The effects of examiner personality variables and training on the accuracy of detection of deception

Kopparumsolan, V.

2018

Kopparumsolan, V. (2018). The effects of examiner personality variables and training on the accuracy of detection of deception. Doctoral thesis, Nanyang Technological University, Singapore.

<http://hdl.handle.net/10356/73352>

<https://doi.org/10.32657/10356/73352>

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

**THE EFFECTS OF EXAMINER PERSONALITY VARIABLES AND
TRAINING ON THE ACCURACY OF DETECTION OF DECEPTION**

V. KOPPARUMSOLAN

SCHOOL OF SOCIAL SCIENCES

**A thesis submitted to the Nanyang Technological University
in partial fulfilment of the requirement for the degree of**

Doctor of Philosophy

2018

ACKNOWLEDGEMENTS

I want to thank Christ Jesus for using this dissertation as an instrument to surface my unconscious facets of my personality to my conscious understanding.

I want to dedicate this dissertation in memory of the late Associate Prof Anthony T. H. Chin, National University of Singapore, who pointed me in the direction of experimental psychology research and the late Robbie S. Bennett, Office Manager, American Polygraph Association, who served in the American Polygraph National Office. Robbie knew that examiners plays a key role in the credibility assessment process and untiringly served an international community of examiners till her last breath.

I want to thank Mr. William F. Norris, Mr. Donald J. Kraphol, Ms. Pamela K. Shaw and officers Walt Goodson and Matt Hicks from Texas Department of Public Safety who were instrumental in facilitating my research in the United States. I also wish to thank Mr. Nathan J. Gordon and Mr. Jason Lim Jiin San for facilitating this research in Singapore. My thesis journey was made all the more enjoyable with the pacing by Novice Psychologist Fu Hui and Advanced Psychologist Jie Xin who kept me going.

This research would not have been possible without the kind and unwavering support of my supervisor Prof Joyce S. Pang. I want to thank my reviewers for your dedicated review and comments, without which a clearer conception of my research would not have been possible.

Finally, I want to thank my wife Jennifer Ting for keeping faith in me while I travelled the road of a policeman, polygraph examiner and psychologist and for her dedication in nurturing Abigail, Michael and Benjamin while I pursued my passions.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
TABLE OF CONTENTS	ii
LIST OF TABLES	ix
LIST OF FIGURES	xiii
LIST OF APPENDICES	xv
ABSTRACT	xvi
1. INTRODUCTION.....	1
1.1. Defining Credibility.....	2
1.2. Credibility Assessment.....	3
1.3. Theories on Observable Correlates of Deception.....	5
1.4. Behavioral Differences Between Liars and Truth Tellers.....	6
1.5. Polygraph – Credibility Assessment Tool and Current Applications	7
1.6. Quantifying and Better Delineating the Role of the Polygraph Examiner	9
1.7. The Four Phases of a Polygraph Process	9
1.7.1. Phase 1: Pre-polygraph Interview and Preparation.....	10
1.7.2. Phase 2: The Polygraph Examination and Test Data Collection.....	11
1.7.3. Phase 3: Physiological Data Analysis.....	12
1.7.4. Phase 4: Post-Polygraph Procedure.....	13
1.8. Examiners’ Diagnostic Accuracy	13
1.9. Examiner’s Role in Circumventing Countermeasures	14
1.10. Selection and Training of Polygraph Examiners	16

1.10.1 Selection Criteria in Defense Academy for Credibility Assessment (DACA)	16
1.10.2. Definition of an Accomplished Examiner.	17
1.10.3. Selection via Job Analysis	18
1.10.4. Limitation of the Job Analysis Method in the Context of Selecting for Polygraph Examiners.	19
1.10.5. How to Systematically Explore Job Performance Variables	20
<i>Characteristics of a Superior Performer – Kelley and Caplan Study.....</i>	<i>22</i>
1.11. Competency Modeling as a Method to Measure Examiner Characteristics	25
1.11.1. What is Competency Modeling?	25
1.11.2. DACA Studies Based on Competency Modeling.....	28
1.11.3. Competency Model Based on an Expert Panel.	28
1.11.4. Competency Model Based on Behavioral Event Interviews.	29
1.11.5. Research on Current Polygraph Training	30
1.11.6. Training and Examiner Performance	32
1.12. Rationale for Current Study	34
1.13. Overview of Research Studies	37
2. Personality Variables.....	44
2.1. Emotional Intelligence	44
2.2. Cognitive Style – Field Dependence Independence.....	46
2.3. Big Five Traits	47
2.3.1. Conscientiousness and Emotional Stability (or Neuroticism).	48
2.3.2. Extraversion, Agreeableness and Openness to Experience.	49

2.4. Motives	50
2.4.1. Implicit Motives	51
2.4.2. Need for Power (<i>n</i>Power) and Examiner Performance	52
2.4.3. Need for Affiliation (<i>n</i>Aff) and Examiner Performance	52
2.4.4. Need for Achievement (<i>n</i>Ach) and Examiner Performance	52
2.4.5. Explicit Motives.	53
Method.....	54
2.5 Study 1.....	54
2.5.1 Aims.....	54
2.5.2. Participants	54
2.5.3. Procedure.....	55
2.5.4. Statistical Design.....	55
Results.....	56
Discussion	58
3. Interaction of Personality Constructs and Training Operationalized	64
3.1. Variables of Interest in Present Research.....	64
3.1.1. Cognitive Affective Processing System.	65
3.2. Channeling Hypothesis	66
3.2.1. CAPS and Channeling Hypothesis.....	67
3.2.2. Implicit Achievement Motive and Conscientiousness.	69
3.3. Operational Definition of Examiner Performance.....	70

3.4. Detection of Deception Tasks of a Polygraph Examiner and Variables	71
3.4.1. Chart Analysis.....	71
3.4.2. Training	74
3.5. Measures	76
3.5.1. Predictor Variables.	76
3.5.2. Big Five Inventory.	76
3.5.3. Emotional Skills and Competency Questionnaire (ESCQ).....	77
3.5.4. Group Embedded Figures Test (GEFT).	77
3.5.5. Picture Story Exercise (PSE).	78
3.6 Outcome Variables.....	79
3.6.1. Accuracy of Detection of Deception Using Polygraph Chart Evaluation.....	79
3.6.2. Polygraph Chart Analysis.	80
3.6.3. Pneumograph Channel.....	82
3.6.4. Electrodermal Channel	83
3.6.5. Cardiograph Channel.....	84
3.6.6. Polygraph Chart Decisions	84
3.6.7. Polygraph Chart Scores	86
Method.....	87
3.7. Study 2.....	87
3.7.1. Aims.....	87
3.7.2. Participants.	87

<i>Not Trained Group</i>	88
<i>Trained Group</i>	88
3.7.3. Procedure	88
<i>Not Trained Group</i>	88
<i>Trained Group</i>	89
3.7.4. Polygraph Case Categorisations	90
3.7.5. Statistical Design	92
Results	93
Effects of Training on Accuracy of Detection of Deception	94
Personality Dimensions as Predictors of Student Rater’s Accuracy	98
Discussion	101
4. Integration of Personality and Training with Two Detection Modalities	104
4.1. Verbal and Nonverbal Analysis	104
4.2. Training	107
4.3. Polygraph Chart Analysis	108
4.4 Overview of Study 3	109
Method	111
4.5. Study 3	111
4.5.1. Aims	111
4.5.2. Participants.	111
<i>Novice Group</i>	112

<i>Basic Trained Group</i>	112
<i>Advanced Trained Group</i>	112
<i>Personality Measures</i>	113
4.5.3. Procedure — Chart Analysis.	113
<i>Novice Group</i>	113
<i>Basic Trained Group</i>	114
<i>Procedure for Singapore Basic Polygraph School Participants</i>	114
<i>Advanced Trained Group</i>	115
4.5.4. Procedure — Behavioral Analysis	115
4.5.5. Statistical Design	117
<i>Chart Analysis</i>	117
<i>Post-Training Chart Scores</i>	118
<i>Behavioral Analysis</i>	118
<i>Analysis Based on US and Singapore Basic Trained Participants</i>	119
<i>Analysis by Training Groups Novice, Basic and Advanced</i>	126
<i>Chart Analysis Accuracy of Training Groups – Decisions Deception Indicated (DI)</i> <i>and No Deception Indicated (NDI)</i>	132
<i>Chart Analysis Accuracy of Training Groups – Average Scores</i>	135
<i>Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception</i> <i>Indicated (DI) and No Deception Indicated (NDI)</i>	141
<i>Personality Traits as Predictors of Chart Analysis Accuracy – Average Scores</i>	145
<i>Analysis of Training Effects on Accuracy of Chart Analysis – Average Scores</i>	147

Results - Behavioral Analysis.....	153
Discussion	163
Chart Analysis.....	163
Behavioural Analysis – Forensic Assessment Interview Technique (FAINT)	168
5. General Discussion.....	171
5.1. Limitations of Research	180
5.2 Future Directions.....	181
Conclusion.....	189
Chart Analysis.....	190
Behavioural Analysis - Forensic Assessment Interview Technique (FAINT)	191
REFERENCES.....	194
APPENDICES	212

LIST OF TABLES

Table 1 Descriptive Statistics for the Rating of Personality Variables.....	56
Table 2 One-sample T-test for Mean Ratings of the Personality Variables	57
Table 3 Frequency of Perception Style Deemed As More Important to Be a Good Polygraph Examiner	58
Table 4 Computation of Accuracy of Decisions reported by Examiners	85
Table 5 Computation of Chart Scores Reported by Examiners	86
Table 6 Polygraph Case Categorisations by Case Types	91
Table 7 Descriptive Statistics of Variables of Interest Assessed for Student Raters.....	93
Table 8 Group Statistics for Accuracy of Detection of Deception – Decisions (DI/NDI)	94
Table 9 Independent Samples T-Test for Accuracy of Detection of Deception – Decisions (DI/NDI)	95
Table 10 Descriptive Statistics of Student Raters’ Accuracy in Detection of Deception – Scores by the Type of Cases and Level of Training Received.....	96
Table 11 Independent Samples T-Test for Accuracy of Detection of Deception – Scores	97
Table 12 Personality Traits as Predictors of Accuracy of Detection – Decision (DI/NDI) for All Cases	98
Table 13 Personality Traits as Predictors of Accuracy of Detection – Scores (All Cases)	99
Table 14 Simple Slopes Analysis for the Interaction Effect of Implicit Achievement and Conscientiousness on Accuracy of Detection – Scores (All Cases)	100
Table 15 Description of Study 2 and 3 Samples and the Independent and Dependent Measures Obtained across each Study	110
Table 16 Descriptive Statistics of Study 3 Personality Variables.....	119
Table 17 Descriptive Statistics for Singapore and US Basic Trained Participants.....	120

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 18 Independent Samples T-Test of Mean Difference of Personality Variables Between US and Singapore Participants.....	123
Table 19 Descriptive Statistics of Personality Dimensions By Training Groups (Novice, Basic, Advanced).....	127
Table 20 ANOVA of Personality Scores across Training Groups (Novice, Basic, Advanced)	129
Table 21 Post-Hoc Pairwise Comparison of Personality between Training Groups (Novice, Basic, Advanced)	130
Table 22 Descriptive Statistics of Accuracy of Detection of Deception Decisions By Chart Analysis – Deception Indicated (DI) and No Deception Indicated (NDI) by Training Groups and Types of Cases	133
Table 23 ANOVA for Accuracy of Detection of Deception By Chart Analysis – Deception Indicated (DI) and No Deception Indicated (NDI) for All Training Groups (Novice, Basic, Advanced).....	135
Table 24 Descriptive Statistics of Accuracy of Detection of Deception By Chart Analysis – Average Scores by Training Groups and Types of Cases.....	137
Table 25 ANOVA for Accuracy of Detection of Deception By Chart Analysis – Average Scores for All Training Groups (Novice, Basic, Advanced)	139
Table 26 Post-Hoc Pairwise Comparison of Average Scores By Chart Analysis between Training Groups	140
Table 27 Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI) No Deception Indicated (NDI) for Simple Cases	142
Table 28 Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI) No Deception Indicated (NDI) for Complex Cases	143

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 29 Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI) No Deception Indicated (NDI) for All Cases.....	144
Table 30 Personality Traits as Predictors of Accuracy of Detection of Deception by Chart Analysis – Average Scores for Simple Cases	145
Table 31 Personality Traits as Predictors of Accuracy of Detection of Deception by Chart Analysis – Average Score for Complex Cases	146
Table 32 Personality Traits as Predictors of Accuracy of Detection of Deception by Chart Analysis – Average Score for All Cases.....	147
Table 33 Descriptive Statistics for Accuracy of Detection of Deception by Chart Analysis for Novice Examiners – Mean Scores at T1 and T2 (n=14).....	148
Table 34 Descriptive Statistics for Accuracy of Detection of Deception by Chart Analysis for Basic Trained Examiners – Mean Scores at T1 and T2 (n=10).....	149
Table 35 Personality and Pre-Training Chart Analysis Mean Scores as Predictors of Post-Training Scores – Simple Cases	150
Table 36 Personality and Pre-Training Chart Analysis Mean Scores as Predictors of Post-Training Scores – Complex Cases	151
Table 37 Personality and Pre-Training Chart Analysis Mean Scores as Predictors of Post-Training Scores – All Cases.....	152
Table 38 Descriptive Statistics of Personality Variables and Pre- Post FAINT Scores For Basic Trained Group.....	153
Table 39 Descriptive Statistics of Personality Variables and Pre- Post FAINT Scores For Advanced Trained Group.....	154
Table 40 Descriptive Statistics of Personality Variables and Pre- Post FAINT Scores For Novice Group.....	155
Table 41 Tests of Between-Subjects Effects for Truthful Subject Post-FAINT Training.....	157

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 42 Tests of Between-Subjects Effects for Truthful Subject Pre-FAINT Training	158
Table 43 Parameter Estimates for Truthful Subject Pre-FAINT Training	159
Table 44 Tests of Between-Subjects Effects for Deceptive Subject Post-FAINT Training ..	161
Table 45 Tests of Between-Subjects Effects for Deceptive Subject Pre-FAINT Training ...	162

LIST OF FIGURES

<i>Figure 1.</i> Competencies of Superior and Average Interrogators (DACA, 2006, p.38).....	30
<i>Figure 2.</i> Examiner Performance Curve (DACA, 2006).....	32
<i>Figure 3.</i> Overview of Study	37
<i>Figure 4.</i> Study 1 Effects of Personality on Detection of Deception	38
<i>Figure 5.</i> Study 2 Effects of Personality and Training on Detection of Deception (Polygraph Chart Analysis)	39
<i>Figure 6.</i> Study 3 Effects of Personality Variables and Training on the Accuracy of Detection of Deception (Charts Analysis and Behavioural Analysis)	41
<i>Figure 7.</i> Study 3 – Effects of Personality Variables and Training on the Accuracy of Detection of Deception by Polygraph Chart Analysis	42
<i>Figure 8.</i> Study 3 – Effects of Personality Variables and Training on the Accuracy of Detection of Deception by Verbal and Non Verbal Analysis	43
<i>Figure 9.</i> Simplified illustration of types of cognitive-affective mediating processes that generate an individual's distinctive behaviour patterns. (Mischel & Shoda, 1995, p. 254).....	68
<i>Figure 10.</i> Segment of a polygraph chart that shows physiological waveforms of the breathing, electrodermal and cardiograph channels that were evaluated.....	81
<i>Figure 11.</i> Example of a scoring feature and evaluation of pneumograph channel	82
<i>Figure 12.</i> Scoring feature for electrodermal channel and an example	83
<i>Figure 13.</i> Scoring feature for cardiograph channel	84
<i>Figure 14.</i> Conditional effects of Implicit motive Achievement on Accuracy of Detection – Scores (All Cases) at different level of Conscientiousness (Low = Blue, Intermediate = Green, High = Yellow)	101
<i>Figure 15.</i> Plot of Estimated Marginal means Scores at pre-FAINT Training (T1) and post-FAINT training (T2) for truthful subject	156

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

<i>Figure 16.</i> Plot of Estimated Marginal means Scores at pre FAINT Training (T1) and post FAINT training (T2) for deceptive subject.....	160
<i>Figure 17.</i> Personality Dimensions of Relevance to Detection of Deception	189
<i>Figure 18.</i> Personality and Training Effects on Detection of Deception (Chart Analysis)...	191
<i>Figure 19.</i> Personality and Training Effects on Detection of Deception (FAINT)	192

LIST OF APPENDICES

Appendix A Comparison Question Test (CQT)	212
Appendix B List of Traits Important to a Polygraph Examiner (DACA, 2006).....	225
Appendix C Importance of competency indicative of superior interrogator performance (DACA, 2007).....	227
Appendix D Big Five Inventory	228
Appendix E Emotional Skills and Competency Questionnaire (ESCQ)	233
Appendix F Group Embedded Figures Test	239
Appendix G Sample Pictures for Picture Story Exercise (PSE)	244
Appendix H Personality Research Form.....	245
Appendix I NUS Study of Detection of Deception, 2003	247
Appendix J FAINT Training.....	250
Appendix K Study 1 Questionnaire	253
Appendix L Email Invite to Student Participants	254
Appendix M Study 3 Email Invites to Study 3 Participants	258
Appendix N FAINT Questionnaire.....	265
Appendix O Post-video Evaluation Questionnaire	268
Appendix P Polygraph Chart Evaluation	269

ABSTRACT

Conventional wisdom and qualitative research in the field of credibility assessment suggest that personality dimensions and training account for differences in job performance (DACA, 2006; DACA, 2007). However, to date, there has been a paucity of empirical research to further validate such qualitative findings. The present research seeks to explore the relationship between personality dimensions, training and job performance of polygraph examiners. Specifically, job performance is operationalized in two ways – firstly, the accuracy of examiners ability to detect deception via the evaluation of psychophysiological data related to detection of deception (i.e. polygraph chart data analysis) and secondly, the accuracy of examiners to detect deception via the analysis of verbal and nonverbal behavioral cues. Three studies were undertaken to investigate research question on examiner personality variables, training and performance.

Study 1 adopted a competency modeling framework based on a survey of an expert panel. Topic experts in the field of credibility assessment in US federal and law enforcement agencies were surveyed to identify personality variables of interest. Data obtained from topic experts revealed that Openness to Experience, Conscientiousness, cognitive style Field Dependence Independence, Achievement motive, Power motive and Emotional Intelligence are possible predictors of polygraph examiner performance. Personality variables identified in Study 1 were modeled in Study 2 based on an experimental design. The model developed in Study 2 was replicated in Study 3 based on a sample comprising US and Singapore professionally trained polygraph examiners.

Study 2 utilized an experimental design based on a NTU student sample who were assigned to two experimental groups, Trained and Not Trained groups. Participants in the Trained groups were provided information and feedback on methods of evaluating polygraph

charts while participants in the Not Trained group were only provided information on polygraph chart evaluation. Trait dimensions Openness to Experience, Conscientiousness, implicit motive Achievement, cognitive style Field Dependence Independence and a theoretically derived interaction variable (i.e. interaction of Conscientiousness and implicit motive Achievement) were modeled as predictor variables of performance dimension of polygraph chart evaluation. While no training effects were noted in Study 2, personality trait dimension of Conscientiousness and implicit motive Achievement were found to be predictors of accuracy of polygraph chart analysis. Study results provided support to channeling hypothesis which is a postulation that implicit motives are channeled through motive supportive trait dispositions (Lang, Ewen, Hulsheger & Zettler, 2012; Winter, John, Stewart, Klohnen and Duncan, 1998).

Study 3 modeled Study 2 variables as predictors of professional polygraph examiner performance in detection of deception using two modalities of detection of deception; polygraph chart analysis and verbal and nonverbal analysis based on the Forensic Assessment and Interview Technique (FAINT). Study 3 participants comprised Advanced trained polygraph examiners, Basic trained examiner and Novice or untrained examiners. Study 3 findings were premised on between and within subject designs were mixed. Between subject study provided data suggesting that detection of deception training places a strong emphasis on detection of deception cues (i.e. basic training orientates examiners towards a lie bias) and that this bias is corrected as they gain professional advanced training. The within-subject study provided data suggesting that detection of deception training places a strong emphasis on detection of truthful cues (i.e. basic training orientates examiners towards a truth bias). Personality dimension cognitive style Field Dependence Independence was found to be a predictor of accuracy of detection of countermeasure cases. In addition, Study 3 investigated the effects of detection of deception by behavioral analysis. This study provided data that trait

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

dimension Agreeableness is a negative predictor and that implicit motive Affiliation and Emotional Intelligence- Perceive and Understand are predictors of detection of deception by verbal and nonverbal analysis. Study 3 results based on FAINT analysis suggest that detection of truthfulness is a more complex task than detection of deceit premised on finding that personality dimensions of Agreeableness, implicit motive Affiliation, and Emotional Intelligence facet Perceive and Understand were predictors of truthful cues but not for detection of deceit. It is possible that leakage of tell-tale physiological and behavioral signs related to a truthful subject is perhaps less due to less internal physiological, emotional and cognitive responses of deception, thus requiring more sensitivity in detection of said cues. Considered together, Study 3 suggest that examiner personality dimensions and training are important predictors of accuracy of detection of deception.

