera. The door was to the participants' right, which was another point that was necessary to take into consideration during the analyses, since one of the non-verbal cues related to the direction of the interviewees' feet and whether they were positioned toward or away from the door. The participants were told to act as they would in regular, every-day circumstances and be relaxed, in addition they were instructed to feel comfortable to take as much time as they wanted to answer the questions. Further, the participants were once again asked whether or not they agreed to be participants and have their data recorded for further analyses while being videotaped. This was taken as a further precaution to follow the guidelines that were established by IRB.

Finally, once all the interviews had been completed, the video recordings were stored away for around two months. It was important that personal biases did not play a role; therefore, by leaving the videos without directly conducting the analyses immediately, there was less of a chance that any subconscious or subliminal personal opinions would affect the observations. Moving onwards, the interviews ranged from

2

around one minute and thirty seconds to two minutes and forty seconds; hence, the analysis of the individual videos did not consume much time.

The individual videos were only watched one time to further determine whether this model would be applicable in daily situations. Two tables were developed in which the participants' numbers were inserted; on one sheet was a list of verbal cues and on the other was a list of verbal cues. As any cues were recognized, an "X" was placed below the cue in the spreadsheet. For the purposes of this research, a general rule of thumb was established; if fifty-percent or more of the cues were detected, then the model determination/theoretical outcome should be that the individuals were lying. Take for instance a case wherein an individual scores eight out of fourteen in terms of non-verbal cues, whereas the same individual only scores one out of six for verbal cues. Based on the rule for this model, the individual should be labelled as being deceptive, since they scored fifty-percent or more in terms of one of the cues.

The research presented here follows a mixed-methods approach in that it primarily relied on qualitative discussions, yet tested the proposed model through quantitative analyses. The work relies upon the individual-level analyses of interviews. In this context, a structured interviewing strategy was enlisted. There was a set of nineteen specific questions that were asked in random order to each of the participants. Therefore, the opening remarks and questions were systematically organized. However, the only way in which this research moved away from the structured interviewing strategy was that there were no probing questions asked in order to make the participants clarify their responses to questions. On the contrary, in terms of quantitative analyses, this work

conducted objective measurements and numerical analyses of data that had been collected through the verbal and non-verbal sheets.

The ethicality of this research was upheld as per the instructions provided by the Institutional Review Board (IRB). Since approval was received from the IRB prior to beginning the research, all aspects of the research were analyzed in-detail to maintain a responsible and professional research workspace and project. All participants were provided with information about the research and were not forced or coerced into taking part in the research. The only incentive that was given to take part in the research was the possibility of a five percent raise to their grade in their mathematics course. However, many openly expressed their disdain with the small grade raise; thus, it did not seem to play a major motivating factor in the students' decisions to take part.

There were four major limitations that were identified for this work. The first limitation was the time allocated to conduct the research. The work was required to be submitted within a given time frame; hence, no experts in the field of D&D were interviewed for additional data. This may have limited the extent to which the analyses were conducted; however, in order to overcome this challenge, thorough research about the field of detecting deception was conducted. The second limitation was that it was established that the identified characteristics of deception may not be applicable to all situations. Of course, there may be scenarios in which the verbal and non-verbal cues may not be useful; however, based on the analyses conducted within this work, it seems that the cues will be majorly useful in a wide variety of situations. Additionally, the third limitation was that the research did not have a wide array of participants from culturally different backgrounds. Each of the participants, as was previously explained, came from

similar backgrounds. Thus, the research was limited to the investigation of deception in a specific set of individuals who may not be fully represent of the culturally diverse background of those within the U.S. Finally, the fourth limitation was that the work did not investigate the ways in which to detect deception in cases where individuals are provided with the opportunity to directly discuss and explain their stories. Nonetheless, as is explained in the following component of this work, this may have actually been a strength of this research work.

In addition, it is also of the utmost importance to recognize that no biases have been identified, since the work was verified using academically rigorous sources and tested non-parametric statistical assessments. All sources were analyzed to ensure that no political or other forms of biases could have influenced the final results of the presented data. While there are no definitive ways to eliminate all biased from an analysis, due to the influence of one's paradigm and inherent cognitive processing systems, the utilized data underwent thorough checks.

Findings and Analysis

Consequent to the execution of the research strategy and tactics for this project, statistical analyses were conducted and the following information was extrapolated. Information has been organized to systematically exemplify the patterns that have been identified in the final results.

The following chart and analyses highlight the commonalities identified through the interviews with the participants. The fourteen non-verbal cues can be seen listed as per the list developed and described during the initial literature review stages. In addition,

the patterns of non-verbal cues utilized by the participants have also been explicitly

recognized.