**The Effects of Examiner Personality Variables and Training on the Accuracy of
Detection of Deception**

1. INTRODUCTION

Credibility assessment is defined as the multi-disciplinary field of existing as well as potential techniques and procedures to assess truthfulness. Specifically, the goal of credibility assessment is to discern if there is an agreement between an individual's knowledge and his statements about his knowledge (Department of Defense Directive number 5210.48, issued 25 Jan 2007). Assessments of individuals' credibility are important for the functioning of criminal justice system and for determining the value of intelligence gathered to assess risks and facilitate security intelligence operations. For example, a correct assessment of an individuals' statement relating to an account of a crime may lead to the identification of suspects or accomplices involved in a crime under investigation, thus ensuring that the right persons are brought to justice. In cases related to security and intelligence operations, the correct assessment of the truthfulness of intelligence sources will aid in the neutralization of security threats.

Integral to the correct assessment of truthfulness is the judgment about whether there is disagreement between an individual's knowledge and his statement. In the field of credibility assessment, this disagreement is also known as deception. Deception is defined as the purposeful act of creating an impression in others, in spite of the deceiver's knowledge that the information provided is false, misleading or inaccurate (Zukerman, Depaulo, & Rosenthal, 1981). By this definition, individuals who provide inaccurate information during an investigation process—perhaps due to possible memory failures or while in states of psychological distress or highly suggestible states—cannot be classified as deceptive, even though they may be considered unreliable witnesses (Sabourin, 2007). Given the importance

of assessments or judgments of truthfulness in criminal justice and security intelligence operations, as well as the complexity of rendering decisions of truth or deception, an understanding of the process and persons who render said assessments and factors leading to the correct judgments of truthfulness or deception is important.

1.1. Defining Credibility

Credibility assessment is a topic that is investigated in multiple fields and the precise definition of credibility is highly dependent on the field of study (Flanagin & Metzger, 2008). In fields of communication and social psychology, “credibility is treated as a perceptual variable: credibility is not an objective property of a source or a piece of information” (Metzger & Flanagin, 2015, p. 446). Following which it can be said that credibility is a subjective perception on the part of the information receiver (Wathen & Burkell, 2002). In this respect, credibility is closely associated with judgment about the believability of a person (Hilligoss & Rieh, 2007).

Historically there have been two approaches to assess the credibility of a person, namely (1) the assessment about the trustworthiness of a person, and (2) the assessment about the trustworthiness of the statements made by the person (Flanagin & Metzger, 2008). The first approach attributes credibility to the reputation or the general behavioral characteristics of a person as well as the known history of the person being involved in deception. This strategy accorded persons with good personal background and reputation more credibility than persons who were of ill repute. However, this reputation-centric assessment of credibility did not take into account that deception is a situation-specific behavior and that persons of good reputation in certain situations have the potential to engage in deception and provide false statements or testimony (Sabourin, 2007).

Considering that deception is context- and situation-specific, an alternative process premised on evaluating credibility based on evaluation of testimony or statement was strategized (Steller & Kohnken, 1989). This strategy postulated that indicators of truth or deception inherent to testimony or statements could be used as indicators of credibility. The indicators were primarily categorized into two categories, namely verbal (e.g. hesitations in verbal communications) and nonverbal behavior (e.g. gaze aversion), versus psychophysiological indicators such as that used for lie detection (e.g. recordings of breathing or heart rate during an interview; Vrij, 2014).

In spite of the availability of numerous definitions of credibility and indicators of credibility, as have been discussed in the abovementioned literature, it is important to note that credibility or believability is still treated in the field of credibility assessment as a perceived quality, in the sense that “...it does not reside in an object, a person or piece of information but can be assigned to them as a result of a judgment made by a subject” (Fogg & Tseng, 1999 p. 80). This process of deriving judgment about truthfulness or deceptiveness of a person’s statements is the key task in the field of credibility assessment.

1.2. Credibility Assessment

Credibility assessment, the process of deriving a judgment about the believability of a person, is both objective (i.e. the cues to detection of deception) and subjective (i.e. judgment of truth or deception facets; Fogg, 2003). The difficulty for assessors in determining credibility is that different people observing the same verbal or nonverbal cues or psychophysiological measures could come to different conclusions of truth or deception based on their perceptual judgment of the cues. This suggest that persons differ in the way they perceive the behavioral cues to infer truth or deception. Individuals differ in the ways they receive, select, organize and interpret information in the assessment of cues to detect

deception. That said, some differences in judgment could be attributed to the way individuals select and process information to assess credibility, which then have direct implications to their judgment of credibility (i.e. decision of truth or deception). Given this, there is a need to study the aspects of individual differences or the inherent qualities of the persons who are skilled at rendering accurate decisions of truth or deception. There are implications for doing so, as selecting persons who can render correct decisions serves towards resolution of cases and verifying of intelligence information provided by sources and agents. This presupposes that the person who is assessing credibility is important to the process of credibility assessment.

Conventional wisdom and qualitative research in the field of credibility assessment suggest that personality dimensions and training account for differences in job performance (Defense Academy for Credibility Assessment (DACA), 2006; DACA, 2007). However, to date there has been a paucity of empirical research to further validate such anecdotal evidence and qualitative findings. There has also been limited exploration of which personality dimensions are particularly useful in predicting variations in job performance. The present research aims to explore the role of personality dimensions as well as training in the job performance of a polygraph examiner. A polygraph examiner's key role is to assess the credibility of an individual in criminal, security and intelligence settings. This study aims to investigate the personal qualities and skills that will better enable a person involved in credibility assessment to detect deception. Specifically, this study will explore the personal qualities, skills and characteristic adaptations of a polygraph examiner whose job involves the analysis of verbal and nonverbal cues and psychophysiological data to detect deception through a credibility assessment process. This research will explore the question on what person-specific characteristics and personality dimensions a good polygraph examiner should possess for him to accurately detect deception in persons he is assessing.

In many government agencies and private security entities, polygraph is one of the predominant tools of credibility assessment. The polygraph techniques and instrument allows polygraph examiners to assess a person's believability by administering diagnostic procedures (Palmatier & Rovner, 2014). The objective of a polygraph examination is to detect deception by making inferences from the physiological and behavioral measures which are identified as correlates of deception. Since the polygraph is premised on the use of physiological and behavioral correlates of deception to infer a person's believability, there is a need to clarify the predominant theories or beliefs about correlates of deception, to better understand the work that is required of an examiner when he assesses the "believability" of a subject.

1.3. Theories on Observable Correlates of Deception

The inference of deception from physiological and emotional correlates is premised on theories of deception that emphasize the intrapsychic and physiological factors related to deception (Buller & Burgoon, 1996). This view follows Ekman and Friesen's (1969a) leakage hypothesis which proposes that internal physiological, emotional and cognitive responses of deception are correlated with tell-tale physiological and behavioral signs, otherwise known as deception cues. This has been likened to the story of Pinocchio's nose — a fictional toy character whose nose grew and protruded more from his face each time he told a lie. Zukerman, Depaulo, and Rosenthal (1981) further developed the leakage hypothesis to a four-factor theory of deception. They introduced arousal, negative affect, cognitive processing and attempted control as factors that are associated with deception. An example of arousal associated with deception would be rapid blinking or an increase in heart rate. Negative affect associated with deception such as anxiety and guilt felt by persons who may be concealing or misrepresenting the truth. Deceivers may manifest the arousal and negative affect related to deception involuntarily and unintentionally. Hence, they are described as

leaking out of the body, resulting in the term “leaking hypothesis” (Burgoon, Guerrero & Floyd, 2001). Based on this premise, polygraph examiners assess the believability of individuals by looking out for possible leakages in physiology or in behavior that could have psychological underpinnings. For this current research, we look at leakage cues from two categories – those which manifest as measurable physiological constructs (i.e. changes in heart rate, blood pressure, sweat gland activity) and those which manifest as observable behavioral indicators (patterns of verbal and nonverbal behavior such as eye-blinking, gaze aversion, hesitant reply, tone of voice etc.). In credibility assessment practice, polygraph examiners use both physiological and verbal and nonverbal cues for their work. The physiological cues are obtained from polygraph analysis, while the verbal and nonverbal behavioral cues are obtained from behavioral interviews that are conducted during the polygraph interview process.

1.4. Behavioral Differences Between Liars and Truth Tellers

At a basic philosophical level, polygraph examiners try to answer the question: What are the purported differences between liars and truth-tellers? To answer this question, one must ask another related question: Why is it hard to differentiate truth tellers from liars?

As compared to truth tellers, research has showed that liars used fewer illustrative behaviors (i.e. reduced frequency of hand, finger, and arm movements that were designed to supplement what was said verbally), manifested more speech hesitations and speech latency (i.e. period between the question being asked and the answer being given; Vrij, 2000). However, behavioral differences between liars and truth tellers are minute at best, leaving little opportunity to “catch” someone in the act of deception (DePaulo, Wetzel, Sternglaz, Wilson, 2003; Vrij, Granhag, Mann & Leal, 2011). Research has also shown that some commonly relied upon indicators of deception, such as gaze aversion, is not a reliable

indicator (De Paulo et al., 2003). Furthermore, assessment of truth or deception is made more complex with the possibility that telling the truth may also elicit arousal, anxiety, fear and cognitive effort (McCornak, 1997). Innocent persons wrongly accused of a crime may also manifest behaviors like that of liars (Ekman, 1985). Additionally, there are different types of lies and not all lies will result in a “leakage” of cues. For example, everyday lies that are said with minimal effort may not necessarily bring about arousal of changes in internal affective states or cognitive load. Hence, the examiner needs to ask relevant and meaningful questions such that deceivers experience more cognitive load (Hatwig & Bond, 2011). Given this situation, the examiner must be attentive in observing and must constantly assess the test subject during the interview. This is even more important as research clearly show that persons intent on deception are more likely than truthful persons to employ information management strategies to keep their narrative simple to avoid having to contradict their narratives later (Hartwig, Granhag & Strömwall, 2007). However, there are, to date, no standard procedures for differentiating between examinees that employ strategies to evade detection of deception from those who do not. As such, in a polygraph examination, a polygraph examiner with the necessary skills and training could apply proper judgment to discern between information management strategies and other deceptive strategies that examinees might employ.

1.5. Polygraph – Credibility Assessment Tool and Current Applications

The polygraph is a commonly used tool for “psychophysiological detection of deception”. In lay-terms, the polygraph examination is commonly referred to as a lie detector. In technical terms, the polygraph is a collection of instruments that record physiological data from an examinee while he answers a series of test questions. Harvard psychologist, William Marston, first introduced the polygraph in 1917 as a single-channel instrument measuring systolic blood pressure as a symptom of deception (Palmatier &

Rovner, 2015). The modern-day polygraph is a multi-channel instrument and is used to record poly or many graphs of a person's physiological data related to breathing-associated chest and abdominal movements, fluctuations in electrodermal responses, and blood pressure changes. These data are recorded on a chart and subsequently analyzed by a polygraph examiner to assess for patterns of physiological responses that indicate lying or deception (Barland, Honts & Barger, 1990).

Today, the polygraph has a wide variety of uses. First, it is used to resolve criminal cases in law enforcement agencies. For example, it can be used in criminal investigations to determine if a suspect is deceptive when interrogated about his involvement in the crime or to elicit crime-related information to provide case leads for further investigation. In security and counterintelligence agencies, the polygraph is used to determine the suitability of candidates for security sensitive positions by verifying information gathered through background checks as well as obtaining information of any involvement in risky behaviors or deviant behaviors that may make them vulnerable in security related missions (e.g. gambling or drug addiction). In addition, the polygraph is used in the investigation of counterintelligence cases where individuals are suspected of spying for foreign intelligence agencies, as well as in the private investigation settings ranging from tourism industries to personnel investigation services.

The polygraph examiner uses the polygraph instrument to gather physiological measures as an indicator of test subject's truth or deception – this is the criterion measure. The polygraph test consists of several techniques but the most commonly used technique in law enforcement and security intelligence setting is the Comparison Question Test or CQT (Honts & Reavy, 2015; refer to Appendix A). Meta-analyses done to date indicate that the criterion-related validity of polygraph CQT used in criminal specific cases focused towards resolving targeted issues is above 90 percent and that the validity of polygraph used in

screening-related cases is above 85 percent (American Psychological Association, 2011).

With the current reported validity and reliability levels of the polygraph, its use is no longer considered controversial in the professional circles of defense and security. In addition, polygraph practitioners attest to the utility of the tool in the detection of deception. As the National Academy of Sciences has stated, “some potential alternatives to the polygraph show promise, but none has yet been shown to outperform the polygraph. None shows any promise of supplanting the polygraph for screening purposes in the near term” (National Research Council, 2003, p. 8).

1.6. Quantifying and Better Delineating the Role of the Polygraph Examiner

To explore variables that can have a bearing on a polygraph examiner’s task performance, it is first essential to understand the role of a polygraph examiner. In practice, the role of a polygraph examiner is complex; conducting polygraph examinations is a multi-component process, involving “soft” skills such as interviewing, to more technical skills such as operating the polygraph instrument to record physiological data in order to derive an assessment. While polygraph refers to a specific instrument used for lie detection, it has been synonymously used to describe the entire credibility assessment process. To begin to understand the qualities of a polygraph examiner that would enable him to accurately detect deception, it is important to understand the processes by which a polygraph examiner derives at a judgment of truth or deception.

1.7. The Four Phases of a Polygraph Process

A complete polygraph process consists of four separate phases, namely (a) the pre-polygraph interview and preparation; (b) the polygraph examination and test data collection; (c) analysis of the physiological data to derive results of examination; (d) post polygraph examination procedure. The examiner’s role is deeply entrenched during all four phases of

the examination. The administration of a four phase polygraph process requires examiners to have the ability to meet varied situational job demands as each phase consists of more than one job component (e.g. a pre-test consist of administering an interview and formulating good test questions).

1.7.1. Phase 1: Pre-polygraph Interview and Preparation.

The pre-polygraph interview, also known as pre-test, is a dyadic social interaction between the examinee and examiner. The pre-polygraph interview has multiple objectives – the examiner brings the examinee up-to-speed on the polygraph process, explains the scope of the test questions, obtains an understanding of the examinee and his past behavior with regards to the test questions. The pre-test is an aspect of the polygraph examination in which examiners adopt a range of approaches and personal styles (DACA, 2007). The approach or style adopted by the examiner may differ from test to test considering that the examiner is required to work with different examinees across tests. For example, the examiner typically adjusts his interaction style to suit the examinee's education level, personality and attitude towards the polygraph session. This serves two objectives – to enhance rapport building and hence cooperation, and to ensure clarity and understanding of test questions by the examinee. For example, when dealing with less educated examinees, the examiner should explain technical terms or concepts in simpler terms or more examples without compromising the test protocols or instructions. The examiner should provide clear instructions about test procedures as well as to explain test questions. He then conducts an interview to elicit, detect and evaluate verbal and nonverbal cues from the examinee during the discussion of test issues. During this interview, the examiner needs to pay attention to various verbal and nonverbal cues which may be used to derive at a preliminary assessment of examinee's overall truthfulness or truthfulness with regards to specific test issues.

The examiner also needs to develop appropriate test questions to meet the investigative/screening needs of the organization he works with before concluding this phase of the polygraph examination (American Polygraph Association, 2009; USA Department of Defence, 2012). Examiners deal with a variety of investigative questions and case situations across different polygraph examinations. As such, examiners seldom have the luxury of applying a ‘template’ for test questions across all examinations. Thus, examiners need to be competent in formulating test questions to fulfill two criteria, (1) Questions are relevant and appropriate, in light of what his examinee has shared with him, and (2) Questions meet the investigative objectives of his organization. The construct of test questions for every investigation case is unique as case scenarios differ from case to case. For example, in a case involving theft of money from a dormitory (e.g., Nanyang Technological University’s residence Hall 2), a suspect could be the person who stole the money or an accomplice who planned the crime but was not at the crime scene or even an innocent person who may have information about the likely suspect. Given this scenario, the examiner must develop test questions based on the case facts during his interview that is most suitable for case resolution. For example, “Did you take the missing money from NTU Hall 2?”; “Did you plan or participate in any way in the theft of the money from the NTU Hall 2?”; or “Regarding the theft of money from NTU Hall 2, are you withholding any information?”, etc.

1.7.2. Phase 2: The Polygraph Examination and Test Data Collection.

During the second phase, the polygraph examiner should administer a test according to a standard test protocol and gather physiological data while a set of test questions are being asked. The examiner also must fine-tune the instrument according to the examinee’s unique physiology so as to obtain quality data. Typically, examiners will need to gather physiological recordings over at least three test runs during which the same set of questions are asked. This is done to ensure that several readable measures or artifact free data is

obtained for each test question asked during the test. Artifact data or non-usable data may arise due to voluntary or in-voluntary subject movements (i.e. subjects rubbing their nose or sneezing). Given the requirement that he needs to calibrate the instrument settings during the test proceedings, obtain repeated physiological measures of questions, and ensure collected data is artifact free, an examiner needs to manage the examinee so that the examinee stays calm and assured throughout the examination. Not doing so may result in examinees becoming anxious and providing data that cannot be properly evaluated for diagnostic decisions.

1.7.3. Phase 3: Physiological Data Analysis.

Next, the examiner evaluates the polygraph chart data using a set of standardized scoring features and he assigns numerical scores for the test question(s) based on a set of scoring rules. In evaluating the charts, he is required to identify and separate useful information from background noise or random data and assign scores based on scoring rules. For example, in evaluating the waveforms relating to sweat gland activity, the examiner needs to evaluate the peak amplitude (i.e. height of tracing from baseline) related to a relevant question (e.g., “Did you take the missing money from NTU Hall 2?”) and compare that to the peak amplitude tracing of a comparison question (e.g., “Have you ever done something dishonest?”) A higher peak amplitude noted to a relevant question as compared to the comparison question will lead to a score of -1 while a lower peak amplitude to a relevant question compared to that of a comparison question will lead to score of +1. The examiner will render a final decision of Deception Indicated (DI), No Deception Indicated (NDI) or Inconclusive (INC) depending on whether the numerical scores meet certain cut-off criteria.

1.7.4. Phase 4: Post-Polygraph Procedure.

Following the aforementioned procedures, the examiner then adopts a post-polygraph procedure, which is contingent to the test outcome. In the event of a test outcome of NDI (No Deception Indicated), subjects would be debriefed as per agency protocols. In the event of an INC (Inconclusive) result or DI (Deception Indicated) test outcome, an examiner would conduct a clarification interview to gather more information to seek a possible explanation for the test results – for example, the examinee may have been withholding some critical information which resulted in his DI/INC test outcome. The examiner would also need to take into consideration the technical aspects of tests, complexity of matter under investigation and information gathered during the clarification interview, to find possible explanations. Based on the information gathered during the clarification interview and re-evaluation of polygraph chart data, the polygraph examiner may then decide to either administer a follow up diagnostic polygraph examination or commence an interrogation session to establish the truth. The post-test phase is thus a complex phase and varies in accordance to the examiners' personal style. Examiners may adopt a variety of interviewing strategies, reasoning or persuasion techniques to gain better insight on the issue under investigation or to elicit a confession (Iacono, 2008).

1.8. Examiners' Diagnostic Accuracy

The examiner's diagnostic accuracy during the four-stage polygraph examination is determined by his ability to consider consistencies or inconsistencies in the examinee's verbal and nonverbal behavior during the four-stage examination process. While the examiner can render a diagnostic decision based on polygraph test results independent of verbal and nonverbal data, the examiner will place a lower confidence in the validity of data in the absence agreement between subject's behavioral and physiological data (Horvath, 1978; Gordon & Fleisher, 2006; Vrij, 2008). In the absence of agreement between subject's verbal

and nonverbal behavior and outcome of chart data analysis, an examiner may choose to re-evaluate his test data, render an inconclusive call and request for a re-test. The ability of the examiner to consider consistencies across different modalities of deception before rendering a diagnostic decision is a complex task.

1.9. Examiner's Role in Circumventing Countermeasures

Another dimension of complexity related to the examiner's role to render a correct diagnostic decision is the threat posed by countermeasures. A countermeasure is any attempt by an examinee to influence the test outcome to bring about a no deception test outcome. This definition includes attempts by truthful subjects to avoid false positive results (a truthful examinee called deceptive) and attempts by deceptive subjects to avoid true positive (deceptive called deceptive). Countermeasures can take the form of behavioral attempts to appear more innocent such as the employing of superior acting skills (Dawson, 1980) or strategies to manipulate the physiological readings during the in-test session of the polygraph examination. A few examples of countermeasure to alter physiological tracings include the deliberate control of breathing, or self-induced mental stimulation. A self-induced mental stimulation, for instance, could be done by doing mental arithmetic tasks during the in-test phase of the polygraph examination with the aim of distracting oneself from the test questions being asked. Honts (1986) study revealed that mental countermeasures when employed by subjects undergoing polygraph does alter their physiological tracings i.e. increases in blood pressure and electrodermal activity.

Research has shown that truthful subjects attempting countermeasures reduce their chances of clearing their tests (Amato & Gordon, 2001; Honts & Reavy, 2015). While the use of countermeasures by truthful subjects may pose no more a serious problem than inconvenience to subjects themselves (due to the increased delay in clearing their tests),

countermeasures employed by guilty subjects pose a serious problem for polygraph examiners. According to the American National Academy of Science:

“Basic science and polygraph research give reason for concern that polygraph test accuracy may be degraded by countermeasures, particularly when used by major security threats that have a strong incentive and sufficient resources to use them effectively. If these measures are effective, they could seriously undermine any value of polygraph security screening” (National Research Council, 2003, p. 20).

An example of a case involving countermeasures that undermined the validity of a polygraph examination is that of Aldrich Ames, an employee of the Central Intelligence Agency. Aldrich Ames was able to pass polygraph examinations in 1986 and again in 1991 while being involved in espionage activities against the United States. As Ames was acquainted with how the polygraph examinations were conducted and evaluated, he was able to manipulate the process by using countermeasures (US Senate Intelligence Report, 1994). Hence, countermeasures pose a significant risk in undermining the validity of polygraph tests.

The threat of countermeasures adds another level of complexity to the examiner's job in that an examiner needs to mitigate possible errors due to countermeasure attempts. Considering that information on polygraph countermeasures are readily available on the Internet and may possibly be utilized by truthful and deceptive examinees, there is an increasing challenge for examiners to render accurate decision (Handler & Honts, 2015). Not being able to do so will lead to degradation of the polygraph test validity. Research suggest that examiners can mitigate for certain classes of physical countermeasures with the use of specialized equipment such as activity sensors (Honts, 2015). Even so, the careful deployment of specialized equipment and ability to carefully analyze physiological data

would require a competent examiner. Seen together, it can be said that the examiner is the only means to mitigate threats of countermeasures.

1.10. Selection and Training of Polygraph Examiners

Given the above indications that selection processes may significantly account for examiner performance over and beyond training, the next step in improving the credibility assessment process is to explore if there are certain pre-existing personalities or traits, which, when used to identify potential examiners, may then predispose said examiners to be more competent in detecting deception in the long term. Here, we review the current selection criteria utilised by US Defense Academy for Credibility Assessment as well as related literature on examiner selection, in order to understand what the current predominant selection criteria are for examiners, and if any of these criteria pertain to personality.

1.10.1 Selection Criteria in Defense Academy for Credibility Assessment (DACA)

The Defense Academy for Credibility Assessment (DACA) is a training arm of the US Defense Intelligence Agency, US Department of Defense, and is considered by many in the profession as the premier polygraph training institute. Hence, DACA's examiner selection criteria is considered by many in the international polygraph community to be one of the most stringent. Admission to the DACA polygraph programme is by the approval of the Director of DACA and the candidates need to fulfill five requirements: (a) US Citizenship, (b) be at least 25 years of age, (c) have a baccalaureate degree, (d) have a minimum of two years of investigative experience and (e) have to pass a polygraph examination. However, DACA does allow waiver of minimum age and investigative experience requirements. Graduates of this programme are conferred the DACA Certificate

of Graduate Study when they fulfill the minimum grade point average and a minimum of a B grade in at least three course modules. Polygraph examiners who aspire to have a career in US Federal Agencies, i.e. Central Intelligence Agency (CIA), National Security Agency (NSA), Federal Bureau of Investigation (FBI), etc. must fulfill a mandatory requirement of being a graduate of DACA's polygraph programme. This high selection standard is administered in consideration of the role of DACA trained polygraph examiners in the US security and intelligence framework. This is evidenced from the foreword written by the Director of DACA in a critical training document:

“In addition to its traditional roles in counterintelligence, and law enforcement, the federal polygraph community is being called upon to help combat an insidious new threat: terrorism. DACA graduates are now engaged in that fight, where they deliver crucial information to the warfighter, combatant commanders, analysts and others engaged in the Global War on Terrorism ... The high standards of DACA's PDD programme is a recognition that only the very best and brightest are selected to attend this graduate level academic institution” (DACA Course Publication, 2016, p. 11).

1.10.2. Definition of an Accomplished Examiner.

The DACA (2007) study interviewed accomplished examiners based on in-depth interviews of a panel of 20 accomplished polygraph examiners nominated by 11 US Federal Government Agencies. Agencies nominated accomplished examiners based on the criteria that these examiners “consistently produce correct DI/NDI¹ decisions”, produce “few no-opinion decisions”, “rarely have quality assurance issues”, and are those whom “you would trust with your most difficult cases” (DACA 2007, p. 17). To date, the DACA operational

¹DI refers to a decision of Deception Indicated
NDI refers to a decision of No Deception Indicated

definition is the most comprehensive and provides a working definition of a good or accomplished examiner for this present study.

1.10.3. Selection via Job Analysis

The traditional method used by business management professionals to decide the qualities of a person relevant to his or her job performance was through job analysis (Sanchez & Levine, 1999). Job analysis is the process of collecting and documenting data about relevant knowledge, skills, abilities and other characteristics of a person to perform the job (Casio & Aguinis, 2005). The process of job analysis requires a careful study of the job content with an assumption that the job exists independent of the person doing the job. In this view, the tasks associated with characteristics and scope of the job are constant across different individuals performing the same job (Connell & Nord, 1996; Cronshaw, 1998). The traditional practices of job analysis originated during the era of mass production methods when job functions were a component of standardized constant activity that could be managed with high efficiency (Singh, 2008). Accordingly, jobs were analyzed in their component parts and assigned to multiple workers with one best prescribed method of doing a job - job analysis methods advocated by Frederick Taylor and scientific management movement (Sanchez, 1994). When viewed from this historical context, it is perhaps unsurprising that, traditional job analysis is primarily focused on the component tasks to be done on the job and organization positions to be filled rather than focusing on the qualities of individuals who need to perform the job functions (Singh, 2008; Sanchez, 1994). These assumptions have its merits in that it allows a job analyst to derive the duties and the appropriate required job behavior relevant to job success (Markus, Thomas, & Allpress, 2005).

1.10.4. Limitation of the Job Analysis Method in the Context of Selecting for Polygraph Examiners.

The job requirements of a polygraph examiner having to administer a multi-phased and complex oriented polygraph examination process suggest that the job of an examiner is not constant over time. While this assumption that job scope and requirements remains constant for all job-holders may hold in jobs related to production lines, it is not true for a polygraph examiner's job because the examination process has to be contextualized to the nature of the matter under investigation and to the type of person the examiner is dealing with (Blair, Reid & McCamey, 2002). Second, the assumption that the job exists independent of the person performing the job needs to be further analyzed. As described in the roles and functions of a polygraph examiner in the preceding sections, the accuracy of the examiner's decision is dependent on his ability to correctly identify and interpret verbal and nonverbal data as well as physiological data gathered during the examination process. The examiners' judgment and interpretation of data, as well as the conduct and behavior of the examiner contribute towards the accuracy of the administration and results of the polygraph tests. For example, the examiner's approach towards an examinee in a non-accusatory manner and ability to conceal his emotions during an interview will facilitate examinees to be less anxious and provide quality test data, which will aid in the correct case diagnosis (Matte, 1993). Given the multi-faceted roles of an examiner in a polygraph examination, the job analysis approach may not be able to capture the complexities required in the job of a polygraph examiner. Another limitation of the traditional job analysis method is that it has limited utility towards identifying qualities of superior performers. This is the result of job analysis that is focused on identifying and analyzing elements of the job that stay constant across numerous cycles of job incumbents (Levine & Sanchez, 2007). Thus, traditional job analysis methods may not be optimal for use for selection of superior performing examiners

for the reason that the examiner's job is hardly independent of the examiner himself (i.e. the polygraph examiner's idiosyncrasies in his behavior, interpretation and analysis needs to be accounted for when explaining examiner job performance let alone inferring qualities of a superior and average examiner). (Sanchez, 2001).

1.10.5. How to Systematically Explore Job Performance Variables

Since the job analysis approach is inadequate for determining the characteristics of superior performers, there is a need to find other ways to explore the qualities that set superior polygraph examiners apart from their less-skilled counterparts. The following outlines several ways in which researchers have attempted to characterize the differences between superior performers from non-superior ones.

According to Ericsson and Smith (1991), the difference between excellent performers and others could be attributed to expertise. Expertise is conceptualized as high performance that is stable over time due to the characteristics of the person rather than by chance alone (Sonnentag, 1998). Specifically, research suggests that superior performers have superior knowledge especially in areas related to procedural knowledge, goal setting, especially long term goals, seek more feedback and are high in social skills (Sonnentag, 2000a). A closer study of the differentiating qualities suggest that psychometric tools or methods need to tap into behaviors that respondents are conscious of such as that of being high in social skills and behaviours that respondents may not be conscious of or able to describe verbally. For example, an unconscious behavior is procedural knowledge, which is “non-consciously acquired knowledge” and “can automatically be utilized to facilitate performance, without requiring conscious awareness or control over this knowledge” (Lewicki, Hill & Bizot, 1988, p. 24). The need for conscious and unconscious dimensions related to behavior has been researched as a dual process cognitive models by cognitive psychologists (De Nays, 2006;

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Sloman 1996). Premised on a dual processing model, Epstein (1994) explained the workings of the conscious and unconscious with his cognitive-experiential self-theory. According to this theory, the mind consists of two systems, the cognitive and the experiential system. The cognitive and experiential systems work together to make sense of reality and determine behavior (Epstein, Lipson, Holstein, & Huh 1992). The cognitive system operates in the conscious realm, is based on logical rules, and is analytical, cautious and provides for planned behavior. While the cognitive processes are relatively slow as compared to experiential also known as the intuitive system, the ability to think through and consider several options before taking action is an advantage. Intuition, sometimes labelled as “gut feeling”, characterizes an effortless decision making process which is mostly unconscious (Bruner, 1960; Kahneman & Frederick, 2002). The intuitive system processes are faster than the cognitive system processes as intuition is based on short cuts in reasoning of available information and is best suited for situational behavioral responses (Epstein, Lipson, Holstein, & Huh, 1992). Considering that the facets of procedural knowledge are beyond the conscious access of the person, self-report questionnaires may yield little or no data. Canobi, Reeve, and Pattison (1998) have suggested that, in order to measure procedural knowledge, a person’s ability to provide accurate answers to problem solving tasks or his ability to enact a sequence of actions to complete a problem solving task may be used. Following Epstein’s postulations about dual process system in which cognitive and experiential systems work together to effect behavior, it would be of interest to explore if job performance has two dimensions; one requiring cognitive system involvement and the other requiring the involvement of the experiential system.

Another way in which polygraph examiner performances can be differentiated is by conceptualizing them into task-performance versus contextual-performance. Task performance is the application of technical skills and knowledge to the job while contextual

performance is the navigation and management of the psychological and social context in which the job is performed (Borman & Motowildo, 1993). An example of task performance is characteristics of a person that is related to knowledge and skills while characteristics related to contextual performance is that of goal setting, seeking feedback and high in social skills related to job performance. Research findings suggest that while distinction between task and contextual performance is not always clear, task performance is said to involve cognitive abilities while contextual performance involve personality variables (Kamp & Hough, 1988). Research findings have consistently shown that supervisors weigh contextual performance as equally important as task performance (Borman & Motowildo, 1993). In summary, literature on the expertise topic suggest that the defining characteristics of a superior performer can be, in most cases, classified as task and contextual performance; and that measures of such defining qualities of superior performers involve both the conscious and unconscious realm of the person. This then leads us to the next question of interest, which is on methods of measuring such defining characteristics.

Characteristics of a Superior Performer – Kelley and Caplan Study

A seminal study by Kelley and Caplan (1993) at AT&T's Bell Labs provides a method of measuring such defining characteristics. Kelley and Caplan (1993) highlighted the need of a systematic study to better understand the differences in the patterns of behavior of superior performers compared to average performers. This research led to the development of a training programme to replicate the behavioral patterns of superior performers to raise the productivity levels of average performers in AT&T (Kelley, 1998).

The objective of Kelley and Caplan's (1993) study was to improve productivity by means of identifying the differences between superior performers and average performers. The impetus of their research was that, AT&T employees who scored high in particular

factors such as cognitive ability or risk taking were not necessarily rated as superior or star performers by their superiors or managers. The study reported that the key difference between superior performers and average performers was not cognitive ability but the strategic and proactive behavior employed by superior performers. In other words, Kelley and Caplan's findings suggest that contextual performance is more indicative of overall job performance than task performance is.

Kelley and Caplan (1998) highlighted the challenges of identifying defining characteristics—psychological or otherwise—of star performers who produce high quality works. They found that star performers have a “hard time describing what goes on in their minds” when asked processes related to high-quality work and that “managers can’t directly observe or accurately evaluate, these mental processes or strategies” (Kelley & Caplan 1993, p. 129). To overcome the said challenges of identifying the work processes of superior performers, Kelley and Caplan proposed that researchers interested in improving worker performance should study the daily regimen of star and average performers in order to identify the differences in their behavior that could explain for superior performance. As an example, Kelley and Caplan stated that besides asking star performers about their daily routines and collating commonly stated routines (i.e. “early morning workouts, nutrition and visualization of success” etc.), researchers need to study the daily routines of non-star athletes to identify differences (Kelley & Caplan, 2000, p. 129).

Accordingly, Kelley and Caplan identified nine strategies of star performers that set them apart namely, taking initiative (e.g. start activities for the benefit of others), being part of a network of professionals (e.g. seeking out domain experts), managing self (e.g. ability to maintain focus at work), seeking perspectives (e.g. seeking feedback from peers), strategic networking with leaders (e.g. managing ego to work in partnership with leaders), leadership

style premised on professional standing, persuasion and influence (e.g. shape team dynamics and work flow based on shared responsibility), creating organizational niche for self (e.g. possess skills to manage competing interest at work), and lastly, ability to communicate audience appropriate and relevant messages (e.g. ability to communicate effectively).

Kelley and Caplan's (1993) study uncovered the importance of "mind secrets" of superior performers, which could be operationalized as job-relevant procedural knowledge. An aspect of interest to this study is that Kelley and Caplan used a broad definition of productivity which they defined as practical ways that managers can distinguish star performers from non-star performers (i.e. problem solving, improved customer service, etc.) Kelley and Caplan adopted this definition, due to the difficulty in defining productivity of knowledge professionals – a facet of work performance. The example cited in this study was that the number of lines a programmer wrote to accomplish a computer code is not a good measure of productivity as "4 lines of elegant computer code are better than 100 lines that accomplish the same objective" (Kelley and Caplan, 1993, p. 129).

Hence, the seminal studies by Kelley and Caplan (1993) and Kelley (1998) provide insights that are relevant to this present study in terms of exploring the defining characteristics of a superior polygraph examiner as compared to average performers. Their research is particularly applicable to this research since the job description of a polygraph examiner fits that of a knowledge professional, i.e. study the regiment of star polygraph examiners as compared to that of non-star polygraph examiners and the use of practical measure of productivity as stipulated by polygraph managers. While Kelley and Caplan (1993) proposed a method of criterion sampling, and systematically study by identifying the behavioral differences between superior and average performers, they did not propose a theoretical framework to explain how and why the differential behavioral patterns resulted in

varying work performance between that of superior and average performers. However a review of literature related to competency modeling suggests that Kelly and Caplan's method of sampling behaviours of star performers as well as average performers is similar to McClelland's postulation of criterion sampling stated in McClelland's (1973) paper "Testing for Competence rather than for Intelligence". McClelland (1973) described the method of comparing the sample behaviors of superior performers to that of poor performers as criterion sampling. In his paper he explained criterion sampling as "If someone wants to know who will make a good teacher, they will have to get video tapes of classrooms, as Kounin (1970) did, and find out how the behaviors of good and poor teachers differ" (McClelland, 1973, p. 8). McClelland termed the differentiating behaviours that of superior and average performers as competencies. Specifically, McClelland (1973) stated that competencies are underlying characteristics of a person which enable them to deliver superior performance in a given job, role or situation.

1.11. Competency Modeling as a Method to Measure Examiner Characteristics

1.11.1. What is Competency Modeling?

McClelland (1973) raised concerns about the over-reliance of scholastic or aptitude tests administered to students prior to selection for college admissions for predicting future job success. McClelland's key statement was that "... Scholastic Aptitude Test taps on skills that the teacher is looking for. No one could object if it had been recognized widely that this was *all* that was going on when aptitude tests were used to predict who would do well in school. According to McClelland, the problem is that people assumed that these skills had some more general validity, as implied in the use of words like intelligence" (McClelland 1973, p. 7). McClelland's assertion was that scholastic aptitudes are poor predictors of job success for such tests are structured to elicit a certain response which may not be representative of skills or abilities that are required to perform tasks related to a job. As an

alternative, McClelland proposed a measurement of competency which McClelland further refined as that of a “combination of motives, traits, self-concepts, attitudes or values, content knowledge, or cognitive or behavioral skills – any individual characteristic that can be measured or counted reliably and that can be shown to differentiate significantly between superior and average performers” (Spencer & Spencer, 1993, p. 4). To assess job competencies, McClelland devised the Behavioral Event Interview (BEI). A BEI is a structured interview allowing respondents to freely describe their thoughts, feelings and actions while they are presented positive and negative work situations (McClelland, 1998). The sampling of thought patterns then allowed for “generalizability of various action outcomes” (McClelland, 1973, p. 12).

Competency modeling (i.e. framework of identifying and measuring competencies) has evolved to include other data collection methods such as questionnaire surveys. Schippmann et al. (2000) identified statistics that 75% to 80% of companies surveyed agree that competency modeling has gained wide spread acceptance and that it had “exploded onto the field of human resources over the past few years” (p. 704).

While the use of competency modeling has outpaced the use of traditional job analysis for personnel selection, academia and industrial-organizational psychologists have identified a lack of consensus on the approaches to competency modeling and operational definition of a competency (Schippmann et al., 2000). The competency modeling heretofore discussed in this paper by researchers such as Kelley and Caplan (1993) can be said to follow a business approach to identify organizational citizenship characteristics that can enhance business competitiveness. Competency modeling, as defined by McClelland, is premised on the psychological approach. The key difference between the two is that the business approach is describing prosocial behaviors that is generic to all levels and types of jobs in an

organization while psychological approach is focused on person specific characteristics that correlates to a performance of a specific job (Markus, Thomas & Allpress, 2005). Of the two approaches it was reported by Bartram (2005) that managers “favour people who are dependable, high achieving, and focused on the task rather than those who display the prosocial behaviors of helping and supporting others” (p. 1199) and that more research is required to examine the effect of task specific behaviors and prosocial behaviors towards overall productivity. Practitioners and experts alike have highlighted that operational definitions of competency are major problems in assessing and researching job performance (Markus, Thomas & Allpress, 2005; Schippman et al, 2000). To overcome said limitations, Industrial-organizational psychologists have proposed an integrative research approach which would be to consider competency modeling as attribute-based job analysis as compared to traditional job analysis (which can be termed as an activity-based job analysis; Sackett & Laczko, 2003). Such an approach has brought about consensus that traditional job analysis is focused on analysis of work activities that is considered the norm for the said job activity while competency modeling is focused on assessing or identifying worker attributes that lead to superior work performance (Stevens, 2012).

McClelland’s psychological approach of competency modeling is relevant to this study as the current research is focused on examiner attributes that contribute to superior performance in the detection of deception – a specific task rather than generalized pro-social organizational behavior. To date there are two studies that have utilized competency modeling methodology to study examiner performance and polygraph examination outcomes. These studies will be discussed in following sections in this chapter based on the chronological phases of a polygraph examination process.

1.11.2. DACA Studies Based on Competency Modeling

The DACA (2007) study focused on polygraph examiner performance during polygraph pre-test and outcome of polygraph examinations. DACA (2007) study researchers administered a structured interview and gathered data from a self-report questionnaire to study participants. The study participants who took part in this study were accomplished examiners sampled from various US Federal agencies. The expert examiners who took part in this study were identified by their respective US Federal polygraph program managers. DACA (2006) explored optimal interrogation strategies of superior examiners as compared to average examiners performance during post-test interview and outcome of polygraph examinations. Researchers involved in the DACA (2006) study administered structured interviews and analyzed videotaped recordings of real life interrogations of subjects after they had undergone their polygraph examinations. Study researchers utilized the BEI to identify defining personality characteristics of superior and average examiners.

1.11.3. Competency Model Based on an Expert Panel.

A qualitative study commissioned by the DACA Research Division (DACA, 2007) focused on the relationship between pretest interview and the polygraph examination test identified a list of important examiner traits that are based on interviews by research analysts and examiners' self-reports. Participants in this study, henceforth referred to as examiners, were highly skilled mid-career to senior examiners with an average of 11 years in the profession. The study comprised interviews and surveys administered to examiners. During the interview phase of the study examiners statements about traits of expert examiners was analyzed by researchers. Study findings showed that examiners stated expert examiners "Must make conscious effort to do the job right every time", "A passion for the job and resolving conflicts", "Must have outgoing personality (but not necessarily an extrovert)", "detail-oriented", "must be careful about revealing emotion", "must be self- motivated" (refer

to Appendix B for listing of traits that was reported in this study). The DACA's (2007) study finding was that superior or accomplished examiners performance can be attributed to examiner specific factors such as motivation and desire to serve. The DACA's (2007) study also recommended that future studies explore the personality traits that contribute towards the superior performance of examiners.