Responses of the Non-verbal Cues

(Table 1.0)

Non-verbal Cues	Steady Eye Contact	Rubbing Nose	Crossing Arms	ernal	Cover Themselves w/ Items	Clasping Hands	Positioning Feet to Exit	Hand Gestures Don't Match Spoken Words	Not sing and Gesture	Fanning Themselves w/ Hands /Items	Pupil Dilation Increasing	More Eye Blinking	Crossing Legs	Moving Fingers	NUMBER	RESULT
Participant 1	X					X			X			X	X	X	A6	6\14
Participant 2						X			X				X	X	A1	4\14
Participant 3	X					X			X					X	A3	4\14
Participant 4	X					X			X				X		A5	4\14
Participant 5								X	X				X	X	A7	4\14
Participant 6					X	X			X				X		A2	4\14
Participant 7	X					X			X			X	X	X	A10	6\14
Participant 8						X	X		X				X	X	A9	5\14

6

	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Participant 9		X				X			X				X		A8	4\14
Participant 10	X					X			X			X		X	A4	5\14
Participant 11	X		X			X			X			X	X	X	B2	7\14
Participant 12	X					X			X				X	X	B8	5\14
Participant 13	X					X	X		X				X	X	B7	6\14
Participant 14	X					X			X				X	X	B6	5\14
Participant 15	X					X							X	X	B5	4\14
Participant 16	X	X	X						X				X	X	B3	6\14
Participant 17					X				X					X	B4	3\14
Participant 18	X		X			X	X		X			X		X	B1	7\14
Participant 19						X			X				X		B10	3\14
Participant 20	X	X					X							X	B9	4\14
Participant 21		X			X	X		X	X			X		X	C4	7\14
Participant 22	X		X			X						X	X		C7	5\14
Participant 23		X	X			X	X		X					X	C9	6\14
Participant 24		X			X			X				X	X	X	C2	6\14
Participant 25	X								X				X		C8	3\14
Participant 26	X					X	X						X	X	C10	5\14
Participant 27	X		X						X			X			C1	4\14
Participant 28	X					X						X		X	C6	4\14
Participant 29						X			X					X	C3	3\14
Participant 30						X			X				X	X	C5	4\14
Count	**18**	**6**	**6**	**0**	**4**	**23**	**6**	**3**	**24**	**0**	**0**	**10**	**20**	**23**		

(Table 2.0)

Non-Verbal	Count
3\14	4
4\14	11
5\14	6
6\14	6
7\14	3
Total	30

(Table 3.0)

Non-verbal Cues	Count
Not Using Hand Gestures	**24**
Clasping Hands	**23**
Moving Fingers	**23**
Crossing Legs	**20**
Steady Eye Contact	**18**
More Eye Blinking	**10**
Rubbing Nose	**6**
Crossing Arms	**6**
Positioning Feet to Exit	**6**
Cover Themselves w/ Items	**4**
Hand Gestures Don't Match Spoken Words	**3**
Touching Suprasternal Notch	**0**
Fanning Themselves w/ Hands/Items	**0**
Pupil Dilation Increasing	**0**

The non-verbal chart directly highlights five points with regard to the commonality of the use of the cues; four individuals utilized three out of the fourteen cues, eleven participants used four out of the fourteen cues, six individuals used five of the fourteen cues, six individuals used six of the fourteen cues, and finally only three individuals used seven of the fourteen cues. No individuals used more than seven or less than three non-verbal cues during their interviews. In addition, it was further realized that although fourteen cues were listed to be identified during the

interrogations, only eleven of the cues were actually recognized and used over the course of the analyses; these cues are listed within the chart provided above as the most prominent and thus most dominant non-verbal cues.

As the analyses shifted to the discussion of the verbal cues, several similar patterns were also identified. These can be seen below:

Responses of the Verbal Cues

(Table 4.0).

Verbal Cues	Speech Stumbles	Long Pauses Prior to Answering	Evading Answering	Answers Begin w/ "well."	Negative Statements	Higher tone & Pitch of Voice	NUMBER	RESULT
Participant 1		X					A6	1\6
Participant 2		X					A1	1\6
Participant 3	X	X				X	A3	3\6
Participant 4	X	X					A5	2\6
Participant 5	X	X					A7	2\6
Participant 6		X					A2	1\6
Participant 7	X	X				X	A10	3\6
Participant 8	X	X				X	A9	3\6
Participant 9	X	X				X	A8	3\6
Participant 10	X	X				X	A4	3\6
Participant 11	X	X					B2	2\6
Participant 12	X	X				X	B8	3\6
Participant 13	X	X					B7	2\6
Participant 14	X					X	B6	2\6
Participant 15	X	X					B5	2\6
Participant 16							B3	0\6
Participant 17	X	X				X	B4	3\6

10

Participant 18	X	X				X	**B1**	3\6
Participant 19		X				X	**B10**	2\6
Participant 20	X	X				X	**B9**	3\6
Participant 21		X					**C4**	1\6
Participant 22	X	X				X	**C7**	3\6
Participant 23	X	X				X	**C9**	3\6
Participant 24	X	X					**C2**	2\6
Participant 25						X	**C8**	1\6
Participant 26		X				X	**C10**	2\6
Participant 27	X	X				X	**C1**	3\6
Participant 28	X					X	**C6**	2\6
Participant 29	X	X					**C3**	2\6
Participant 30	X	X				X	**C5**	3\6
Count	**22**	**26**	**0**	**0**	**0**	**18**		

(Table 5.0)

Verbal	Count
0\6	1
1\6	5
2\6	11
3\6	13
Total	30

(Table 6.0)

Verbal Cues	Count
Long Pauses Prior to Answering	26
Speech Stumbles	22
Higher tone & Pitch of Voice	18
Evading Answering	0
Answers Begin w/ "well."	0
Negative Statements	0

The analyses of the six verbal cues aided in the recognition that most individuals (thirteen) used three verbal cues during their time being interviewed. The second most frequent amount of cues used was two, then one, and finally zero being the least likely alternative. Accordingly, the chart clearly displays the fact that while six verbal cues were analyzed only three of the cues were actually used.