1.11.4. Competency Model Based on Behavioral Event Interviews.

The DACA (2006) study explored the optimal interrogation strategies adopted by expert examiners. Examiners conducted additional interrogations to elicit confessions during the post-test phase of the polygraph examination when examinees are deemed to have failed their polygraph examinations. This study method employed structured interviews and analysis of audio video recordings of the interrogation sessions conducted by examiners to distinguish behaviors of superior and average examiners in their ability to elicit confessions. The study findings reported that superior and average examiners alike displayed basic skills and abilities, also known as competencies. However, they differed in terms of strength and integration of several competencies (refer to Figure 1). Referring to the Figure 1, DACA (2006) depicted the performance of average examiners (shown with the blue arrow pointing to the circumference of the blue circle), while having the same competencies of superior examiners, showed lower level of strength and integration of said competencies. Examples of examiner competencies reported in the study were (a) emotional competency, such as “skillfully presents multiple themes to gauge or determine reaction of suspect”, (b) motivational competency, such as “taking control by interrupting and refocusing suspect at appropriate time”, (c) interpersonal competency, such as “strongly and continuously focuses

on the words and actions of suspects during the interrogation”, (d) cognitive competency, such as “recognizing incongruities in the details of suspects’ statements”.

Figure 1. Competencies of Superior and Average Interrogators (DACA, 2006, p.38)

DACA’s (2006) seminal findings and recommendations were that examiners cannot be trained to develop some of the core competencies for polygraph assessment, as these competencies rely on, or are inherent personality characteristics. The DACA (2006) study also concluded that the training programme should be focused on the identification of thresholds for competencies such as job-relevant skills and knowledge. This would aid the development of examiners with superior interrogation skills.

1.11.5. Research on Current Polygraph Training

In DACA’s study (2007), subjective feedback from the panel of experts also yielded an examiner job performance graph showing the trend of polygraph examiners’ performance over time – the notional examiner job performance curve (refer to Figure 2). The job performance curve shows that examiner job performance trajectories diverge beyond their

internship period, despite examiners having undergone the same Federal-sponsored polygraph training programme. A study of the examiner notional performance curve suggests that examiners reach a level of peak performance a year after their graduation and thereafter show a slight decline in performance. This decline in performance is defined as an increase in inconclusive test outcomes or unresolved cases. A possible explanation for the decline was examiners steering away from classroom based solutions learned during their training and may not be applicable in on-the-job case scenarios, which may be more complex (DACA, 2007). Following the decline, training interventions and mentorship programmes mitigate to arrest the degradation of job performance but only to a certain point. Thereafter, the graph of an examiner's job performance trajectory takes one of three pathways. One trajectory is that examiners regain their earlier performance level. In the second trajectory, examiners show a marked improvement in their job performance and become accomplished practitioners or exemplary performers. However, in a third trajectory, the examiners continue in their trajectory of job performance degradation despite a period of associated interventions and either leave voluntarily or are dismissed from the job.

Figure 2. Examiner Performance Curve (DACA, 2006)

These examiners in the third trajectory are under-performers. The finding that dissimilar examiner job performance trajectories could develop over time despite every examiner receiving standardized examiner training, similar interventions, and/or mentorship suggests that formal training may not fully account for variation in examiner job performance in the long term. DACA's (2007) study revealed that interventions in terms of training and mentorship had varying effects on examiner performance. The said intervention did not prevent the degradation of job performance of some examiners. However, it assisted some examiners to improve on their job performance, while some others continue to become accomplished examiners. This difference in examiner job performance trajectory, despite undergoing similar or same training intervention needs, is postulated to be due to personality characteristics such as traits and motives.

1.11.6. Training and Examiner Performance

The operational definition of a good or accomplished examiner and a discussion based on information obtained from accomplished examiners is relevant for the theoretical

framework of this present study. While DACA administers a robust training programme to candidates, the training outcome for polygraph examiners appears to be sub-optimal, at least for a fraction of polygraph examiners. In a qualitative study, accomplished examiners were interviewed about new training methods which can bring novice examiners to the standards of expert examiners within a shorter time span (DACA, 2007).

Based on the information gathered from the panel of accomplished examiners, the study concluded by highlighting the need for a few course of actions which include: developing a programme to screen examiner candidates for selection, gathering information about motivational incentives that need to be provided to examiners to enhance their performance, and to further develop an examiner mentorship programme (DACA, 2007). This study also recommended using constructs related to examiners' skills, traits and motivation as possible criteria for examiner selection (DACA, 2007). This recommendation will be discussed later in the relevant section of this chapter.

Given that training does not appear to fully account for the variance in examiner job performance beyond the initial short period, there is a need to better understand the underlying reasons for the difference in the job performance outcome of superior examiners and poor performers related to training effects. One postulation is that the present examiner selection system may be sub-optimal. Considering that persons undergoing the same training and internship display differentiated performance trajectories over time, it may be that these persons are different in terms of their inherent personal qualities. To this end, there is a need to identify the qualities of an examiner that are enduring and stable over time. These qualities can be used as selection criteria that will be predictive of examiner job performance in the long term. Identifying said personality dimensions would serve two purposes – (1) the screening and selection of superior performers, and (2) studying the possible interaction effects between personality and training on job performance. It is also important to have a

management system in place which can identify superior performers who consistently demonstrate outstanding performance in relation to others (Bish & Kabanoff, 2014).

Training literature is also silent on the effects of professional training on levels of prior training. Given the significance of an examiner's role in the validity of polygraph examinations, it is logical that agencies accord high emphasis on examiner training.

1.12. Rationale for Current Study

The study findings based on competency modeling reported by DACA (2006) and DACA (2007) are noteworthy in several ways. First, both studies suggest that examiners' characteristics are predictive of superior examiner performance. Second, study findings suggest that the relative strength of competencies and degree of integration of competencies differentiate the superior and average polygraph examiner.

Taken together, both the 2006 and 2007 DACA studies lend support to the idea that examiners' skills, knowledge and behavioral characteristics differentiate superior and average examiners in the conduct of pre-test interviews and post-test interrogations. The studies also provide empirical data to support the position that a polygraph examiner's job is complex and that to meet the job demands, the examiner needs to have different competencies which come into play at various phases of the polygraph examination process. Existing research suggest training does explain for examiner job performance in the short term but it does not explain for the variance in examiner job performance in the long term despite mitigation measures such as additional training and feedback (e.g. quality control reviews and mentoring). Lastly, the studies suggest that contextual factors related to job functions of polygraph examiner differentiate performance of superior and average polygraph examiner.

Presently, there is a paucity of research related to examiner competencies that are required for superior performance during the in-test and test data analysis phases of the examination. Throughout the four phases of the polygraph examination, the examiner carries

out his multi-component role, which includes analysis of verbal and nonverbal behaviours, as well as the collections and analysis of physiological data during the in-test and test data analysis phases. Accordingly, the ability of an examiner to carry out these two components is of the utmost importance in accounting for an examiner's decision accuracy. As such, studying the competencies necessary for both detection of deception via analysis of verbal and nonverbal behavior, and analysis of physiological signals, should yield the most utility towards an enhanced selection of polygraph examiners. An aim proposed by the present dissertation is to study the characteristics of an examiner who can accurately detect deception using two modalities namely – (1) detect deception through the analysis of verbal and nonverbal behavior and (2) detect deception by analyzing polygraph charts containing physiological data collected from subjects. Gaining insights into examiner competencies that are relevant for the said two modalities of detection of deception will go towards building a general examiner competency framework, which can be used for examiner selection and training.

In building the framework for examiner performance the concept of expertise was discussed. Specifically, expertise was evinced as high performance which is stable over time that can be attributed to the characteristics of a person rather than chance alone (Sonnentag, 1998). Furthermore, a facet of a superior performer that of having superior procedural knowledge to perform tasks without conscious awareness based on intuition was discussed as best suited for situational behavioural responses. Integrating the various defining characteristics of a superior performer it is important to explore characteristics that will enable him to navigate and manage the psychological and social context in which the job is performed. The psychological and social context in which examiner performs his job was described in detailed in the roles and function of a polygraph examiner during the four phases of the polygraph process. Furthermore, given that detection of deception is a perceptual task

i.e. the examiner attaches meaning to the psychophysiological or verbal and nonverbal behavioural cues he senses, the need to explore examiner competencies which will enable him to be a superior performer will be need to be explored in this study.

The competencies of superior examiners (refer to Appendix C) could be conceived as constructs of emotional intelligence, motivation and personality traits respectively. To date, research studying the personality correlates of polygraph examiner's performance is scarce. Though several studies have investigated if some personalities are better than others in detecting deception, few personality traits had been addressed in enough studies to conduct a meta-analysis. Positive findings reported by isolated studies are to be interpreted with caution till more studies are done to replicate said findings to build on to the body of knowledge related to personality and job performance.

An approach towards sampling examiner contextual behaviors based on an attribute-based job analysis is premised on a personality-job fit analysis. This analysis explores the degree to which one's personality that are consistent with the tasks and demands on the job (Christian, Siker & Frost, 2014). In the context of the polygraph examiner's job, we will explore personality traits and training which are potentially relevant in the detection of deception using both modes - verbal and nonverbal behavioral analysis as well as chart analysis. Refer to figure 3 for a conceptualization of the effects of personality dimensions and training on detection of deception.

Figure 3. Overview of Study

1.13. Overview of Research Studies

A total of three studies were conducted to explore the relationships between personality traits and training on the accuracy of detecting deception. The aim of Study 1 was to identify the personality traits that are relevant for detection of deception. To this effect topic experts were consulted to gain additional data on personality variables relevant to detection of deception identified from a theoretical perspective. Consulting with topic experts served to shape this study similar to that of the seminal study of Kelley and Caplan (1993) in which they consulted employees and managers to develop a list of traits that differentiated behaviours of star performers and average performers. Accordingly, topic experts within the domain of polygraph practice and research from US Agencies were consulted on personality traits that are deemed relevant for effective detection of deception. Relevant personality traits were obtained using a survey questionnaire with structured and open-ended questions (refer to Appendix K). Relevant personality traits identified from Study 1 were used in Study 2 and Study 3 where the relationship between personality traits and accuracy in detection of deception were further investigated. Conceptualization of study 1 is stated in figure 4.

Figure 4. Study 1 Effects of Personality on Detection of Deception

The aim of Study 2 was to explore the effects of personality and training on the detection of deception. Study 2 participants comprised undergraduate student participants, also known as student raters recruited from Nanyang Technological University (NTU). Accuracy of detection of deception in Study 2 was operationalized as student raters correct classification of cases as deception indicated (DI) or no deception indicated (NDI) based on their analysis of polygraph charts obtained from subjects who were programmed innocent or programmed guilty of a mock crime. To study training effects, training variable in Study 2 was operationalized at two levels namely (1) information only and (2) information, practice and feedback based on an experimental research paradigm. Study 2 participants were randomly assigned to two groups, namely, the Not Trained and the Trained group. The Not Trained group received only information on methods to evaluate polygraph chart data. The

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Trained group received information, practice and feedback to evaluate polygraph chart data. Multiple regression analyses were used to study the effects of personality traits and training on the accuracy of detection of deception by means of analyzing psychophysiological data also known as polygraph charts.

Figure 5. Study 2 Effects of Personality and Training on Detection of Deception (Polygraph Chart Analysis)

Study 3 was conducted to investigate the effects of both personality traits and professional training on the accuracy of detection of deception based on polygraph chart analysis and verbal and non-verbal behavioral analysis. Participants of Study 3 were law enforcement officers from Singapore and United States agencies. In addition to polygraph chart analysis, Study 3 also explored effects of personality and training on the detection of deception based on verbal and nonverbal behavioral analysis.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Study 3 participants comprised law enforcement officers with three levels of training namely (1) Novice, (2) Basic Trained and (3) Advanced Trained. Participants from the Novice group received only information in the detection of deception by means of polygraph chart analysis and verbal and nonverbal behavioral analysis. Participants from the Basic Trained group and Advanced Trained group completed basic and advanced professional training respectively in detection of deception techniques namely polygraph chart analysis and verbal and nonverbal behavioral analysis.

Participants from the Novice group who were untrained in detection of deception methods were the control group for this study. To provide a comparable study group to participants in the basic-trained group and advanced-trained group, participants in the control group were matched on their career stages and current job demands. All participants were assessed at the same pre- and post-time frames. All participants were observed during their analysis of the polygraph data and verbal and nonverbal behavior. This was done to mitigate for possible Hawthorne effect across the three groups i.e. the alteration of behavior by participants of a study due to their awareness of being observed. A within-subjects experimental design was also employed to explore the causal relationship between training and performance in detecting of deception. Conceptualization of Study 3 is stated in Figures 6, 7 and 8.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Figure 6. Study 3 Effects of Personality Variables and Training on the Accuracy of Detection of Deception (Charts Analysis and Behavioural Analysis)

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Figure 7. Study 3 – Effects of Personality Variables and Training on the Accuracy of Detection of Deception by Polygraph Chart Analysis

Figure 8. Study 3 – Effects of Personality Variables and Training on the Accuracy of Detection of Deception by Verbal and Non Verbal Analysis

2. Personality Variables

The overarching research question of this study is to explore the effects of personality and training on detection of deception. Study 1 will aim to identify the personality variables that are relevant to polygraph examiner performance in detection of deception. As reviewed in Chapter 1, traditional job analysis and competency modeling methods have been used to identify personality variables relevant for polygraph examiner performance. This research will adopt an integrative approach, that uses attribute based job analysis. Attribute based job analysis was proposed as a means to mitigate for the limitations and integrate the strengths of traditional job analysis and competency modeling methods of identifying personality variables (Sackett & Laczko, 2003). This chapter will explore the personality variables or competencies such as traits, motives, cognitive style and emotional intelligence based on psychology premised constructs. This study will aid towards integrating personality variables in following chapters to develop a theoretical framework to explain for examiner performance in detection of deception

2.1. Emotional Intelligence

Emotional intelligence is the ability to monitor one's own emotions and others' feelings and emotions (Mayer & Salovey, 1997). Additionally, emotional intelligence comprises four types of abilities, (a) the ability to perceive accurately, appraise and express emotion; (b) the ability to capitalize fully upon one's changing moods to best fit the task at hand; (c) the ability to comprehend emotions, to be sensitive to slight variations between emotions, and to recognize and describe how emotions evolve over time; and (d) the ability to manage and regulate emotions.

Emotional intelligence can account for individual differences in examiners' ability to read and evaluate nonverbal cues, considering that examiners must be able to perceive

simulated or suppressed emotional expressions that may be utilized by persons undergoing an interview. While persons may be able to conceal or falsify their emotional expressions, they may not be able to prevent the leakage of true emotions felt during the interview. An examiner's emotional intelligence in terms of his sensitivity to variations of emotional expressions is important to detection of deception. (Wojciechowski, Stolarski & Matthews, 2014). Examiners must be able to regulate and manage their own emotions while interacting with examinees so that examiners themselves do not leak any emotional or behavioral cues, which may provide feedback as to how the examinees are faring in the interview process. Examiners in doing so engage in emotional labor which is altering of their emotional displays to prescribed display rules required for the job (Diefendorff, Croyle & Gosserand, 2005). To cope with display rules, examiners should engage in surface acting or deep acting. Surface acting may involve modifying facial expressions while deep acting may involve modifying their inner feelings (Grandey, 2003). Examiners who are high in emotional intelligence are more skilled in adjusting their emotions to meet with the situational demands of the job.

A personality construct that is closely related to emotional intelligence is self-monitoring. Aamodt and Heather's meta-analysis (2006) found that self-monitoring is weakly correlated with the ability to detect deception, with $r = 0.14$. High self-monitors are people who scan the environment to determine how others are behaving to adjust their behavior accordingly (Snyder, 1974). In other words, high self-monitors can readily adjust their behavior as per what is required of the situation, while low self-monitors give minimal regard to adjusting their behavior in response to situational demands, maintaining their own attitudes regardless of the situation (Snyder, 1974). As such, high self-monitors find it much easier to change their behavior based on the situation than low self-monitors do. Examiners who are high self-monitors encourage trust and rapport building with their examinees. Examiners who are high self-monitors may have a greater inclination to behave in a certain

manner that enables rapport and trust building and in doing so can elicit more discriminating information from their examinees. In the current research, emotional intelligence will be studied, rather than self-monitoring, because emotional intelligence competencies are more basic competencies. Individual differences in emotional intelligence might affect performance on a wider range of tasks than self-monitoring would.

2.2. Cognitive Style – Field Dependence Independence

Field-dependence/field-independence or FDI is a dimension of cognitive style ranging from highly analytical and differentiated processing of information (i.e. field-independence) to highly contextual and global processing (i.e. field-dependence) (Witkin, Goodenough & Oltmann, 1979). Moreover, it is seen as a personality characteristic in the sense that individuals display dispositional tendencies towards either field-dependence or field-independence.

Without research specifically linking cognitive styles to job performance in polygraph examiners, the next alternative is to look at personality correlates of job performance in jobs that have aspects that are similar to a polygraph examiner. For example, Vrij, van der Steen, and Koppelaar (1995) found superior performance in field-independent police officers than officers who were field-dependent ones. The officers were better able to ignore distracting sights and sounds and were more accurate in deciding when to shoot their guns. This illustrates that field-independent individuals can deliver their task without allowing surrounding events to influence their ability to deliver their task effectively. While examiners must be able to display empathy where required to encourage rapport building hence facilitating conversation, it would be counterproductive if they allow the examinee's emotions to affect their mission to administer the test and/or conduct the interview. Also, examiners cannot allow irrelevant or superfluous information provided by the examinee to

cloud their judgment. In other words, there is an apparent need for examiners to function independently without allowing behaviors of others to affect their mission or task at hand. Such attributes of being task-oriented and impersonal have been said to be a trademark of field-independent individuals.

Next, given that the polygraph process is more open-ended than structured, there is no rigid rule to dictate specific words to be said in an order, as long as key elements of the test protocol are administered. This situation calls for examiners to impose their own sense of order in a situation that is lacking structure, something that field-independent individuals are better at. Field-independent individuals also tend to be drawn to careers that require objective analysis of information (Goodenough, 1978), which is a major aspect of a polygraph examiner's job during the analysis of the polygraph chart data (Nelson, Blalock, Oelrich & Cushman, 2011).

Examiners are required to analyze physiological data collected by applying fixed algorithms to derive a test result. This process involves an objective analysis of information (Nelson & Krapohl, 2011). Accordingly, Goodenough (1978) found that people who are field-independent prefer jobs that are analytical. Hence, it is hypothesized that examiners who score high in FDI will render more accurate decisions than examiners who score low in FDI.

2.3. Big Five Traits

Traits are descriptions of characteristics of a person's thoughts, actions and behaviors as a person interacts with his environment (McCrae & Costa, 1995). The trait approach embodies two key perspectives, one is that people behave the same way across situation and across time and that people differ in terms of said characteristics as known as personality differences (Carver & Scheier, 2014). The said personality differences can be characterized

using descriptions of behaviors listed under the Five Factor Model (or FFM; Costa & McCrae, 1992) The five factors are: Openness to Experience (sometimes abbreviated to Openness), Conscientiousness, Extraversion, Agreeableness and Neuroticism (Adams, 2009). The said traits are measured in terms of a continuum for example extroversion (e.g. talkative and spontaneous) versus introversion (silent and inhibited) high in Conscientiousness (e.g. responsible and thorough) and low Conscientiousness (e.g. irresponsible and careless). Meta-analysis studies to date have revealed that the Big Five traits are predictors of job performance, namely Conscientiousness and Neuroticism can be viewed as job performance across all jobs while Extraversion, Agreeableness and Openness to Experience are predictors of job performance in specific types of jobs (Barrick & Mount, 2005). Accordingly, the Big Five traits will be reviewed per general and specific predictors of the job performance of a polygraph examiner. Where possible, studies relevant to detection of deception will be cited to draw inference for the relevance of the traits to the performance of a polygraph examiner.

2.3.1. Conscientiousness and Emotional Stability (or Neuroticism).

Under the FFM, being “detail-oriented” could be characterized by the trait dimension of Conscientiousness. Such people are characterized as being persistent, organized, thorough, careful, responsible, and hardworking. Conscientiousness is commonly reported to be significantly linked to job performance in general (Barrick & Mount, 1991; Barrick, Mount, & Strauss, 1993). Judge et al. (1999) reported that Conscientiousness is positively correlated with job performance ($r=.33$). A polygraph examiner must conduct a multi-phase examination process and should be attentive to behavioral and psychophysiological cues to detection of deception to derive at a decision of truth or deception. Interestingly, in jobs with high autonomy, Conscientiousness and Extraversion (discussed later in this section) are found to be even more strongly related with job performance (Barrick & Mount, 1993). It is worth

noting that an examiner's job comes with a high level of autonomy – orchestrating the whole polygraph process independently without supervision and direction, and making decisions ranging from interview questions and procedure, and rendering a decision of truth or deception. Given the job demands, an examiner who is organized, careful, responsible and hardworking will more likely perform better than an examiner who is careless, disorganized and not hardworking.

Emotional stability or the capacity to allocate resources is another trait which may influence an examiner's job performance. A polygraph examiner's job is complex and highly dynamic, and such unpredictability can give rise to a stressful work environment. Also, examiners often face immense time pressure to produce a conclusive decision about his or her examinee's truthfulness (to facilitate downstream work processes). The stress levels are also heightened due to the implications that their decision accuracy has on the examinee and/or agency – the accuracy of test outcomes can have direct impact on someone's employment opportunity, criminal accusations or even compromise national security. An ability to remain collected and cope with stressful situations is a valuable trait in view of such a work environment. Hence, it is postulated that examiners high on emotional stability – or low on neuroticism – will be better performers than those who are highly neurotic, as the latter are likely to react in negative ways to stressful situations (Magnus, Diener, Fujita, & Pavot, 1993).

2.3.2. Extraversion, Agreeableness and Openness to Experience.

Individuals high in the traits of Extraversion and Agreeableness traits are social in nature. Having an “outgoing personality” is descriptive of the extraversion dimension (such persons are characterized as talkative, active, sociable, and gregarious). Extraversion has been reported to predict job performance that require influencing and a need to exert power (Barrick et al., 2001). Research suggests that it is also a valid predictor of performance in

jobs characterized by social interaction and that extraversion is positively correlated with police personnel's performance (Barrick & Mount, 1991). Polygraph examiner's job, like police investigative work, requires interaction with examinees and a need to exert influence and power. Given the similarity between a police work and polygraph examiner's job it is postulated that persons high in extraversion scale will perform better than persons who are low in the extraversion scale.

Persons who are high on the Agreeableness scale are described as friendly, warm and good natured, and tend to avoid conflict. Research has shown that trait Agreeableness is an important predictor of job performance when team work is required to complete a task (Barrick & Mount, 2005). Specific to detection of deception tasks, an interesting finding is that research suggests that persons with high in Agreeableness trait are better at detection of deception (Enos et al., 2006). Enos et al. (2006) postulated that the sensitivity to opinions and emotions to persons during social interactions may explain the better performance in terms of detection of deception. Openness to Experience measures the persons' disposition in terms of degree of perceptiveness, imagination, adaptive and creativity (McCrae & Costa, 2002). Specific to detection of deception, persons high on the scale of Openness to Experience, Enos et al. (2006) reported persons high on the Openness to Experience scale were better at detection of deception tasks. Study authors postulated that persons high in Openness to Experience trait made decisions based on "available data rather than of preconceptions" (Enos, et al., 2006, p. 815)

2.4. Motives

Based on the trend displayed in the DACA (2006; refer to Figure 1) data, it is apparent that, even when all examiners are exposed to the same training and all exhibited similar competency levels at some point, some manage to develop themselves into excellent

examiners while others fail to do so. A possible explanation of these trends could be that individual differences in performance are attributed to the motivation of individual examiners.

Motivation can be conceptualized as comprising two distinct motivational systems, one that in the non-conscious realm of the person which is known as implicit motives and the other which is the conscious realm of the person also known as explicit or self-attributed motives (Schultheiss & Brunstein, 2010). Implicit and explicit motives are activated by different situational demands of the task to be performed. Implicit motives are aroused by task intrinsic factors while explicit motives are aroused by factors extrinsic to the task performance (i.e. deriving satisfaction from doing the task itself rather than focus on task outcome and approval of others) (Koestner & Weinburger, 1991).

2.4.1. Implicit Motives

Implicit motives are relatively stable unconscious needs that have an affective core and are triggered by situation cues that indicate rewarding type of activity (McClelland, 1980). Implicit motives are believed to be shaped by factors such as hereditary, environment and early pre-linguistic learning (Leontiev, 2012). Because they are non-conscious, implicit motives are measured using projective measurements such as the Picture Story Exercise (Pang & Schultheiss, 2005). According to McClelland, Koestner and Weinberger (1989), implicit motive measures are generally better than explicit motive measures in predicting spontaneous behavioral responses. On the other hand, explicit measures typically outperform implicit measure in predicting “planned and controlled behavioral responses”. These authors further explained that implicit measures tap into “automatic emotional memories and behavioral response tendencies”, while explicit measures tap into self-concepts which are verbalized and conscious, and often influenced by personal and social standards.

McClelland (1995) refers to the “big three” implicit motives as: Power, Affiliation and Achievement. The Power motive relates to dominance and social control, while the Achievement motive is aroused when personal standards of excellence are to be met or exceeded. Lastly, the Affiliation motive is aroused when social relationships are established or intensified. The Power and Affiliation motives are also known as social motives (Schulthesiss & Brunstein, 2010).

2.4.2. Need for Power (*nPower*) and Examiner Performance

Examiners need to exert control and authority over examinees. Specifically, the need for power is exercised when the examiner dictates the pace and direction of the interview, instructs the examinee and make sure there is compliance to test-protocol.

2.4.3. Need for Affiliation (*nAff*) and Examiner Performance

Affiliation motivation is defined as a concern with establishing, maintaining, or restoring a positive emotional relationship with another person (Koestner & McClelland, 1992). Individuals high in Affiliation motivation are sensitive to nonverbal signals such as facial expressions (Schulthesiss, Pang, Torges, Wirth & Treynor, 2005). Implicit Affiliation motive has been found to predict correct intuitive judgments (Qurin, Dusing & Kuhl, 2013). Therefore, we posit that persons high in Affiliation motive will be more sensitive to verbal and nonverbal behavioral cues than persons with low need for Affiliation.

2.4.4. Need for Achievement (*nAch*) and Examiner Performance

Persons high in a need for achievement are attracted to tasks that require a high level of autonomous decision-making (Pang & Schultheiss, 2005), a characteristic of a polygraph examiner's job as earlier discussed. Given the complexity of detecting deception – there is no single defining feature of deception and examiners need to consider a repertoire of verbal and non-verbal behavioral cues over the entire span of the polygraph process to derive the

presence of deception – the task of arriving at an accurate decision is unarguably a challenging one (albeit not impossible). Hence, it is likely that persons high in the need for Achievement (*nAch*) will be derive satisfaction from the tasks related to detection of deception.

2.4.5. Explicit Motives.

Explicit, or self-attributed, motives are based on self-concepts. Explicit motives are said to be cognitively based because they are the reasons people self-attribute for their actions (McClelland, 1995). Such motives are outcomes of evaluations of expected outcomes, goals, consequences and ego development. In the same way that people can be motivated implicitly by needs for Power, Achievement, and Affiliation, they could also form self-concepts of having these same needs, and thus attribute motives to themselves for explicit Power motivation, explicit Achievement motivation and explicit Affiliation motivation. However, research has shown that the correlation between implicit and explicit motives is low or even non-existent (Brunstein, 2008).

Method

2.5 Study 1

2.5.1 Aims

To identify key attributes of employees who display superior performance, psychologists typically consult an expert panel within the domain of interest to identify competencies that sets the top performers apart from the others (Goleman, Boyatzis & McKee, 2002, p. 249). Along the same vein, study 1 aimed to identify attributes that distinguish superior examiners from the average ones. This is also to obtain greater confidence that the set of attributes discussed in the literature review are relevant to examiner's performance (i.e. accuracy in detecting deception, the opinions of topic experts in polygraph were sought). Hence, a survey was conducted with the aim to assess the topic experts' perspectives on the importance of each of the personality constructs in the making of a good polygraph examiner. To ensure that data collected from the study is meaningful and reliable, only qualified and acknowledged experts in the field of polygraph were selected.

A review of literature based on DACA studies stated in earlier sections, suggest that examiner traits and training effects, however, there has not been any explicit findings reported specific to polygraph program managers. Bartum (2005) report that “managers favour people who are dependable, high achieving, and focused on the task rather than those who display the pro-social behaviours of helping and supporting others” (p.1199) suggest that a survey with said experts identify task and possibly contextual behaviours relevant for detection of deception.

2.5.2. Participants

The American Polygraph Association National Office was requested to email a questionnaire to topic experts in the area of credibility assessment. The office manager of the

American Polygraph Association (APA) utilized a stratified sampling method based on APA database and emailed a questionnaire to 30 participants. The participants sampled for this survey include programme managers with US State agencies, senior examiners conducting research in US federal institutions as well as board members of the APA. Response rate was 19 out of 30. Out of the 19 participants, there were six APA board members, four US polygraph school directors, four polygraph instructors with the US federal agencies and five polygraph examiners with US state agencies. All participants had a minimum of ten years of experience as polygraph examiners.

2.5.3. Procedure

The questionnaire comprised 11 items rated on a 10-point scale (1= *not important at all* to 10 = *very important*) (refer to Appendix K for questionnaire). Participants indicated their responses on the extent to which each of the 11 personality dimensions make a good polygraph examiner. The dimensions included the five personality traits from the Big Five Inventory (BFI) (John, Donahue & Kentle, 1991), implicit Achievement, Affiliation and Power motives (PSE) (McClelland, Koestner & Weinberger, 1989) and field-dependence/field-independence cognitive styles (Witkin, et, al., 1962). Participants also responded to an open-ended question asking for suggestions about other qualities of a good polygraph examiner that were not included in the survey.

2.5.4. Statistical Design

One sample t-tests were used to test if the mean scores ratings of topic experts significantly deviated from the normal score of 5. The level of significance was set at $p < 0.05$. The data was analyzed for outliers using box plots and if the dependent variables were approximately normally distributed. Shapiro-Wilk tests for normality indicated that the dependent variables except for Achievement motive was normally distributed. An inspection of the histogram showed that all variables were approximately normally distributed.

Results

Table 1

Descriptive Statistics for the Rating of Personality Variables

	<i>N</i>	<i>M</i>	Min	Max	<i>SD</i>
Extraversion	17	5.88	1	9	2.44
Openness to Experience	18	6.00	3	10	1.91
Neuroticism	18	5.61	2	9	2.00
Agreeableness	18	5.94	2	9	2.36
Conscientiousness	18	6.89	2	10	2.05
Achievement Motive	17	7.59	2	10	1.93
Affiliation Motive	17	5.59	2	9	1.97
Power Motive	17	7.47	2	10	2.09
Field Dependence	18	4.61	1	9	2.68
Field Independence	18	6.11	1	9	2.67

Topic experts who took part in this study gave a mean rating of more than 5 to 9 dimensions of personality. However, one participant, director of a US training school stated that none of the variables were important characteristics of a good polygraph examiner. The said participant stated that trainee examiners he had graduated thus far did not exhibit any particular personality types and that he does not equate good and bad examiners with their personality.

Table 2

One-sample T-test for Mean Ratings of the Personality Variables

	<i>t</i>	<i>df</i>	Sig (2-tailed)	95% Confidence Interval	
				Lower	Upper
Extraversion	1.487	16	.156	-.38	2.14
Openness to Experience	2.222	17	.040*	.05	1.95
Neuroticism	1.294	17	.213	-.39	1.61
Agreeableness	1.696	17	.108	-.23	2.12
Conscientiousness	3.900	17	.001*	.87	2.91
Achievement Motive	5.505	16	.000*	1.59	3.58
Affiliation Motive	1.231	16	.236	-.42	1.60
Power Motive	4.862	16	.000*	1.39	3.55
Field Dependence	-.615	17	.547	-1.72	.94
Field Independence	1.761	17	.096	-.22	2.44

* $p < 0.05$.

Mean rating scores of Openness to Experience ($M = 6.00$, $SD = 1.91$) is higher than the normal score of 5, $t(17) = 2.22$, $p = 0.04$. Mean rating scores Conscientiousness ($M = 6.89$, $SD = 2.05$) is higher than 5, $t(17) = 3.90$, $p = 0.001$. Mean rating scores of Power motive ($M = 7.47$, $SD = 2.09$) is higher than 5, $t(16) = 4.89$, $p < 0.01$. Mean rating scores of Achievement motive ($M = 7.59$, $SD = 1.93$) is higher than 5, $t(16) = 5.5$, $p < 0.01$.

Table 3

Frequency of Perception Style Deemed As More Important to Be a Good Polygraph Examiner

	<i>n</i>	%
Field Dependence	5	26.3
Field Independence	12	63.2
Total	17	89.5

Approximately, 63.2 percent of the topic experts surveyed stated that good examiners should have a cognitive style of field-independence rather than field-dependence. Specifically, field independence ($n = 12$) was deemed by topic experts as a more important perception style for polygraph examiners as compared to field dependence ($n = 5$).

One participant also responded to the open-ended question that emotional intelligence is another key characteristic of a good polygraph examiner.

Discussion

Gasper and Schweitzer (2013) highlighted that emotions are both antecedents and consequences of deception. Polygraph examiners, besides studying physiological data, detect deception by observing elicited and spontaneous verbal and nonverbal behavior. Existing research suggests that there are significant observable verbal and nonverbal behaviors of both truthful and lying subjects (Vrij, Mann, Robbins & Robinson, 2006). In addition, research studying behavioral cues in relation to the detection of deception suggests that lie detection would be most accurate if both verbal and nonverbal indicators of deception are utilized (Vrij, 2008). Furthermore, Ekman (1999) theorized that nonverbal cues to deception arise primarily from cognitive and emotional sources. It is likely that an examiner who can accurately perceive, appraise and understand emotions is better at detecting deception. Emotional intelligence is one way of measuring the ability to accurately perceive, appraise

and understand emotions (Mayer & Salovey, 1997). The most comprehensive definition describes emotional intelligence as a four-level set of abilities, as follows: (a) the ability to perceive accurately, appraise, and express emotion; (b) the ability to access and/or generate feelings when they facilitate thought; (c) the ability to understand emotions and emotional knowledge; and (d) the ability to regulate emotions to promote emotional and intellectual growth (Mayer & Salovey, 1997). To measure the abilities defined above, the Emotional Intelligence Competency Questionnaire (ESCQ) (Takšić, 2005) was used in this study. The ESCQ measures one's ability to (a) accurately interpret emotion in others, (b) describe one's emotions, and (c) handle or control one's emotion.

Overall, findings from this study and from the literature review support the view that examiner predispositions are important predictors of polygraph examiner performance. However, a causal relationship between examiner predispositions and their performance in detection of deception cannot be inferred based on study utilizing questionnaires. The experts surveyed identified examiner characteristics important to polygraph performance and these can be categorised into four broad personality dimensions: Big 5, motives, cognitive style field-dependence/field-independence, and emotional intelligence. In general, characteristics identified by topic experts also agree with examiner traits identified by accomplished examiners in DACA (2006). For example, Big 5 dimension Openness to Experience stated in the DACA (2006) is that examiners need to have adaptability, flexibility and fortitude, and that they must have a natural curiosity and natural inquisitiveness of people.

It is of interest that while the survey questionnaire was not phrased with explicit mention of psychological constructs of Openness to Experience, Conscientiousness, Achievement and Power motives, cognitive style Field Dependence Independence, topic experts rated them as important variables to the performance of good polygraph examiners. This suggest that descriptions of general behavioural tendencies indicative of the constructs

correlate with the behavioural signatures related to the job performance of a polygraph examiner. The importance of Field Dependence Independence was inferred from majority of topic experts stating that field independence perceptual style is more important than field dependence perceptual style towards the performance of a good polygraph examiner. Field Dependence Independence is a measure of how individuals extract features from the environment and organise the said gathered information and make sense of it (Blanton, 2004). Topic experts' ratings to the survey question "of the two perceptual styles 9a) and 9b), which do you think is more important in the making a good polygraph examiner" and their general consensus was that examiners with "perception of an object is rarely influenced by its background" suggest that topic experts viewed that examiners with a cognitive style of field independence will perform better than examiners who are field dependent. Considering that polygraph examiners' job is very similar to that of professionals in the field of investigative work, Vrij, van der Steen, and Koppelaar's (1995) finding that field-independent police officers are superior performers than field-dependent police officers is an important consideration. Taken together, there is sufficient evidence from survey data and empirical research to include cognitive style as a variable in this present study to explore cognitive style as a predictor of polygraph examiners' job performance.

The survey questionnaire did not operationalize the definition of what was meant by a good polygraph examiner. Bartram (2005) reported that managers tend to provide better rating of job performance for people who are dependable, high achieving and focused on the task rather than those who display pro-social behaviors of helping and supporting others. Considering that survey participants were persons holding senior managerial positions, it can be inferred that characteristics of a good polygraph examiner gathered during the survey can also be said to that of examiners who are dependable, high achieving, and focused on the task rather than that related to pro-social behaviors. Following this, the characteristics of a good

polygraph examiner identified through this survey can be used as the general selection criteria for polygraph examiners (i.e. select examiners based on characteristics of Big 5 dimensions, motives, cognitive style field independence and emotional intelligence).

The questions specific to motives was phrased in a manner that enquired of topic experts on three basic motivations of achievement, Affiliation and Power motives and no distinction was made between that of implicit and explicit motives. Data from topic experts have indicated that achievement and power motive are relevant to job performance of a good polygraph examiner and Affiliation motive is not a predictor of the performance of a good polygraph examiner. Facets of power motive stated in DACA (2006) is that examiners “Must maintain control throughout the pre-test, and post-test. Some novices get too friendly, too close and allow the examinee to take over the interview. Rapport is important but not get influenced by the examiner” (DACA 2006, p. 33). This suggest that power motive is related examiners’ job dimension of having impact and control on others in order to facilitate the examination process.

Specific to research question of contextual task performance of detection of deception based on polygraph chart analysis and verbal and nonverbal behaviours, there is a need to explore the relevance of variables of interest identified in Study 1. Study 1 variables related to the detection of detection of deception will be premised on tasks related to chart analysis and verbal and nonverbal analysis. Specifically, variables Openness to Experience, Conscientiousness, implicit motive Achievement and cognitive style and their relevance for detection of deception by polygraph chart analysis will be explored in Study 2. In addition, a theoretically derived interaction variable implicit motive Achievement and trait Conscientiousness will be introduced in Study 2 to explore channeling hypothesis. Study 2 will employ an experimental design in order to provide useful evidence to further the current

state of knowledge about the effects of personality variables in particular the channeling hypothesis and training that are predictors of job performance.

The survey research data obtained from topic experts in this study revealed that mean score rating for trait Agreeableness and implicit motive Affiliation is not significantly higher than normal score 5. However, existing research suggest that persons high in Agreeableness trait are better at detection of deception due to their sensitivity to opinions and emotions of persons during social interactions (Enos et al., 2006). Existing research also suggests that individuals high in Affiliation motive tend to notice social cues and that they are sensitive to nonverbal signals such as facial expressions (Schultheiss, Pang, Torges, Wirth, & Treynor, 2005). Given these findings, it is possible that Agreeableness and implicit motive Affiliation may still account for examiner performance in the detection of deception. Specifically, Agreeableness and Affiliation motivation could contribute to better examiner performance in the analysis of verbal and nonverbal cues. This issue will be explored in subsequent studies (see chapter 4). One possible explanation for the discrepancy between literature findings and topic experts' reports could be that the questionnaire did not adequately operationalize the traits and implicit motives constructs. Another possible explanation could be that detection of deception tasks require procedural knowledge (i.e. unconsciously acquired knowledge) which the topic experts were not consciously aware to respond to in a questionnaire.

The response of a survey participant who stated that none of the variables were important characteristics of a good polygraph examiner is of interest. The survey participant mentioned that none of the traits stated in the questionnaire matters as examiners he has graduated did not exhibit any particular personality profile. This observation is consistent with findings depicted in the DACA (2006) notional performance curve. All examiners were on the similar performance trajectory after graduation for three to five years before their performance trajectory varied to that of superior, average and poor performers (DACA,

2006). Data also suggest that the degradation of in the performance of some of the examiners could not be mitigated for despite mentorship attempts. This suggests that training effects alone may not fully explain for the variance in examiner performance. As such, other variables such as personality traits which can be described as more enduring qualities of an examiner need to be considered. This is key focus of this present study. Secondly, this study perspective is that detection of deception has dimensions of task performance and contextual performance. As such, while training may equip persons with task performance skills, contextual performance is largely dependent personality dimensions. Given this, it is important to identify the person specific variables to better explain for examiner performance in the detection of deception.

The view expressed by the US school director is representative of the experimental psychology tradition. There are two separate psychology traditions that of “differential psychology and experimental psychology” (Schmitt & Chan, 1996, p. 236). The differential psychology emphasizes on individual differences and this tradition has been furthered by selection researchers while training researchers have furthered the research and emphasize on learning process leading to shaping behaviour. IO Psychology scholars have urged researchers in the field of selection and training research to adopt an integrative approach with a view to contribute towards a providing a more complete theoretical model to explain for the construct of job performance. This research will adopt an integrative approach in exploring effects of training and personality variables to explain for examiner performance in the detection of deception

3. Interaction of Personality Constructs and Training Operationalized

3.1. Variables of Interest in Present Research

We have highlighted the various person specific factors that may be relevant to detection of deception. The DACA studies identified two aspects by which personality dimensions superior and average polygraph examiners differed. The DACA (2007) study finding was as follows:

“A striking difference is the consistency and ease with which superior interrogators utilize these competencies. One might say their delivery comes across as more internally natural or with a higher degree of comfort. Although average interrogators may possess and utilize some or many of the 17 threshold skills, their application was of a lesser quality, and or occasionally used inappropriately or with less effective timing. Superior interrogators consistently demonstrate these and the superior competencies in an integrated manner.” (DACA 2007 p.38)

The above quote highlights that the superior and average interrogators differed in (1) strength and (2) the integration of the competencies and skill sets utilized within the situation context of the task (i.e. detecting of deception and eliciting confessions). The difference in strength of competencies between superior and average interrogators can be explained with the additional capacity, the person has to adapt the situational task demands. Competency modeling suggest that personality dimensions described (i.e. motive, traits, skills, etc.) are predictors of superior job performance however, there are knowledge gaps as to how and why there were differences in the integration of the competencies for the same situational task demands. This present research will explain this DACA finding through the lens of the cognitive affective processing system proposed by Mischel and Shoda (1984).