Theoretical/Actual Result-

(Table 7.0)

NUMBER	Non-Verbal	Verbal	Model Prediction	Actual	Conclusion
A6	6\14	1\6	T	T	Acceptable
A1	4\14	1\6	T	T	Acceptable
A3	4\14	3\6	L	L	Acceptable
A5	4\14	2\6	T	T	Acceptable
A7	4\14	2\6	T	T	Acceptable
A2	4\14	1\6	T	T	Acceptable
A10	6\14	3\6	L	L	Acceptable
A9	5\14	3\6	L	L	Acceptable
A8	4\14	3\6	L	L	Acceptable

A4	5\14	3\6	L	L	Acceptable
B2	7\14	2\6	L	T	Not Rejectable
B8	5\14	3\6	L	L	Acceptable
B7	6\14	2\6	T	T	Acceptable
B6	5\14	2\6	T	T	Acceptable
B5	4\14	2\6	T	T	Acceptable
B3	6\14	0\6	T	T	Acceptable
B4	3\14	3\6	L	L	Acceptable
B1	7\14	3\6	L	L	Acceptable
B10	3\14	2\6	T	T	Acceptable
B9	4\14	3\6	L	L	Acceptable
C4	7\14	1\6	L	T	Not Rejectable
C7	5\14	3\6	L	L	Acceptable
C9	6\14	3\6	L	L	Acceptable
C2	6\14	2\6	T	T	Acceptable
C8	3\14	1\6	T	T	Acceptable
C10	5\14	2\6	T	T	Acceptable
C1	4\14	3\6	L	L	Acceptable
C6	4\14	2\6	T	T	Acceptable
C3	3\14	2\6	T	T	Acceptable
C5	4\14	3\6	L	L	Acceptable

COUNT

(Table 8.0)

Non-Verbal	Verbal	Model Prediction	Total
> =50% = L	>= 50% = L	L	1
> =50% = L	< 50% = T	L	2
< 50% = T	>= 50% = L	L	12
< 50% = T	< 50% = T	T	15
		Total	30

(Table 9.0)

Model Prediction	Actual	Conclusion	Total
L	T	Model is not Rejectable	2
L	L	Model is Acceptable	13
T	T	Model is Acceptable	15
T	L	Model is Rejectable	0