3.1.1. Cognitive Affective Processing System.

Mischel and Shoda (1984) postulated the Cognitive Affective Processing System (CAPS) model to account for the variability of person's behavior across situations. Accordingly, the CAPS model postulates that personality or the personal characteristics are not static factors in a person but are dynamic and the said characteristics interact with the situation to shape behavior. A person's behavior in a given situation is also known as his behavioral signature. A person's behavioral signature is a result of interactions and associations his thoughts and feelings (Mischel & Shoda, 1984). These interactions conform to a set pattern and have an if...then conditional quality which results the behavioral signature. Research has shown that the "if...then" profiles of a person and their resulting behavioral signatures are stable (Mischel, Shoda & Wright, 1994). The behavioral signatures capture the distinctive way in which a person responds to particular types of situation and is consistent over time which can be conceptualized as personality (Mischel, Shoda & Mendoza-Denton, 2002).

The contextual performance of a polygraph examiner can be framed using the CAPS model. Specifically, the behavioral signatures could account for the difference in the examiners' situational performance. In each situation, different persons will perceive or extract different aspects or psychological features inherent in a situation - this even if they are observing the same event or stimulus. The psychological features extracted from a given situation are dependent on the schema that they evoke in each individual. A schema is a cognitive framework or concept that helps persons organize and interpret information. The schema is also a result of the associative and interactive thoughts and feelings of a person which conform to the "if...then" contingency with a resulting behavioral signature (Mischel & Shoda, 1984).

Mischel and Shoda (1984) postulated five “cognitive-affective units”, one of which they termed competencies (p. 252). Competency modelling is the targeted analysis of the behavioral signatures of an individual for a given context. In the current research, a major question is regarding which personality constructs or person-specific facets to assess, in order to capture the behavioral signatures of superior polygraph examiners. Given that the behavioral signature is an outcome of interactions amongst competencies, it will be of interest to explain how the “integration of competencies” (Carer & Scheier, 2014) results in behavioral signatures of superior and average performing examiners. Applying this framework to the performance of examiners involved in the detection of deception, the interaction between motives and traits can be studied as possible explanations for the increase or decrease in performance of examiners. The interaction between implicit motives and traits has been conceptualised as the “channelling hypothesis” in recent personality research (e.g., Lang, Ewen, Hülshager & Zettler, 2012).

3.2. Channeling Hypothesis

Rather than studying the effects of individual traits and motives on performance, recent personality research has taken the path of integrating implicit motives and explicit personality traits to better understand behavior (Bing, LeBretton, Davison, Migetz & James, 2007; Brunstein & Maier, 2005; Winter, John, Stewart, Klohnen & Duncan, 1998). The idea underlying the channeling hypothesis is that “implicit dispositions can be expressed in multiple ways and that explicit dispositions shape the way implicit dispositions are expressed in behavior” (Lang, Ewen, Hülshager & Zettler, 2012, p. 1201). To the extent that one’s explicit personality traits allow the expression of an examiner’s implicit motives through his behavior, the examiner will be able to function more efficiently in his job. This research will explore the effects of implicit motive Achievement and Conscientiousness trait on performance.

3.2.1. CAPS and Channeling Hypothesis

The contextual performance of a polygraph examiner can be framed using the CAPS model. Specifically, the behavioral signatures could account for the difference in the examiners' situational performance. In each situation, different persons will perceive or extract different aspects or psychological features inherent in a situation - this even if they are observing the same event or stimulus. The psychological features extracted from a given situation are dependent on the schema that they evoke in each individual. A schema is a cognitive framework or concept that helps persons organize and interpret information. The schema is also a result of the associative and interactive thoughts and feelings of a person which conform to the "if...then" contingency with a resulting behavioral signature (Mischel & Shoda, 1984).

Figure 9 is a simplified illustration of types of cognitive-affective mediating processes that generate an individual's distinctive behaviour patterns. The figure has three components namely the features of the situation, behaviour generation process that involves the interactions between the cognitive affective units which also includes competencies such as motives and traits and finally the behaviour which is resultant of the interaction between the competencies i.e. interaction between motive and traits. The interaction between the competencies has been discussed as the channelling hypothesis which postulates that the extent to which one's explicit personality traits allow the expression of an examiner's implicit motives through his behavior, the examiner will be able to function more efficiently. As an example, in detection of deception tasks the extraction of deception cues be it psychophysiological or nonverbal behavioural cues present in situational context are features of a situation. The rewards related to correct diagnostic decision of truth or deception by means of extracting physiological or behavioural cues will trigger implicit motive to select orientate oneself to the situational cues relevant for detection of

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

deception. The extraction of the detection of deception cues leading towards correct diagnosis of truth of deception is dependent on the interaction between the examiners explicit trait that will allow him to channel his implicit motives. As discussed with the framework of channeling hypothesis the relation may be a positive, depicted by a solid line in figure 9, i.e. the examiners explicit trait allows him to channel his implicit motive to select and orientate towards detection of deception cues spontaneously and done with ease leading to higher performance. In a negative relationship, depicted by a dotted line in figure 9, the examiners explicit traits does not allow him to channel his implicit motive to select and orientate towards situationally embedded detection of deception cues which leads to diminished performance. The following section discusses the abovementioned postulation in more detail.

Figure 9. Simplified illustration of types of cognitive-affective mediating processes that generate an individual's distinctive behaviour patterns. (Mischel & Shoda, 1995, p. 254)

3.2.2. Implicit Achievement Motive and Conscientiousness.

Persons with dispositionally high implicit achievement motivation have recurrent preferences for affectively rewarding experiences or derive satisfaction related to improving one's performance and internal set standards to evaluate their own performance (Brunstein & Maier, 2005). They derive satisfaction from independently mastering of tasks in situations where standards of excellence are important. A key aspect of the implicit achievement motive is that it "energizes spontaneous impulses to act in such situations and is activated by incentives related to the task itself" (Spangler, as cited in Lang et al., 2012, p.1206). On the other hand, persons high on the trait dimension of Conscientiousness tend to display self-control, engage in purposeful planning, organizing and maintaining orderliness in the conduct of tasks. In the case of the polygraph examiner's performance on the job, examiners high in trait of Conscientiousness have a natural tendency to conduct their polygraph examinations in a planned, purposeful and organized manner to attain excellence, integrity of work, and to ensure his accuracy in detecting deception. Given the contextual or situational detection of deceptions task-intrinsic factors related to a polygraph examiner's job performance (e.g. independent mastery of task), his implicit achievement motive will energize his actions related to facets of his conscientious behavior. Implicit motive and trait interaction in this situation will lead to higher performance. Given that a person is highly Conscientiousness, his high need for achievement will also be channeled through his personal style of performing conscientiously on the job. On the contrary, an examiner high in implicit achievement motive but low in conscientiousness (i.e. not organized, distracted, haphazard manner of doing a task) will not be able to express his desire to achieve mastery of a task according internal standards despite the task intrinsic factors – a situation in which examiner's implicit motive cannot energize his behavior. Given this, it can be postulated

that the achievement motive is more positively related to the accuracy of deception detection when examiner is higher in Conscientiousness predisposition than when Conscientiousness is low.

3.3. Operational Definition of Examiner Performance

Schmitt and Chan (1998) stated that “The basic objective of personnel selection research is to evaluate a hypothesis or theory of work performance. However, performance per se is rarely defined by selection researchers, or, in summarizing selection research, authors have ignored the fact that performance has been operationally different in great many ways” (p. 3). DACA studies reviewed in this present research have utilized a multi-dimensional measure of examiner performance (i.e. their ability produce correct DI/NDI¹ decisions with few no-opinion decisions and low incidence of quality assurance issues). Additionally, element of trust in polygraph examiners to handle difficult polygraph cases has also been stated in this paper. While the mentioned definition are relevant from polygraph agency perspective, theoretical premised definition of performance requires a different measure – “performance is behavior – not necessarily results” (Schmitt & Chan, 1998, p. 4). In the context of detection of deception, scores assigned by examiners during the polygraph chart analysis or scores assigned by examiners as they analyze verbal and nonverbal will need to be transformed to decisions of Deception indicated (DI) or No Deception Indicated² (NDI) based on decision thresholds also known cut scores. For example with cut score of +2, -4 , scores obtained from chart evaluations will rendered as NDI if scores are +2 or greater and a decision of DI will be rendered for any scores - 4 or less obtained from chart evaluations will correspond to a decision of DI. Scores obtained

²DI refers to a decision of Deception Indicated
NDI refers to a decision of No Deception Indicated

with the range of +2 and -4 between will correspond to a decision of INC or inconclusive.

Polygraph examination protocols require that examiners derive decisions based on cut scores that are predetermined. Given this two examiners having derived different scores e.g. +5 by one and +8 by another will both report their decisions based on chart evaluation as NDI. Theoretical definition of performance requires that the scores that is a result of examiner behavior be considered as accuracy of detection of deception rather than final decision derived from applying a given decision threshold. Given this scores assigned by examiners to cases that they evaluate will need to be explored as more proximal measure of examiner performance. In addition, a measure of performance will require understanding of the contextual task related to a polygraph examiners role in polygraph chart analysis and verbal and non verbal analysis need to be explored before developing testable hypothesis towards theory building.

3.4. Detection of Deception Tasks of a Polygraph Examiner and Variables

3.4.1. Chart Analysis

The task involved in evaluating charts will require an examiner to take an overview of the chart and note characteristics of the chart to make an assessment if the set of charts are of scorable quality and artifact free. The examiner will evaluate this based on the review of all parameters recorded on the chart (i.e. upper and lower breathing wave forms, electrodermal or sweat gland waveforms and wave form of the cardio activity tracing). Next, examiner must apply the chart evaluation criteria to each of the physiological parameter being scored. For the breathing, a measure of less air intake as a measure of reaction, peak amplitude as a measure of electrodermal activity and increase in the baseline arousal of the cardio waveform as a measure of cardio activity. Examiner will then have to visually evaluate the responses to the relevant questions and comparison questions, visually extract diagnostic feature and evaluate the magnitude of the

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

differential response to the relevant and comparison question. The comparison question is the index question to which physiological responses to that of relevant question are compared to. Each chart has at least three pairs of comparison relevant pairs of questions. In a typical chart evaluation, the examiner must evaluate between three to five polygraph charts. The examiner should consistently apply the same scoring rules and assign scores based on scoring features he can extract. While evaluating charts, examiner should evaluate the data and make an assessment if the physiological data is artifact data or true physiology. This assessment is made on the timeliness of the physiological reactions and the examinees physiological norms obtained during the recordings of the chart data. While chart evaluation rules have to be adhered to, the examiner has to exercise judgment in terms of selection of physiological waveforms as there are variations in timelines of the response onset or duration of physiological responses related to the asking of the relevant question stimulus or to the comparison question stimulus.

Under the FFM, being “detail-oriented” could be characterized by the trait dimension of Conscientiousness. The task of chart analysis as described above requires examiners who are persistent, organized, thorough, careful, responsible, and hardworking. Hence, it is hypothesized that examiners high in the Conscientiousness trait will render more correct decisions of truth and deception.

Openness to Experience measures the persons’ disposition in terms of degree of perceptiveness, imagination, adaptive and creativity (McCrae & Costa, 2002). Enos et al. (2006) reported persons high on the Openness to Experience scale were better at detection of deception tasks. Study authors postulated that persons high in Openness to Experience trait were made decisions based on “available data rather than of preconceptions” (Enos, et al., 2006, p. 815). Examiners need to render decisions based on available data rather than on preconceptions.

Hence, it is hypothesized that examiners high in the Openness to Experience trait will render more correct decisions of truth and deception.

Examiners are required to analyze physiological data collected by applying fixed algorithms to derive a test result. This process involves an objective analysis of information (Nelson & Krapohl, 2011). Accordingly, Goodenough (1978) found that people who are field independent prefer jobs that are analytical. Hence, it is hypothesized that examiners who score high in FDI will render more accurate decisions than examiners who score low in FDI

Persons high in a need for achievement are attracted to tasks that require a high level of autonomous decision-making (Pang & Schultheiss, 2005), a characteristic of a polygraph examiner's job as earlier discussed. Given the complexity of detecting deception – there is no single defining feature of deception and examiners need to consider a repertoire of psychophysiological cues while reviewing several sets of polygraph chart data to derive a decision of truth or deception – the task of arriving at an accurate decision is unarguably a challenging one (albeit not impossible). Hence, it is likely that persons high in the need for achievement (*nAch*) will be derive satisfaction from the tasks related to detection of deception.

To the extent that one's explicit personality traits allow the expression of an examiner's implicit motives through his behavior, the examiner will be able to function more efficiently in his job, is a postulation of the channeling hypothesis.

The summary of the above study postulations are as follows:

Hypothesis 1a: Examiners high in the Conscientiousness trait will render more correct decisions of truth and deception

Hypothesis 1b: Examiners high in the Openness to Experience trait will render more correct decisions of truth and deception

Hypothesis 2: Implicit Achievement Motive – Examiners high in implicit achievement motive will render more correct decisions of truth and deception.

Hypothesis 3: Cognitive Style – Examiners high in the dimension of field dependence will render more correct decisions of truth and deception than examiners who are field dependent.

Hypothesis 4: The achievement motive is more positively related to an examiners' performance to render more correct decisions of truth and deception when Conscientiousness is high than when Conscientiousness is low (i.e., the 'channeling hypothesis').

3.4.2. Training

Performance at work can be described as an employee controlled behavior that is relevant to organization goals (Schmitt & Chan, 1998). Ajzen (1991) theory of planned behavior, an employee's performance will be situated between two ends of a continuum; that of either having complete control over his behavior or one that of not having any control. Lack of resources such as required skills, either perceived or real, will limit employee's control over his behavior which will constraint his performance. Similarly, McClelland's (1951) general theory of behavior states that "the resources and opportunities available to a person must to some extent dictate the likelihood of behavioral achievement" (McClelland, 1951, p.183). Seen together, Ajzen's theory of planned behavior and McClelland's theory of general behavior both suggest personality traits and relevant skills are equally important determinants of work behavior. In this

sense, having the relevant skills is an equally important factor that determines behaviours of a superior performer and an average performer.

Detection of deception training has three components namely that of providing information on valid cues to detect deception, practice and feedback on performance of detection of deception tasks. Existing research shows that trainees provided with information on detection of deception cues with opportunities to practice utilizing information provided to detect deception and thereafter feedback on their performance do the best. Research also suggests that repeated practice improves performance of trainees by means of providing trainees opportunities to apply information gained on detection of deception cues. Feedback component is said improve detection of deception cues by means of providing means to associate the reliability of detection of deception cues or indicators to detection of deception (Zukerman, Koester & Alton, 1984; Porter, McCabe, Woodworth & Peace, 2007). Research also suggests that feedback provides for trainees to realize their actual detection of deception capabilities as compared to their perceived capabilities to detect deception (Elaad, 2003). This study will explore training using a experimental method where training will be operationalized at two levels namely (1) information only and (2) information, practice and feedback. The study hypothesis related to training will be:

Hypothesis 5: Participants who received information, practice and feedback will render more correct decisions of truth and deception as compared to participants who received information only.

3.5. Measures

3.5.1. Predictor Variables.

To assess the constructs of interest, five instruments were selected. The Big Five Inventory (BFI)(John, Donahue, & Kentle, 1991) taps into the personality traits of Openness to Experience, Conscientiousness, extraversion, Agreeableness and neuroticism; the Group Embedded Figures Test (GEFT)(Witkin et al., 1962) captures field-dependence/independence; the Emotional Skills and Competency Questionnaire (ESCQ)(Takšić, 2001) measures levels of emotional intelligence; the Picture Story Exercise (PSE)(Schulthesis & Pang, 2007) captures three separate implicit motives of achievement, power, and Affiliation.

3.5.2. Big Five Inventory.

The Big Five Inventory (refer to Appendix D for the inventory) used in this study consists of 44 items rated on a 5-point scale (*1 = disagree strongly; to 5 = agree strongly*). The inventory provides for five subscales representing extraversion, Agreeableness, Conscientiousness, neuroticism and openness (to experience).

Extraversion Subscale. The extraversion subscale was derived based on the mean score of 8 items (e.g., *Is full of energy*; $\alpha = .83$).

Agreeableness Subscale. The Agreeableness subscale was derived from the mean score of 9 items (e.g., *Is relaxed, handles stress well*; $\alpha = .75$).

Conscientiousness Subscale. The Conscientiousness subscale was derived from the mean score of 9 items (e.g., *Does a thorough job*; $\alpha = .84$).

Neuroticism Subscale. The neuroticism subscale was derived from the mean score of 8 items (e.g., *Is depressed, blue*; $\alpha = .73$).

Openness to Experience Subscale. The Openness to Experience subscale was derived from the mean score of 10 items (e.g., *Is original and comes up with new ideas*; $\alpha = .78$).

3.5.3. Emotional Skills and Competency Questionnaire (ESCQ).

The ESCQ (Taksic, 2005; refer to Appendix E for the questionnaire) consists of three subscales with a total of 45 items rated on a 5-point scale (1 = *never*; to 5 = *always*). The score of each subscale was computed based on the average for its subscale items.

Perceive and Understand Subscale. The Perceive and Understand subscale consists of 15 items and assesses one's perception of his ability to accurately interpret emotions in others (e.g., *When I see how someone feels, I usually know what happened to him*; $\alpha = .89$).

Express and Label Subscale. The Express and Label subscale consists of 14 items and assesses one's perception of his ability to define or describe his own emotions (e.g., *I am able to express my emotions well*; $\alpha = .88$).

Manage and Regulate Subscale. The Manage and Regulate subscale consists of 16 items and assesses one's perception of one's ability to handle or control his own emotions (e.g., *when I am in a good mood, every problem seems solvable*; $\alpha = .76$).

3.5.4. Group Embedded Figures Test (GEFT).

The GEFT is a measure of field-independence/field-dependence (refer to Appendix F for the test). It comprises three sections and participants are asked to find and trace a simple form embedded in a complex figure. The first section comprises 7 problems and participants were given 2 minutes to complete this section. The second section comprises 9 problems to be completed in 5 minutes and third section comprises 9 problems to be completed in 5 minutes. The total score of this test was based on the total number of correctly traced items embedded in

complex figures in the second and third sections, $\alpha = .82$. Section one was not scored as it was administered as a practice test (Witkin et al., 1962).

3.5.5. Picture Story Exercise (PSE).

The PSE assesses implicit motives by having individuals construct a story for each of a series of between 4-6 pictures. The instrument was programmed in Inquisit 3.0 (Millisecond Software, Seattle, WA) and administered online following standard instructions described in Schultheiss and Pang (2007) and Pang (2010). Six pictures were used in this study: Women in Laboratory, Ship Captain, Nightclub Scene, Couple by River, Bicycle Race and Boxer (refer to Appendix G for a sample of the picture). These pictures have been used in previous research on implicit motives and their cue properties and original sources are described in Schultheiss and Pang (2007). Picture order was randomized and each picture was presented on a black background for 10 seconds and then replaced by a screen with writing instructions. Participants looked at each picture displayed and typed their stories directly into a window on the screen. After 4 minutes had elapsed, a text appeared in the lower half of the screen instructing participants to finish typing the story and move on to the next picture, along with instructions to hit “CTRL + Enter” when they were ready to proceed.

Stories were later coded for motivational imagery independently by two trained raters using Winter’s Manual for Scoring Motive Imagery in Running Text (Winter, 1994). According to the manual, imagery indicative of a need for power (*nPower*) is scored whenever a story character shows a concern with having impact on others through strong, forceful actions, controlling, influencing, helping, impressing or eliciting emotions in others. Imagery for the need for achievement (*nAchievement*) is scored whenever a character shows a concern with a standard of excellence, as indicated by positive evaluations of goals and performances, winning or

competing with others, disappointment about failure, or unique accomplishments. Imagery for the need for Affiliation (*n*Affiliation) is scored whenever a story character shows a concern with establishing, maintaining or restoring friendly relations, as expressed by positive feelings toward others, sadness about separation, affiliative activities, or friendly, nurturing acts. The raters had previously exceeded 85% agreement on calibration materials within the manual and attained 90% agreement with each other's scores. In instances when the raters could not agree with each other, they discussed and scored the stories together in order to reach agreement. Scores for each motive were averaged per picture across both scorers for all further analyses and aggregations. The stories were corrected for word count by dividing number of total number of words indicative of each motive across six stories by the total word count across six stories, and then multiplying by 1000.

3.6 Outcome Variables.

This study has three outcome variables based on two modalities of detection of deception. The outcome variables for chart analysis are the chart scores assigned by examiners and accuracy measured by the percentage of correct classification of truthful and deceptive cases. The outcome variable for verbal and nonverbal behavioral analysis is the scores assigned by examiners based on the Forensic Assessment Interview Technique (FAINT) protocol. Participants in this study evaluated two videos recordings of suspects of an actual crime, one who was verified innocent and the other verified guilty of the crime.

3.6.1. Accuracy of Detection of Deception Using Polygraph Chart Evaluation.

A total of 36 polygraph data sets obtained from a mock crime case were utilized for this research. The mock crime cases were part of a study of detection of deception conducted by the

Department of Economics, National University of Singapore (NUS) in 2003. Permission to use the polygraph data sets was given by the authors (refer to study in Appendix I).

3.6.2. Polygraph Chart Analysis.

See Figure 10 for an example of a segment of a polygraph chart that participants evaluated. Examiners evaluated the polygraph charts based validated scoring features (APA, 2011). Examiners utilised the Empirical Based Manual Scoring System also known as ESS to assign scores based on the validated scoring features (Nelson, et. 2011). Refer to Figures 11, 12, and 13 for a brief explanation of scoring features and ESS method. For details, refer to Appendix P.

Figure 10. Segment of a polygraph chart that shows physiological waveforms of the breathing, electrodermal and cardiograph channels that were evaluated.

Figure 11. Example of a scoring feature and evaluation of pneumograph channel.

3.6.3. Pneumograph Channel

Figure 11 shows an example of evaluation of the pneumograph channel. Scores will be assigned to either the upper or lower pneumograph channels based on scoring features (i.e. apnea, decrease in amplitude or decrease in cyclic rate) the examiner observes in either of the pneumograph channels. Pneumograph waveforms observed to a pair relevant question and comparison question will be evaluated. In this example, scoring criteria 3 (i.e. decrease in breathing cyclic rate) was noted on lower pneumograph channel when compared to normal breathing cycles (norm) noted on the comparison question. As a result, the examiner will assign a score of -1 to this relevant/comparison question pair.

Figure 12. Scoring feature for electrodermal channel and an example.

3.6.4. Electrodermal Channel

Figure 12 shows the scoring feature for the electrodermal waveform. Scores are assigned based on comparing the amplitudes of the waveforms of a relevant question and a comparison question. If the peak amplitude to the relevant question is higher than that of the comparison question, a score of -2 will be assigned and vice versa. In this example, the peak amplitude for the comparison question is of a higher amplitude than that observed to the relevant question. Thus, a score of +2 will be assigned.

Figure 13. Scoring feature for cardiograph channel.

3.6.5. Cardiograph Channel

Figure 13 shows the scoring features of the cardiograph waveform that was evaluated for a relevant question and a comparison question. In this example the peak amplitude of the relevant question is of higher amplitude than that observed to the comparison question and a score of - 1 will be assigned.

3.6.6. Polygraph Chart Decisions

The accuracy of a participant's detection of deception based on polygraph chart evaluation refers to his or her ability to derive a correct decision (i.e., the participant correctly classified the individuals innocent of the mock crime as "No Deception Indicated" (NDI) and those guilty of

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

the mock crime as “Deception Indicated” (DI) based on evaluation of the physiological data.

This is operationalized as accuracy. Refer to Table 4 for the computation of accuracy.

Table 4

Computation of Accuracy of Decisions reported by Examiners

Ground Truth	Decision – Deception Indicated (DI) ¹	Decision – No Deception Indicated (NDI) ²	Decision – Inconclusive (INC) ³
Deceptive (Programmed Guilty)	True Positive (TP) - number of cases involving programmed guilty subjects correctly classified as deceptive	False Negative (FN) - number of cases involving programmed guilty subjects incorrectly classified as truthful	Inconclusive (not included in accuracy computation)
Truthful (Programmed Innocent)	False Positive (FP) - number of cases involving programmed innocent subjects incorrectly classified as deceptive	True Negative (TN) – number of cases involving programmed innocent subjects correctly classified as truthful	
Accuracy =			$\frac{TP+TN}{TP+TN+FP+FN}$
¹ Decisions of NDI were made based on cut scores of + 2 or more			
² Decisions of DI were made based on cut scores of -4 or lesser			
³ Decisions of INC were made on scores reported between -4 to +2			

Table 5

Computation of Chart Scores Reported by Examiners

Ground Truth	Scores Indicated
Deceptive (Programmed Guilty)	Scores Reported for Programmed Guilty Cases (Scores were reverse coded i.e. score of -4 was coded as +4, a score of +4 was coded as -4.)
Truthful (Programmed Innocent)	Scores Reported for Programmed Innocent Cases (Scores were not reverse coded)

3.6.7. Polygraph Chart Scores

Polygraph chart scores reported by examiners for cases evaluated were utilised as a measure of their ability to detect psychophysiological cues to detect deception. Scores reported for all guilty cases were reverse coded to facilitate summation of chart scores across innocent and guilty cases. Examiners with high average scores were deemed to be better in detection of deception cues than examiners whose average scores were lower (e.g. examiner whose average score of +4 was deemed better in detection of deception cues by chart analysis than an examiner whose average score was - 4).

Method

3.7. Study 2

3.7.1. Aims.

This study examines the relationship(s) between personality dimensions — Conscientiousness, Openness to Experience, field-dependence/field-independence, need for achievement (*nAch*), and *nAch X C* (interaction between need for achievement and Conscientiousness) — on the accuracy in detection of deception by means of psychophysiological detection of deception or evaluation of polygraph charts. Secondly, it examines the effects of different levels of training — Not Trained and Trained — on the accuracy in analyzing polygraph chart to detect deception. To study more conclusive evidence on the effect of personality traits on accuracy in analyzing polygraph chart, the level of training received was controlled by using only undergraduate students as participants, all of whom presumably had no experience with polygraphs. Meta-analysis studies based on detection of deception studies suggest that there is no significant difference in the average detection of deception accuracies between that of that of lay persons including college students and that of professional lie catchers. (DePaulo & Pfeifer, 1986; Ekman & O'Sullivan, 1991; Meissner & Kassin, 2002; Vrij & Graham, 1997). Considering this, Study 2 utilized students sample to investigate the relevance of personality variables and training to detection of deception using an experimental design.

3.7.2. Participants.

A total of 53 undergraduates were recruited from NTU for this study. Participants, henceforth referred to as Student Raters, were randomly assigned to two groups namely (a) Not

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Trained ($n = 28$), (b) Trained ($n = 25$). The participants of the groups were belonged to either the Not Trained group or Trained group.

Not Trained Group.

Twenty-eight individuals received only information on polygraph chart evaluation rules and scoring criteria. Age of participants ranged between 19 years to 24 years ($M = 21$ years, $SD = 1.64$ years). There were males 17 and 11 females.

Trained Group.

Twenty-five individuals received a 30-minute training on polygraph chart evaluation as part of this study. Age of participants ranged between 19 years to 24 years ($M = 20$ years, $SD = 1.76$ years). There were 15 males and 10 females.

3.7.3. Procedure.

Participants from the *Not Trained* and *Trained groups* were recruited via email invitations to undergraduate students residing in NTU Halls 1 and 2 (refer to Appendix L).

Student participants were randomly assigned to either morning (0900 hours to 1230 hours) or afternoon (1400 hours – 1730 hours) session. The participants in the morning session were assigned to the *Not Trained group*, and only received information on chart evaluation. Participants in the afternoon session were assigned to Trained group and received information, practice and feedback on polygraph chart evaluations. All participants were paid SGD \$35 upon completion of study.

Not Trained Group.

Participants were given instructions to facilitate their chart evaluation exercise. This entailed a 30-minute presentation on the general characteristics of a polygraph chart, scoring

features for the physiological data channels, and the procedure for how to sum up scores across the chart to decide if the case suspect was deceptive or truthful.

Trained Group.

Participants in the afternoon session were provided with the same instructions and information as those in the *Not Trained group*, coupled with practice and feedback on polygraph chart evaluation. The additional training by means of practice and feedback on polygraph chart evaluation was given following a 30 minute presentation that was identical to the presentation shown to the *Not Trained group*. The participants in the *Trained group* were also given more training on how to identify chart characteristics indicative of a truthful person and on characteristics that are indicative of a deceptive person. Thereafter, they were given a sample chart to practice their chart evaluation and scoring. Finally, the experimenter reviewed the sample chart with the participants and provided them with feedback on how the chart should have been evaluated. The additional training received by the *Trained group* took 25 minutes to complete.

Participants from the *Not Trained group* and *Trained group* were tasked to evaluate 12 sets of polygraph charts. The polygraph charts were projected on a screen and were group-administered. Participants were allowed 3 minutes to evaluate each chart. The experimenter also cued the participants to specific questions on screen so the process of chart evaluation was standardized. (i.e. each relevant question was evaluated against a particular comparison question across all participants). Participants were tasked to make decisions of either Deception Indicated (DI), No Deception Indicated (NDI) or Inconclusive (INC) for each of the 12 cases based on the chart evaluations. Each case comprised four polygraph charts. Accuracy of detection of

deception was computed for each participant based on the proportion of his or her correct decisions (see Table 4 for computation of accuracy).

Participants from both *Not Trained* group and *Trained group* completed the PSE as well as the BFI, ESCQ and GEFT. The PSE was self-administered online at the participants' preferred time and location using the web version of the experimentation software Inquisit 3.0 (2010). This exercise required about 35-40 minutes to complete. The BFI, ESCQ and GEFT questionnaires were mass administered in a classroom setting.

3.7.4. Polygraph Case Categorisations

The outcome variable polygraph examiner performance in this study was operationalised using performance measure stated by polygraph program managers who defined good polygraph examiner as those who consistently produce correct DI/NDI decisions", produce "few no-opinion decisions", "rarely have quality assurance issues", and are those whom "you would trust with your most difficult cases" (DACA 2007, p. 17). The requirement for examiners to handle difficult cases was operationalized in terms examiners ability to accurately evaluate guilty countermeasure cases. National Academy of Science (2003) reported that "polygraph test accuracy may be degraded by countermeasures particularly when used by major security threats who have a strong incentive and sufficient resources to use them effectively. If these measures are effective, they could seriously undermine any value of polygraph security screening" (p. 216). NAS study highlights the possible threats posed by subjects who should be deemed guilty but evade detection through the use of countermeasures. NUS dataset comprised cases of guilty subjects who were taught countermeasures i.e. physical techniques (curling of toes during polygraph data recordings) or mental techniques (mental arithmetic during polygraph data recording) to influence the outcome of their test. Polygraph data from NUS study participants

who were programmed guilty countermeasure group were categorized as complex cases. It needs to be noted that NTU study dataset includes subjects who were programmed innocent countermeasure i.e. innocent subjects who were taught techniques to “improve their chances of being deemed truthful”. The present study data set included polygraph data of innocent countermeasure subjects which will be included under the category All cases. Regardless of ground truth innocent or guilty countermeasure groups, decision of truth or deception was based on ground truth of programmed innocent or programmed guilty. Refer to Table 6 for polygraph case categorisations.

Table 6

Polygraph Case Categorisations by Case Types

Case Types	Description
All Cases	Data obtained from subjects of NUS study who were assigned to guilty control, innocent control, innocent countermeasure and guilty countermeasure groups.
Simple Cases	Innocent control, Guilty control – Data obtained from subjects of NUS study who were assigned to either innocent or guilty control groups
Complex Cases	Guilty countermeasure - Data obtained from programmed guilty subjects of NUS study who were trained to alter their physiology recordings during their polygraph tests.

The outcome variable for accuracy of detection by decisions was coded as ‘Accuracy of Detection of Deception – Decisions (DI/NDI)’. Additionally, scores reported by examiners was

computed as ‘Accuracy of Detection of Deception – Scores’. See Table 6 for categorisation of polygraph cases.

3.7.5. Statistical Design

Independent-samples t-test and multiple regression analysis were conducted to examine the effects of training and personality traits, on examiner ability to detect deception by analysing polygraph charts. Examiners’ accuracy based on decisions and scores were used as dependent variables. The level of significance was set at $p < 0.05$. The data was analyzed for outliers using box plots and if the dependent variables were approximately normally distributed. Shapiro-Wilk tests for normality indicated that the dependent variable Accuracy of Detection of Deception – DI/NDI decision was not normally distributed $SW(53) = 0.943, p = .014$ but an inspection of the histogram and analysis of the skewness ($s = 0.521$) and kurtosis (-0.592) statistics showed that the variable was approximately normally distributed. Shapiro-Wilk tests for normality indicated that the dependent variable Accuracy of Detection of Deception – scores was normally distributed $SW(53) = 0.98, p = .854$.

Results

The means, standard deviations and range of the measured variables of interest among the Student Raters are illustrated in Table 7.

Table 7

Descriptive Statistics of Variables of Interest Assessed for Student Raters

	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Level of Training	53	1	2		
BFI -Conscientiousness Subscale	53	17	41	29.32	4.714
BFI -Openness to Experience Subscale	53	19	47	33.19	5.681
Implicit Motive - Achievement	52	.00	18	5.676	4.044
Field Dependence Independence	53	2	18	15.68	2.881

Effects of Training on Accuracy of Detection of Deception

The means and standard deviations for Student Raters' accuracy in detection of deception – decisions (DI/NDI), by type of cases and level of training, are illustrated in Table 8.

Table 8

Group Statistics for Accuracy of Detection of Deception – Decisions (DI/NDI)

	Level of Training	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>
All Cases	Not Trained	28	.616	.112	.0218
	Trained	25	.619	.160	.0321
Simple Cases	Not Trained	28	.503	.183	.0347
	Trained	25	.476	.251	.0505
Complex Cases	Not Trained	28	.407	.269	.0510
	Trained	25	.393	.260	.0522

Independent samples t-tests on accuracy in detecting deception – decisions (DI/NDI) revealed no significant differences when comparing Not Trained ($M = 0.616$, $SD = 0.112$) and Trained ($M = 0.619$, $SD = 0.160$) for all cases; Not Trained ($M = 0.503$, $SD = 0.183$) and Trained ($M = 0.476$, $SD = 0.251$) for simple cases; and Not Trained ($M = 0.407$, $SD = 0.269$) and Trained ($M = 0.393$, $SD = 0.260$) for complex cases ($ps > 0.05$). See Table 9 for independent samples t-test for accuracy of detection of deception – Decisions (DI/NDI).

Table 9

Independent Samples T-Test for Accuracy of Detection of Deception – Decisions (DI/NDI)

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
All cases	Equal variances assumed	6.522	.014	-.095	51	.925	-.0035	.038	-.079	.072
	Equal variances not assumed			-.093	42.42	.926	-.0035	.039	-.081	.074
Simple Cases	Equal variances assumed	3.049	.087	.438	51	.663	.02631	.06007	-.09429	.14691
	Equal variances not assumed			.430	43.479	.669	.02631	.06114	-.09695	.14957
Guilty Complex	Equal variances assumed	.025	.876	.197	51	.844	.0144	.073	-.132	.161
	Equal variances not assumed			.198	50.66	.844	.0144	.072	-.132	.160

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

The means and standard deviations for Student Raters' accuracy in detection of deception – scores, by type of cases and level of training, are illustrated in Table 10.

Table 10

Descriptive Statistics of Student Raters' Accuracy in Detection of Deception – Scores by the Type of Cases and Level of Training Received

	Level of Training	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>
All Cases	Not Trained	28	31.143	28.175	5.325
	Trained	25	19.040	28.684	5.737
Simple Cases	Not Trained	28	.214	11.992	2.266
	Trained	25	-3.72	14.167	2.833
Complex Cases	Not Trained	28	-1.571	21.883	4.135
	Trained	25	-4.760	14.368	2.874

Independent sample t tests on accuracy in detecting deception – scores revealed no significant differences when comparing Not Trained ($M = 31.143$, $SD = 28.175$) and Trained ($M = 19.040$, $SD = 28.684$) for all cases; Not Trained ($M = 0.214$, $SD = 11.992$) and Trained ($M = -3.72$, $SD = 14.167$) for simple cases; and Not Trained ($M = -1.571$, $SD = 21.883$) and Trained ($M = -4.760$, $SD = 14.368$) for complex cases ($ps > 0.05$). Refer to table 11 for independent samples t-test for accuracy of detection of deception - scores.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 11

Independent Samples T-Test for Accuracy of Detection of Deception – Scores

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
All Cases	Equal variances assumed	.059	.809	1.548	51	.128	12.102	7.818	-3.594	27.800
	Equal variances not assumed			1.546	50.107	.128	12.102	7.827	-3.617	27.823
Simple Cases	Equal variances assumed	.263	.611	1.095	51	.279	3.934	3.593	-3.280	11.149
	Equal variances not assumed			1.084	47.316	.284	3.934	3.628	-3.363	11.232
Complex Cases	Equal variances assumed	3.342	.073	.619	51	.539	3.188	5.152	-7.155	13.532
	Equal variances not assumed			.633	47.033	.530	3.188	5.035	-6.941	13.319

Personality Dimensions as Predictors of Student Rater's Accuracy

Regression analysis was done to investigate the effect of personality traits on accuracy of detection. The groups were merged and training was no longer used as an independent variable.

Regression analysis was done to investigate the effect of personality traits on accuracy of detection – Decisions (DI/NDI). Decision DI/NDI all cases was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence, and the interaction of Implicit Motive – Achievement and Conscientiousness. The model was not found to be a good fit $F(5, 46) = 1.859, p = .120$. The predictors do not explain the variance of the accuracy of detection – Decision (DI/NDI). The estimated parameters are reported in Table 12.

Table 12

Personality Traits as Predictors of Accuracy of Detection – Decision (DI/NDI) for All Cases

	<i>B</i>	<i>SE</i>	β	<i>t</i>	Sig.
(Constant)	.759	.250		3.030	.004*
BFI -Openness to Experience Subscale	.003	.003	.127	.923	.361
BFI -Conscientiousness Subscale	-.012	.007	-.416	-1.798	.079
Implicit Motive – Achievement	-.051	.029	-1.491	-1.775	.082
Field Dependence Independence	.003	.007	.068	.489	.627
Interaction Implicit Achievement X Conscientiousness	.002	.001	1.839	2.142	.037*

* $p < .05$.

Regression analysis was done to investigate the effect of personality traits on accuracy of detection – Score. Scores was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence, and the interaction of Implicit Motive –

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Achievement and Conscientiousness. The model was found to be a good fit, $F(5, 46) = 2.719$, $p = .031$, $R = 0.478$ ($R^2 = 0.29$). The estimated parameters are reported in Table 13. The interaction effect was found to be statistically significant ($b = 0.549$, $SE = 0.197$, $p = .008$).

A simple slopes analysis was conducted to probe the interaction effect. The conditional effect of Implicit Achievement on Accuracy of Detection – Scores for all cases at low, intermediate, and high levels of Conscientiousness was investigated. The effect was only found to be statistically significant at high Conscientiousness (as defined as 1 *SD* higher than the mean value of Conscientiousness), $b = 4.467$, $SE = 1.397$, $p = .003$. The estimated parameters of the simple slopes analysis are reported in Table 14. A plot of the 3 simple slopes is presented in Figure 14.

Table 13

Personality Traits as Predictors of Accuracy of Detection – Scores (All Cases)

	<i>B</i>	<i>SE</i>	β	<i>t</i>	Sig.
(Constant)	93.800	50.823		1.846	.071
BFI -Openness to Experience Subscale	-.465	.671	-.091	-.692	.492
BFI -Conscientiousness Subscale	-2.842	1.356	-.467	-2.096	.042*
Implicit Motive - Achievement	-14.247	5.788	-1.992	-2.462	.018*
Field Dependence Independence	1.257	1.328	.126	.946	.349
Interaction	.549	.197	2.298	2.780	.008*
Implicit Achievement X Conscientiousness					

* $p < .05$.

Table 14

Simple Slopes Analysis for the Interaction Effect of Implicit Achievement and Conscientiousness on Accuracy of Detection – Scores (All Cases)

Levels of Conscientiousness	<i>B</i>	<i>SE</i>	<i>t</i>	Sig.
Low	-0.754	1.278	-0.590	0.558
Intermediate	1.857	0.955	1.944	0.058
High	4.467	1.397	3.197	0.003

Figure 14. Conditional effects of Implicit motive Achievement on Accuracy of Detection – Scores (All Cases) at different level of Conscientiousness (Low = Blue, Intermediate = Green, High = Yellow)

Discussion

Study 2 revealed that there is no training effect on the accuracy of detection of deception based polygraph chart decisions or scores. Training in this study was operationalized at two levels namely (1) information only and (2) information, practice and feedback. The Not Trained group received information only while the Trained group received information, practice and feedback. A possible explanation could be that the training provided to the Trained group did not allow them adequate practice to apply the information relevant to polygraph chart evaluation.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Another possible explanation is that feedback provided to participants of the Trained group did not reinforce the reliability of psychophysiological indicators to detection of deception.

Additionally, as the performance feedback was provided to the Trained group in a group setting, the members of the Trained group may not have gained as valuable insights about the process of chart analysis. In future iterations of such a study, performance feedback could be provided individually rather than in a group setting, so that examiners could gauge the gap between their perceived abilities as compared to their actual abilities to detect deception by means of chart analysis.

Participants in this study utilized the same diagnostic features as taught in the APA accredited schools and decision rules were made in accordance with the APA training manual. Given that no training effects were noted despite the materials and methods used, plans to further operationalize professional training paradigms in laboratory settings was not executed for study 3. Study 3 was carried out using standard procedures for administering basic-professional and advanced-professional training curriculum for polygraph chart analysis and verbal and nonverbal behavioural analysis.