	Total	30

(Image 1.0)
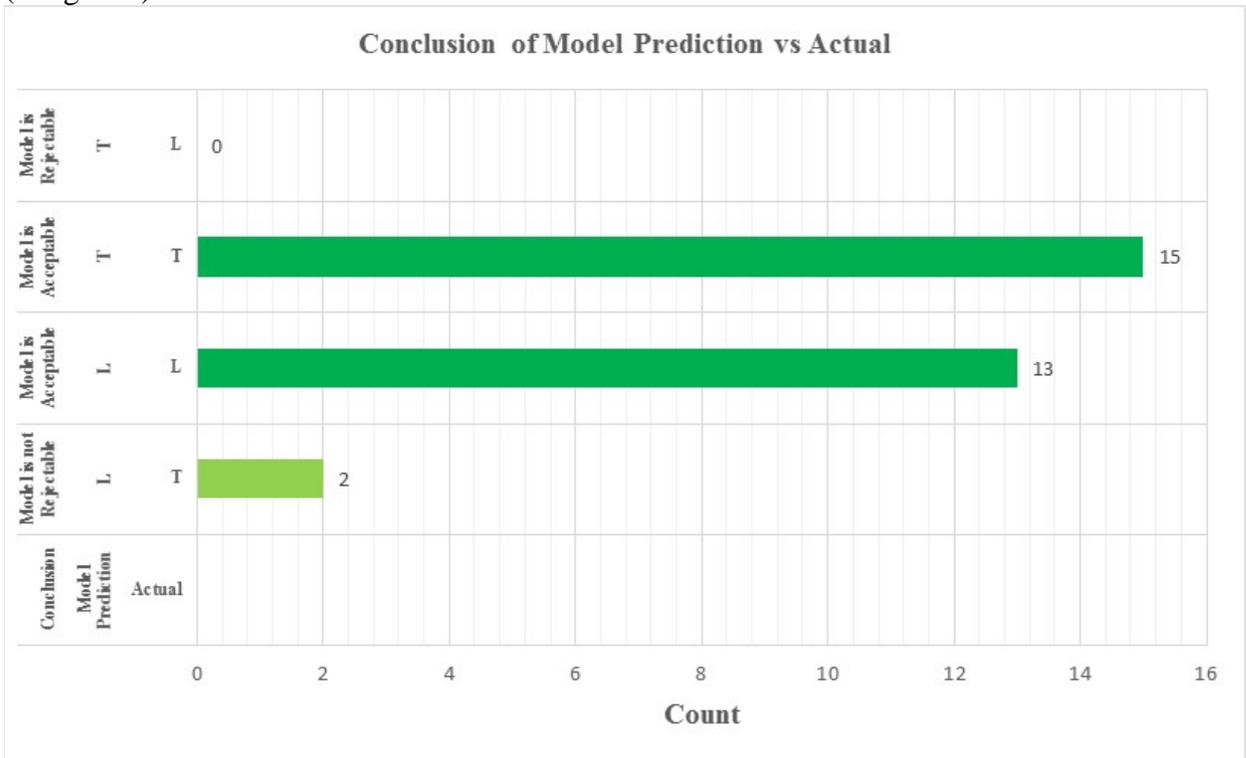
(Image 2.0)
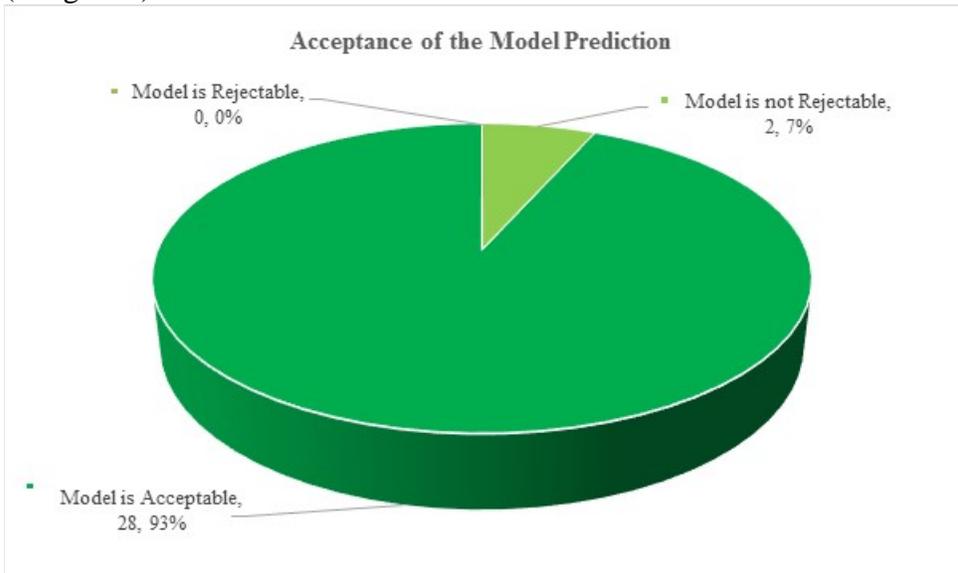
Theoretical/Actual Statistical Analysis Result-

There is no specific mathematical shape or function or distribution available to judge the validity of the model. Hence, a non-parametric statistical analysis was

conducted for this problem. In this particular problem, it was necessary to determine if the "Model Prediction" was same as the "Actual" results. The McNemar Test was accordingly applied, as is mainly the norm in social science research, due to the fact that the project at-hand related to a comparison of opinions due to pairing and involves quantitative studies.

The Null Hypothesis was that, "The results from the "Model Prediction" are the same as the "Actual" results within each of the situations." This meant the following could be derived:

H_0: T or L in the "Model Prediction" is the same as in the "Actual" results.

Deception - Model Prediction: Actual - Analysis of the Responses
(Table 10.0)

NUMBER	Non-Verbal	Verbal	Model Prediction	Actual	Conclusion
A6	6\14	1\6	T	T	Acceptable
A1	4\14	1\6	T	T	Acceptable
A3	4\14	3\6	L	L	Acceptable
A5	4\14	2\6	T	T	Acceptable
A7	4\14	2\6	T	T	Acceptable
A2	4\14	1\6	T	T	Acceptable
A10	6\14	3\6	L	L	Acceptable
A9	5\14	3\6	L	L	Acceptable
A8	4\14	3\6	L	L	Acceptable
A4	5\14	3\6	L	L	Acceptable
B2	7\14	2\6	L	T	Not Rejectable
B8	5\14	3\6	L	L	Acceptable
B7	6\14	2\6	T	T	Acceptable
B6	5\14	2\6	T	T	Acceptable
B5	4\14	2\6	T	T	Acceptable
B3	6\14	0\6	T	T	Acceptable
B4	3\14	3\6	L	L	Acceptable
B1	7\14	3\6	L	L	Acceptable
B10	3\14	2\6	T	T	Acceptable
B9	4\14	3\6	L	L	Acceptable
C4	7\14	1\6	L	T	Not Rejectable
C7	5\14	3\6	L	L	Acceptable

C9	6\14	3\6	L	L	Acceptable
C2	6\14	2\6	T	T	Acceptable
C8	3\14	1\6	T	T	Acceptable
C10	5\14	2\6	T	T	Acceptable
C1	4\14	3\6	L	L	Acceptable
C6	4\14	2\6	T	T	Acceptable
C3	3\14	2\6	T	T	Acceptable
C5	4\14	3\6	L	L	Acceptable

(Table 11.0)

Model Prediction	Actual	Total
L	T	2
L	L	13
T	T	15
T	L	0

Frequency Table of Results

(Table 12.0)

		Actual	
		T	L
Model Prediction	T	A	B
	L	C	D

A and D – Prediction was correct with the Actual. That is no change in the Prediction and in the Actual.

B – Prediction was as L, but Actual is T.

C - Prediction was as T, but Actual is L.

Therefore, total number of changes = B + C

Therefore, average number of changes = (B + C) / 2

That is, the expected changes = (B + C) / 2

Our test statistic $= X^2{}_0 = \sum (O_i - E_i)2 / E_i$

$$= [(B - (B + C) / 2)^2 / (B + C) / 2] + [(C - (B + C) / 2)^2 / (B + C) / 2]$$

$$= [(B - C)^2 / 4 + (C - B)^2 / 4] / (B + C) / 2$$

$$= [2B^2 - 4BC + 2C^2] / 2(B + C)$$

$$= (B - C)^2 / (B + C)$$

If B or C < 5, continuity correction is required and therefore,

Continuity correction of a table with r rows and c columns is, $(r - 1)(c - 1)$

Hence, for a 2x2 table, the continuity correction = 1

Therefore, Our test statistic $= X^2{}_0 = (|B - C| - 1)^2 / (B + C) = X^2{}_{calculated}$

In a 5% significance level, $X^2{}_{table} = X^2{}_{continuity\ correction,\ 5\%}$

Now our decision criterion is,

If $X^2{}_{calculated} > X^2{}_{table}$, then reject H_0

If $X^2{}_{calculated} < X^2{}_{table}$, then accept H_0

Our Frequency Table of Results

(Table 13.0)

		Actual	
		T	L
Model Prediction	T	15	0
	L	2	13

Therefore, our continuity correction (df) = 1

Our test statistic $= X^2{}_0 = (|0 - 2| - 1)^2 / (0 + 2)$

Therefore, $X^2{}_{calculated} = 0.5$

In a 5% significance level, $X^2{}_{table} = X^2{}_{1,\ 5\%}$

Therefore, $X^2{}_{1,\ 0.05} = 3.84$

Hence, $X^2_{calculated} < X^2_{table}$

Therefore, we do not reject our null hypothesis.

Accordingly, we accept the results of the "Model Prediction" as "Actual."

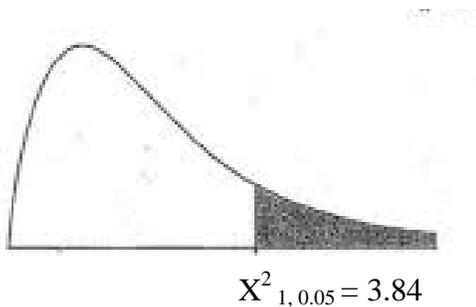**Therefore, our Model is acceptable. The confidence interval of this model is 95%.**

Chi-Square Table

(Table 14.0)

df	Significance Level											
	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
1	1.32	1.64	2.07	2.71	3.84	5.02	5.41	6.63	7.88	9.14	10.83	12.12

(Image 3.0)

$$X^2_{1,\,0.05} = 3.84$$

The above-mentioned results of the study shown in this component of this work explicated the detailed nature of the case study project, in addition to the overall effectiveness of the proposed model. As was noted previously, the analyses were more difficult, due to the way in which the questions were posed to the participants. Nonetheless, out of the thirty cases studied, only two incorrect determinations were made. In both of these cases, it was determined that the participants were lying, whereas the individuals were actually found to be telling the truth. In this study of thirty participants, there were only two instances in which the model did not correctly analyze the individuals; thus, this is a major sign that the model has a high success rate.

Moving forward, when law enforcement or intelligence personnel interview or meet individuals, they must thoroughly conduct their analyses to determine the truth; hence, it can be extremely dangerous for officials to incorrectly assume that an individual is innocent or is telling the truth, rather than incorrectly progressing under the assumption that the individual at-hand is guilty or lying. For instance, if an official was investigating a murder case and he/she mistakenly determined that an individual was being truthful, the official would have then shifted his/her focus to other suspects or facets of the case that would not lead to the correct outcome. Conversely, if the same official mistakenly determined that an individual was guilty, they may ultimately waste time trying to prove the guilt of the individual until their innocence is revealed, yet they would not allow the guilty or deceptive party to walk free without thorough investigations as would be the case in the previous scenario.

Accordingly, whilst the model did make two mistakes, the model never incorrectly predicted that the participants were telling the truth. In this manner, the model can be especially useful, since the testing in this project proved that the model did not, when used appropriately, incorrectly determine that individuals are telling the truth. Of course, there could be further implications in the incorrect deduction of individuals being deceptive; however, here it has been recognized that the harsh consequences of the incorrect determination of telling the truth greatly outweigh the consequences otherwise plausible in other cases.

As has been repeatedly stated throughout this research project, the hypothesis for the work was that "The 'Model Prediction' results are the same as the 'Actual' results within each of the interviews." According to the results of these case studies and analyses,

the hypothesis was confirmed without any reservations. The results entirely led to the confirmation of the hypothesis, since the verbal and non-verbal cues led to the identification of deception in 95% of the cases.

It is also important to note the conditions under which the cues were useful in the study of the participants. As can be seen from the provided charts and graphs and the discussion in these chapters, there were six verbal cues that were tested and fourteen non-verbal cues. Each of these cues had been identified by previous researchers in the field and seemed to stand out as the main signs of deception. The questions that were posed only required monosyllable answers (e.g. yes or no). Once the questions had been formed and asked, it was then realized that this form of questioning made the detection of deception a much greater task. Since the questions only necessitated one-word answers, it clearly established an easier environment for the individuals to lie without feeling the pressure of having to tell their story and/or restate their story several times whilst being subject to common interrogation practices. Despite these facts, the work continued and the analyses were conducted. Finally, it was recognized that although the questions had been posed in such a manner, the model ensured the correct detection of truthfulness and deceit. Furthermore, it was established that the model was statistically acceptable at a 5% significance level. There is a 95% confidence interval for this model. Accordingly, this then means that the power of this model is 95%.

Based on these discoveries, it was further established that if law enforcement officials and/or intelligence personnel did not limit their questioning to those that only required one-word answers, then there should be a much higher statistical possibility of correctly detecting deception. Expanding on these ideas, there have been three different

strategies devised to help officials easily recognize deception on a timely basis. These strategies are as follows:

1. **<u>When conducting in-depth interviews, follow the common practices and tactics enlisted in Cognitive Interviews (CI):</u>** When officials interview eyewitnesses and victims of crimes, CIs are commonly utilized to ensure that the individuals being interviewed have improved opportunities to explain themselves and provide more complete and real explanations of information. In the case of detecting deception, the common practices of this form of interviewing should be enlisted. Firstly, officers should allow the interviewees and actually instruct the individuals to "think-aloud" during the interview. During this form of interviewing, law enforcement and intelligence personnel should "read each question to the subject, and then record and/or otherwise note the processes that subject uses in arriving at an answer to the question" (Willis, 1999, 1). Accordingly, the interviewer should also ask the interviewee what they are thinking whenever they take long pauses (Willis, 1999, 1). Another strategy of CI that could be applied is known as verbal probing; here, the officer "asks the survey [does not have to be a survey question in the case of detecting deception] question, and the subject answers, the interviewer then asks for other, specific information relevant to the question, or to the specific answer given" (Willis, 1999, 5). It is important to recognize that for the purposes of detecting deception, the specific details of the CI method are not entirely applicable. However, the two above-mentioned techniques will particularly allow the personnel interviewing subjects more time to identify whether the subjects are showing any of the noted

verbal or non-verbal cues. **<u>NOTE:</u>** This may not apply to daily discussions for law enforcement/intelligence personnel who must conduct brief interviews with individuals.

2. **<u>When analyzing individual responses, do not over-analyze and/or allow personal beliefs or biases to skew judgment:</u>** Upon analysis of the results, it was important to determine why the model failed to determine that the two identified participants were telling the truth rather than lying as had been noted. The main reason that was identified was the probability that incorrect cues had been marked down. For instance, since the questions only required one-word responses, there was limited time to establish a determination of the common patterns and verbal/non-verbal norms of the individuals as was recognized as being useful in the previous review of literature. Thus, it may be possible that what was denoted as being representative of one of the cues of deception may have been a common practice for the individuals. Another explanation may be that the individuals were merely nervous and as a result exerted these cues subliminally.

   Therefore, it is important to quickly identify the cues without spending too much time on whether or not there is a possibility that the individual is lying or telling the truth and in-turn more closely trying to purposefully identify specific cues to fulfill a biased agenda. This also expands to scenarios in which officers must interrogate several individuals with regard to the same case. Consequent to interviewing several individuals, it is apparent that there will be components of the stories that corroborate and complement one another. Nevertheless, in order for the model to work effectively, it will be important that the individuals are

analyzed objectively. It may be possible for the interviewers to identify common patterns, yet the model should not be used to fulfill biased opinions with regard to patterns in individuals' stories. Therefore, the model should be applied without biases; otherwise, it will merely become a tool that can be used to substantiate and validate subjective claims.

3. **Taking notes is not mandatory, but can be conducive to appropriate detection of deception:** There are fourteen non-verbal cues, whereas there are only six verbal cues; therefore, it may be possible to remember the six cues and mentally observe the individuals being interviewed. However, to remember each of the fourteen cues would require at least general training, yet even in these cases it may be difficult for officials to take into consideration the cues whilst also ensuring that they are asking the most appropriate questions and gaining all information that is necessary under the specific circumstances. Therefore, the use of a worksheet that would list out the cues would provide the officials with an opportunity to speak to the individuals, and then check of any cues that are noticed without having to remember the cues at the time. Below is an example of the verbal chart that could be utilized by law enforcement officials and/or intelligence personnel, the non-verbal chart would follow this pattern:

Cue Chart -

(Table 14.0)

VERBAL CUES	Speech Stumbles	Long Pauses	Higher Tone & Pitch of	Evading Questions	Result

	("umm" "ahh")		Voice		Cues:3/6 – Indicative of truth or lie (Circle One)
John Roe	X		X	X	

 Note: This is solely a suggestion and is not required although it can be extremely useful and improve the statistical chances of successful detection of deception.

Officials who plan to utilize the model should take the three aforementioned suggestions into consideration. Accordingly, if this model is to be used in professional settings it may be more appropriate to establish a training course that would prepare officials to use the model on a timely basis. As is the case with any novel implementation, individuals may have difficulties in becoming comfortable with the new techniques; thus, it is of the utmost importance that the individuals are able to effectively use the model prior to applying it in the field. A training course to direct the officers on how to use the model would not require months, or many weeks. Rather the training could be broken down into four major components and taught throughout a six-week process. Each of the weeks would require devotion to the learning of the model, yet it would not overwhelm the officers by taking too much time out of their daily lives.

1st Week: Officers are provided with worksheets and readings that allow them to immerse themselves in the understanding of what is deception, common deceptive practices, and how the model itself works. This week will be the introductory phase that

would establish a basis for officers to understand what is expected in detecting deception. This week would be representative of a "flipped classroom" whereby students are provided materials to read and/or watch, and then attend the classes to discuss what has been learnt. The officers should feel comfortable to openly discuss the material, explain any challenges in understanding the materials, and actively engage in discussions with fellow officers to ensure that every individual in the course has progressed at the same pace.

2nd Week: This week should be devoted to allowing the officers to watch videos of individuals who are telling the truth and/or lying. When the analyses for this research were conducted, the entire process was new, since no training had been undergone prior to the beginning of the project. Whilst the results have proven that the model can be used by those without training, the six-week course would be useful for those officers who wish to further learn about the processes that are involved in detecting deception. Accordingly, this week would be the prime time for officers to become accustomed to watching brief interviews with individuals and identify the non-verbal and verbal cues. The instructors in this course, especially during this week, should allow the officers to learn their most comfortable strategies to identify the cues and note them down. For instance, when the research was conducted for this work, the verbal and non-verbal cues were listed on two separate excel sheets. As the cues were recognized, a check mark was entered into the graph, which ultimately allowed for further analyses.

3rd Week: By the end of week 2, the officers should be well aware of the discipline of detecting deception and should feel more comfortable in watching interviews and recognizing the cues. Therefore, this week should be devoted to allowing

the officers to conduct interviews amongst themselves within the regulations of their divisions, while also noting the cues exemplified by the interviewees. They should also be made aware, if not already, of the CI method. The officers should recognize the extent to which the model can be applied and how they can personalize their own interviewing styles to incorporate the use of the model. This week should allow the officers to experiment with the model.

4th Week: Based on the results of the project, there was a lack of cultural variety in the selected participants. Since each of the participants were born and raised in and around the same areas in Eastern Tennessee (e.g. Tazewell, TN, Claiborne, TN, & Harrogate, TN) and were students at Walters State Community College, there was a lack of context to establish the possible differences that may have arisen had there been a broader range of individuals with a wider variety of backgrounds. Thus, for those who have chosen to take the course, this week would be extremely useful by allowing the officials to interview individuals and determine the different ways in which certain individuals answer questions based on their background. Overall, this week would be a continuation of the practices for week 3.

5th Week: This week should be a review week for the officers to once again gather around and take part in lively discussions. Furthermore, these discussions would allow the officers to discuss patterns or strategies that they have developed over the course of the past weeks. The instructors should facilitate detailed discussions to determine whether or not the individuals seem to have a strong understanding of what has been taught and what is required in the use of the model. The instructor should ask general questions and ask all the participants to discuss their answers with one another.

The individuals should also be asked to complete papers of minimum one-page in which they must prove their knowledge of the model and the background of detecting deception.

6th Week: The fifth week is essentially the week of the course in which the instructor determines whether or not the participants have an adequate understanding of the model and the discipline. This week the instructor must return the graded papers with either a P for pass or an F for fail. The participants will be allowed to engage in group detection of deception activities in which they will be once again allowed to practice their skills. However, in this case, the officers will be working in groups, rather than on their own. This week will ultimately act as a cumulative review of all information that has been taught over the course of the six weeks.

Conclusion

Deception is not that which can be easily detected with high accuracy by laymen without training in the discipline. The inability of law enforcement and intelligence personnel to easily recognize deception necessitated this research work. Through a systematic analysis of the current body of literature, it was possible to identify that a majority of researchers in the field have merely reinstated the usefulness of verbal and non-verbal cues, while failing to provide detailed statistical analyses to determine the actual extent to which these cues can be used to successfully detect deception. Thus, for the purposes of this work, a research project was conducted whereby thirty participants were interviewed. The results of these interviews were then analyzed through the application of the developed DETECT model, which was referred to as the model throughout the work for purposes of causing less confusion. The research question that had been posed for the work was "Will the DETECT model correctly identify deception

and truthfulness in the thirty conducted interviews?" Along these lines, the null

hypothesis was established which read that, "The 'Model Prediction' results are the same

as the 'Actual' results within each of the interviews." This hypothesis was proven in that

the identification of fifty-percent or more of the cues was able to help successfully

recognize deception in twenty-eight out of the thirty tested individuals.

The analyses also recognized that the model is statistically acceptable at a 5%

significance level. There is a 95% confidence interval for this model, which means that

the power of this model is 95%. In only two instances did the model incorrectly interpret

that the individuals were lying rather than telling the truth. Au contraire, as was

previously explained, the failure to determine the truth, rather than the failure to detect

deception was more useful. Had the model incorrectly identified that individuals were

telling the truth, then the actual effectiveness of the model would have drastically

declined.

Upon further investigation into the usefulness of the model, it was determined that

it had a 5% statistical significance, which also led to the conclusion that the model was

acceptable. Moreover, the model analysis recognized that whilst the model identified that

two individuals were lying when they were telling the truth it also correctly predicted that

thirteen individuals were lying and fifteen other individuals were telling the truth.

Therefore, the above-mentioned hypothesis was proven to be correct.

The model itself was designed for law enforcement officials, such as police

officers, and intelligence personnel who must conduct individual-level interviews to

determine deception. However, consequent to the completion of the analyses, it was

further recognized that this model would be useful for other federal, state, and local

government employees. It was more specifically recognized as being useful for the Transportation Security Administration (TSA), since these professionals encounter countless individuals on a daily basis, and they must, at times, ask questions that only require one-word answers. Through the use of DETECT, the officers would most probably have higher probability rates of detecting deception and further securing U.S. borders at the domestic and international levels.

The research certainly encountered several limitations, most of which were the result of a lack of funding and time. For instance, due to a lack of time, no experts in the field of D&D were consulted; additionally, a lack of funds led to the inability to recreate various environments and use other research participants from a wider cultural background, in which to conduct the interviews and record the varying reactions. Nonetheless, the work was proven to be successful in the utilized environment; thus, this could be a point that other researchers in the discipline could take into consideration. It may be possible for other researchers to further investigate whether or not individuals from different cultural backgrounds react differently to the model, and if so what would be these explicit differences. Moreover, it may be useful for researchers to also examine the influence of different environments on the effectiveness of the model.

The future of detecting deception will rely on the research that is conducted today, in the twenty-first century. There will be no major improvements that can aid in the safeguarding of intelligence systems and the upholding of the national security of the country if there is no impetus to focus on this research topic and place a priority on improving the ways in which government officials can determine if an individual is being deceptive. If a government official cannot detect deception, then the risk of falling victim

to D&D, and then compromising the security of the country is raised. As more of these officials fail to recognize deceit, the overall safety standards of the country will begin to waver.

Therefore, the research work that has been presented here adds to the existing body of knowledge by providing a novel avenue whereby law enforcement officers and intelligence officers may detect deception on a timely basis. Of course, there may be instances in which the model cannot be applied; yet, in a majority of the instances, the utilization of the model is plausible. Thus, the work has added a novel facet to be further explored and investigated by researchers in the field who have an avid, yet unbiased interest in the determination of the overall effectiveness of the model in a wide array of circumstances.

Finally, it is paramount to note that as technology advances, law enforcement and intelligence personnel may feel more enthusiastically about utilizing novel technological devises to detect deception, rather than relying upon models that require traditional methods of writing and examining data. However, the responsibility of law enforcement and intelligence officers to aid in the efforts to protect the nation domestically and internationally; therefore, the most useful model should be utilized, not the one that has gained the most publicity or acknowledgment from the media. The pure goal of detecting deception for government officials is to predict, and then prevent any deceptive practices that may cause harm to the country or those living within the nation.

Upon completing a majority of the presented research, a rare opportunity was provided to test the model on a rehabilitated terrorist who had been in charge of intelligence matters for a notorious terrorist group. For security and privacy reasons, the

name of the individual, the location of the interview place, and other related data have not

and will not be disclosed to the public. The former intelligence officer for the terrorist

group agreed to be interviewed about the intelligence practices of the terrorist group.

Twenty questions were posed to the individual with regard to the intelligence

procedures during a civil war in which the group was involved. The individual spoke

three different languages; yet, certain questions had to be repeated to ensure the

appropriate meaning had been conveyed and understood. Over the course of the hour-

long interview, he exemplified four of the fourteen non-verbal cues, whilst he also

showed three of the six verbal cues. Thus, it was concluded that he was in fact being

deceptive. Due to the nature of the interview, it was not possible to receive a

confirmation of whether or not the individual was in fact being deceitful. However, as

time progresses and more data are released to the public, it may be possible to make a

determination of whether or not the model prediction was correct. This experience was

useful in the confirmation of the applicability of the model in real-life situations for

intelligence and law enforcement personnel. Plans have been made to further test this

model through interviews with former members of this terrorist group in the future.

In its entirety, DETECT is a model that has been tested through non-parametric

statistical analyses and has proven to be acceptable and extremely useful in the successful

identification of deception in a majority of individual-level interviews. Accordingly,

whilst there were limitations to this research, it is hoped that this branch of research will

become more widely known and an emphasis will be placed on the testing of this model

scenarios different to those tested in this work. Accordingly, as this research has come to

a conclusion, it is imperative to note that DETECT may have a perfect place within the

fields of intelligence and law enforcement; thus, the development and completion of this research is a call to fellow researchers to take an initiative to test, examine, and report about this model and aid in the improvement of this model to provide officers with an effective means of detecting deception.

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