The mean accuracy of Student Raters' for all cases was above chance level, the detection of simple cases was close to chance level and that of complex cases was below chance level. Mean detection scores of the three groups show a similar trend. This suggests subjects utilising countermeasures are more likely to evade detection. Performance of examiners evaluated based on scores showed that detection cues was lower for complex cases than for simple and all cases. It will be of interest to analyse the detection rates amongst professionally trained polygraph examiners.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

The findings that personality dimensions as predictors of raters performance based on decisions and scores is of interest. Study finding is that personality dimension is not a predictor of examiner performance based on accuracy of decisions. However, personality dimensions of performance were found to be predictors of examiner performance based on scores. This suggest that examiners score ratings are a more proximal measure of performance i.e. measure of scores provided by examiners as measure of performance rather than decisions of DI/NDI.

The finding that interaction effect of implicit motive Achievement and trait Conscientiousness is a significant predictor of examiner performance is an important as it supports theoretically driven postulation of the channelling hypothesis and for identifying personality traits that are predictors of examiner performance in detection of deception by chart analysis. Motive researchers have advocated for the integrative aspects of implicit motives and explicit traits also known as the channelling to better explain and understand behaviour (Lang, Zettler, Ewen & Hulsheger, 2012; Bing, LeBreton, Davison, Migetz, & James, 2007; Winter et al., 1998). The channelling hypothesis postulates that “a high implicit motive disposition is consequently most strongly expressed in behaviour when the person also has a comparatively high level of functionally related explicit disposition” (Lang et al 2012, p. 1201). This present research finding, that the conditional effect of Implicit Achievement on Accuracy of Detection – Scores was statistically only significant at high levels of trait Conscientiousness, lends support this claim. Second, this finding also suggest that implicit motive Achievement and Conscientiousness are important personality characteristics that lead towards higher performance towards contextual task performance of detection of deception by chart analysis .

4. Integration of Personality and Training with Two Detection Modalities

In detection of deception it is important to look into both modalities of detection of deception i.e. psychophysiological measures and verbal and nonverbal analysis. This is important based on theoretical and roles performed by a polygraph examiner. A theoretical perspective premised on the leakage hypothesis discussed earlier in the chapter postulate that physiological, emotional and cognitive responses of deception are correlated with tell-tale physiological and behavioral signs. In essence the leakage of deception cues is through more than one channel i.e. physiological and behavioural, as such processes attuned to measures of both channels will ensure a better measure of the construct of deception. Furthermore, the examiner's diagnostic accuracy is dependent on the presence or absence of agreement between subject's behavioral and physiological data (Gordon & Fleisher, 2006; Vrij, 2008). As discussed the examiner will place a lower confidence in the validity of his decision in the absence of agreement between physiological and verbal and nonverbal data streams.

4.1. Verbal and Nonverbal Analysis

In the detection of deception relating to verbal and nonverbal analysis, examiners have to assess cues and correlate it to what is being said by the examinee in relation to question that was asked. The examiner has to ask questions in a systematic manner so that he can assess for chronological consistency and not induce confusion in his examinee. The examiner needs to evaluate extra-verbal cues such as “ahs” and “hmms” said by the examinee. Latency in providing answers is indicative of high cognitive load which may be indicative of deception. The examiner is required to constantly keep notice of change of facial expressions, bodily movements and change in voice characteristics and correlate said changes for behaviors that are indicative of deception i.e.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

look out for illustrators and adaptors. Illustrators are nonverbal behaviors that help understand or reinforce speakers verbal communication (e.g. posturing open arms when saying person has nothing to hide) while adaptors are nonverbal gestures that interfere with understanding what the speaker is stating (e.g. covering the mouth when answering a question). Besides assessing verbal and nonverbal cues and evaluating for illustrators and adaptors, an examiner has to note the increase or decrease of illustrators from interview onset to completion of interviews. Examiners need perceive and understand emotional expressions of their interviewees, note the emotional intensity experienced and expressed by interviewees, and either ask more probing questions or decide on a different line of questioning.

The detection of deception by means of verbal and nonverbal analysis can be said to be more complex than that of chart data analysis. The detection of deception by verbal and nonverbal requires analysis of situation and context specific cues. This is because behavioral differences between liars and truth tellers are minute at best, leaving little opportunity to “catch” someone in the act of deception (DePaulo, Wetzel, Sternglanz, Wilson, 2003; Vrij, Granhag, Mann & Leal, 2011). Furthermore, assessment of truth or deception is made more complex with the possibility that telling the truth may also elicit arousal, anxiety, fear and cognitive effort (McCornak, 1997). Innocent persons wrongly accused of a crime may also manifest behaviors like that of liars (Ekman, 1985). Considering the task demands and complexity of behavioral analysis, this study will explore the relevance of personality traits, motives and emotional intelligence that may explain for examiner performance in detection of deception

Persons high on the trait dimension of Agreeableness have sensitivity to opinions and emotions to persons during social interactions as such they may perform better in detection of

deception by verbal and nonverbal analysis (Enos et al., 2006). It is hypothesized that examiners high in Agreeableness trait are better at detection of deception by verbal and nonverbal analysis.

Persons high in Affiliation motive tend to notice social cues and are also sensitive to nonverbal signals such as facial expressions (Schultheiss, Pang, Torges, Wirth & Treynor, 2005). Given this it is hypothesized that examiners who are high in need for Affiliation will perform better in detection of deception by analysis of verbal and nonverbal as they will be more sensitive to change of facial expressions, bodily movements and change in voice characteristics and correlate said changes for behaviours that are indicative of deception i.e. look out for illustrators and adaptors.

An examiner's emotional intelligence in terms of his sensitivity to variations of emotional expressions is important to detection of deception (Wojciechowski, Stolarski & Matthews, 2014). Examiners must be able to perceive simulated or suppressed emotional expressions that may be utilized by persons undergoing an interview. Given this it is hypothesized that an examiner ability to perceive and understand emotions may explain for individual differences in examiners' ability to read and evaluate nonverbal cues.

Hypothesis 5: Examiners high on the Agreeableness scale will detect more verbal and nonverbal cues of truth or deception

Hypothesis 6: Examiners high on the Implicit Affiliation motive score will detect more verbal and nonverbal cues of truth and deception

Hypothesis 7: Examiners high on the emotional intelligence dimension of Perceive and Understand will detect more verbal and nonverbal cues of truth and deception.

4.2. Training.

Research suggests that there are no significant differences in detection of deception among experts such law enforcement officers and judges and non-experts (Bond & Depaulo 2006). This situation suggests a need for training to equip professionals involved in detection of deception with the relevant skills. However, research on the effects of training as an intervention method is mixed. Hauch et al. (2016) meta analyses revealed that the effect of training was found to have small to medium effect for detection of lie accuracy but not truth accuracy. Hauch et al. (2016) meta analyses revealed that the effect of training is larger if it was based on verbal content cues. However, such findings contradict Vrij and colleague's (2000) findings who reported that nonverbal cues are far more "superior" than verbal cues. Data also suggests that training biases judgments towards deceptiveness rather than truthfulness (Masip, Garrido, & Herrero, 2009).

Masip et al. (2009) postulated that this bias may be explained using training programme methods that promote information searching for cues for deception while overlooking the cues of truthful behavior. An emphasis on truthfulness cues could compensate for this tendency, as well as for the professional's inclination to judge person's undergoing assessment as deceptive. Given the present findings it will be of interest to find out the effects of training on said two types of detection of deception methods that of psycho-physiological analysis of data and combination of verbal and nonverbal analysis of truth and deception. While several studies related to detection of deception via verbal and nonverbal cues have been done to date, there has not been not been any published studies exploring the training effects on the accuracy of psycho-physiological detection of deception. This study will address the research gap by operationalizing training in three levels that of Novice, Basic and Advanced training.

4.3. Polygraph Chart Analysis

Personality dimensions discussed in Study 2 Conscientiousness, Openness to Experience, Cognitive Style field dependence-independence, Implicit motive Achievement and namely the theoretically derived variable *nAchxC* premised on the channeling hypothesis will be modeled in Study 3. The study hypothesis of personality variables in the detection of deception by chart analysis explored in study 3 is as follows:

Hypothesis 1a: Examiners high in the Conscientiousness trait will render more correct decisions of truth and deception

Hypothesis 1b: Examiners high in the Openness to Experience trait will render more correct decisions of truth and deception

Hypothesis 2: Cognitive Style – Examiners high in the dimension of field dependence will render more correct decisions of truth and deception than examiners who are field dependent.

Hypothesis 3: Implicit Achievement Motive – Examiners high in implicit achievement motive will render more correct decisions of truth and deception.

Hypothesis 4: The achievement motive is more positively related to an examiners' performance to render more correct decisions of truth and deception when Conscientiousness is high than when Conscientiousness is low (i.e., the 'channeling hypothesis').

4.4 Overview of Study 3

Study 3 was conducted to investigate the effects of both personality traits and professional training on the accuracy of detection of deception based on polygraph chart analysis and verbal and nonverbal behavioral analysis.

Study 3 utilised the same personality measures as Study 2, the training variable in Study 3 was operationalized at three levels of training namely (1) Novice (2) Basic Trained and (3) Advanced Trained. Participants of Study 3 were law enforcement officers from Singapore and United States agencies. In addition to polygraph chart analysis, Study 3 also explored effects of personality and training on the detection of deception based on verbal and nonverbal behavioral analysis. The within subject experimental design was employed to explore the causal relationship between training and performance in detecting of deception. Refer to Table 15 for a comparison between Studies 2 and 3 designs.

Table 15

Description of Study 2 and 3 Samples and the Independent and Dependent Measures Obtained across each Study

Sample Size	Population Type	Personality Measures				Detection of Deception Modalities			
		ESCQ	BFI	PSE	GEFT	Accuracy of Analysing Polygraph Charts T1 ^a	Accuracy of Analysing Polygraph Charts T2 ^b	Accuracy of Behavioral Analysis Videos T1 ^a	Accuracy of Behavioral Analysis Videos T2 ^b
Study 2									
n=28	Untrained Undergraduate Student Examiners	Y	Y	Y	Y	N	Y	N	N
n=25	Trained Undergraduate Student Examiners	Y	Y	Y	Y	N	Y	N	N
Study 3									
n= 23	Novice Examiners	Y	Y	Y	Y	Y	Y	Y	Y
n= 53	Basic Trained Examiners ^c	Y	Y	Y	Y	Y	Y	Y	Y
n=33	Advanced Trained Examiners	Y	Y	Y	Y	N	Y	Y	T

^a. T1 represents measure taken before the intervention, which is one of the following – short-term training or professional training (i.e. Basic or Advance Polygraph Training) – depending on the respective sample.

^b. T2 represents measure taken after the intervention, which is one of the following – short-term training or professional training (i.e. Basic or Advance Polygraph Training) – depending on the respective sample.

^c. This sample consists of Basic Trained Examiners from 4 independent polygraph training schools following the same curriculum: Singapore n= 10; Ohio n = 10; Missouri n = 17; Texas, n = 16

Note. Y denotes participants who were administered said personality measure or who were participants of training at T1 or T2

N denotes participants who were not administered said personality measure or were not participants of training at T1 or T2

Final participant count in Study 3 was 109. Missing data was not included in the analysis

Method

4.5. Study 3

4.5.1. Aims.

Using law enforcement professionals as participants, Study 3 examines the effect of personality dimensions and of training on the accuracy in detection of deception via analysis of polygraph chart, and analysis of verbal and nonverbal behaviors. It also explores possible interaction effects between personality traits and professional training on accuracy in detecting deception in the use of behavioural analysis. A within-subjects design was used for this study to examine training effect on accuracy of detecting deception. Within-subjects design was used in this study to infer, with greater confidence, the causality of training on performance. Potential differences in accuracy of detection of deception across two different professional training levels was explored — for this objective, a two-way between subjects design was used.

4.5.2. Participants.

A total of 109 participants were recruited from Singaporean and United States law enforcement agencies (refer to appendix M for solicitation email). The study comprised of 66 Singapore and 43 US participants. Participants were categorized into three groups according to their respective level of training: (a) *Novice* ($n = 23$), (b) *Basic trained* ($n = 53$), and (c) *Advanced trained* ($n = 33$). Of the 53 basic trained participants, 10 were from Singapore and 43 were from basic polygraph training schools in U.S. from the state of Ohio ($n=10$), Missouri ($n=17$) and Texas ($n=16$).

Novice Group

Twenty-three individuals who had not attended training in polygraph chart evaluation or Forensic Assessment Interview Technique (FAINT) behavioral analysis took part in this study. Participants were recruited from Singapore Law Enforcement Agencies through an email invite sent out by the training branch of the said department. Age range of participants was between 29 and 43 ($M = 36$ years, $SD = 3.57$ years). These sample consisted of 17 males and 6 females. This group was operationalised similarly as the information only group in Study 2.

Basic Trained Group

Fifty-three individuals in this group received a ten-week full-time professional basic polygraph course. Training included modules on physiology, psychology, polygraph chart evaluation and analysis of verbal and nonverbal behavioural cues to detect deception. The professional basic polygraph course adhered to a standardized curriculum established by the APA. The age range of basic trained examiners was between 22 years and 53 years ($M = 38.6$ years, $SD = 7.25$ years). This group was operationalised as the information and practice group in this study.

Advanced Trained Group

This group comprised 33 individuals. Similar to the *Basic trained group*, participants in this group received the same full-time professional basic polygraph course. Additionally, this group also received advanced professional polygraph training and a one-year internship phase during which they conduct a minimum of two tests a month under the supervision of a senior examiner. The age range of certified examiners was between 26 years and 60 years (M

= 43.13 years, $SD = 8.32$ years). They included 26 males and 7 females. This group was operationalised as the information, practice and feedback as in Study 2.

Personality Measures

All three training groups completed the Picture Story Exercise (PSE) as well as the Big Five Inventory (BFI), Emotional Skills and Competence Questionnaire (ESCQ) and Field Dependence-Independence (FDFI). The PSE was self-administered online at the participants' preferred time and location. This exercise required about 35-40 minutes to complete. The BFI, ESCQ and FDFI questionnaires were mass-administered in a classroom setting online.

4.5.3. Procedure — Chart Analysis.

Novice Group

Participants from the *Novice group* were recruited via email invitations. Participants were given instructions on the study and provided with information to facilitate their chart evaluation exercise. Information provided entailed a 30-minute presentation on: the general characteristics of a polygraph chart; scoring features for the physiological data channels; and how to sum up scores across the chart to decide if the case suspect was deceptive.

Participants were then tasked to evaluate 16 sets of polygraph charts, with each set consisting of 4 polygraph charts. Hence, a total number of 64 charts were evaluated per participant. The polygraph charts were projected on a screen and were administered in groups. Participants were allowed 3 minutes to evaluate each chart. An experimenter cued the participants to specific questions on screen to standardize the process of chart evaluation (i.e. each relevant question was evaluated against a particular comparison question across all participants).

Participants were tasked to make a decision of Deception Indicated (DI), No Deception Indicated (NDI) or Inconclusive (INC) for each of the 16 sets of polygraph cases based on the

chart evaluations. Accuracy of detection of deception was computed for each participant based on the proportion of correct decisions. Participants evaluated the same set of charts and were administered the same procedure 10 weeks from their first session of polygraph charts evaluation.

Basic Trained Group

Participants in this group comprised trainee examiners undergoing basic polygraph training in polygraph training schools in Singapore and United States. Trainee examiners who completed 10 weeks of their basic course, just before their graduation, were informed their participation in this study was voluntary (i.e. it is not a pre-requisite for graduation and performance was not assessed to contribute to their final grades towards graduation from the course). Participants from the *Basic trained group* were given the same instructions and procedure as those in the *Novice group*.

Procedure for Singapore Basic Polygraph School Participants

Prior to the beginning of their basic polygraph training, participants from the Singapore *Basic trained group* were given 16 sets of polygraph charts to evaluate, each case comprising 4 polygraph chart. Hence, a total number of 64 charts were evaluated per participant. The polygraph charts were projected on a screen and administered in groups. Participants were allowed 3 minutes to evaluate each chart. The experimenter also cued the participants to specific questions on screen so the process of chart evaluation was standardized (i.e. each relevant question was evaluated against a particular comparison question across all participants). Participants rendered Deception Indicated (DI), No Deception Indicated (NDI) or Inconclusive (INC) decisions after evaluating four series of

polygraph chart per case. Accuracy of detection of deception was computed for each participant based on the proportion of his or her correct decisions.

After the participants completed their ten-week training, the same procedure was administered to the participants as during their first polygraph chart evaluation session. Participants rendered DI, NDI or INC decisions after evaluating four series of polygraph chart per case. Accuracy of detection of deception was computed for each participant based on the proportion of their correct decisions. US participants were assessed only post Basic Polygraph professional training. ie US participants evaluated polygraph charts after they had completed 10 weeks of professional Basic training.

Advanced Trained Group

Participants were invited to participate in the research study via email and were informed that participation was voluntary. Participants from the *Advanced Trained group* were credited with 20 continuing training hours upon completion of study. Apart from that, they were given the same instructions and adhered to the same procedure as those in the *Novice group* and *Basic Trained groups*.

4.5.4. Procedure — Behavioral Analysis

Participants from the Novice ($n=15$), Singapore Basic Trained school ($n=10$) and Advanced Trained examiners ($n=36$) took part in this study.

The outcome variable used was scores participants' assigned when evaluating verbal and nonverbal behaviours of case suspects featured in video recordings. In order to do this effectively, participants were trained in the Forensic Assessment Interview Technique (FAINT) (Nate & Gordon, 2007; refer to Appendix J for description on the FAINT training). The recordings included interviews of two suspects who were involved in the damage of a car

from a work place garage in the United States. This was a verified case in which one suspect (suspect 1) was verified truthful through a follow-up investigation while the other (suspect 2) confessed to the damage of the car subsequent to his forensic interview. The interviewer depicted in the recordings was trained in FAINT.

Participants from the *Novice group* evaluated the same videos using the FAINT interview at intervals of 3 days using a FAINT questionnaire. Participants from the Singapore Basic Training School and Advanced trained examiners were also given training in the use of FAINT. The training took place over a 2.5-day workshop and participants were taught to utilize verbal and nonverbal behaviours to evaluate deception. Before the training, participants were shown video recordings for two case subjects (one who is innocent of the crime (i.e. non-deceptive) and another who was guilty of the crime (i.e. deceptive). At the end of the 2.5-day workshop, they were shown the two videos again.

All participants were shown the two videos in the same sequence (i.e. video of suspect 1 followed by video of suspect 2) prior to and after training. Each video was scored using the 27-item FAINT questionnaire (refer to Appendix N for questionnaire). Participants were given a recess of 15 minutes after evaluation of each video to prevent fatigue. They rendered a decision of DI, NDI or INC for each of the suspects based on their evaluation of the videos using the FAINT questionnaire. After the evaluation of each video, participants also completed a post-video evaluation questionnaire (refer to Appendix O for post-video questionnaire). The purpose of this questionnaire was to verify if participants utilized verbal and nonverbal behavioural cues in deriving their decisions.

At the end of the study, each participant rendered four decisions. Two decisions were made for suspect 1 (pre-training decision and post-training decision) and two decisions for suspect 2 (pre-training decision and post-training decision).

Participants from Novice Group formed the control group. While they did not receive any FAINT training, they followed the same procedures and evaluated the same videos as basic trained examiners and advanced trained examiners using the FAINT questionnaire.

4.5.5. Statistical Design

The data was analyzed for outliers using box plots and if the dependent variables were approximately normally distributed. Shapiro-Wilk tests for normality indicated that the dependent variable.

Chart Analysis

Accuracy of Detection of Deception – DI/NDI decisions Simple cases was normally distributed $SW(104) = 0.980, p = .121$, with skewness ($s = .293$) and kurtosis (0.010).

Accuracy of Detection of Deception – DI/NDI decisions Complex cases was not normally distributed $SW(104) = 0.841, p = .000$ with skewness ($s = 1.275$) and kurtosis (4.203). With the said statistic it was noted that the standard error will be larger than what it is supposed to be and will be inflated and furthermore the power of the test will be lower. Accuracy of Detection of Deception – DI/NDI decision was not normally distributed $SW(104) = 0.973, p = .032$ but an inspection of the histogram and analysis of the skewness ($s = 0.518$) and kurtosis (0.615) statistics showed that the variable was approximately normally distributed.

Accuracy of Detection of Deception – Scores Simple Cases was normally distributed $SW(106) = 0.978, p = .069$ with skewness ($s = 0.504$) and kurtosis (0.152). Accuracy of Detection of Deception – Scores Complex Cases was normally distributed $SW(106) = 0.982, p = .152$ with skewness ($s = 0.228$) and kurtosis (0.854). Accuracy of Detection of Deception – Scores All Cases was not normally distributed $SW(106) = 0.963, p = .005$ but an inspection

of the histogram and analysis of the skewness ($s = 0.660$) and kurtosis (0.865) statistics showed that the variable was approximately normally distributed.

Post-Training Chart Scores

Accuracy of Detection of Deception Chart Analysis Scores Post-Training for Simple Cases was normally distributed $SW(24) = 0.954$, $p = .334$, with skewness ($s = -0.588$) and kurtosis (-0.164). Accuracy of Detection of Deception Chart Analysis Scores Post-Training for Complex Cases was normally distributed $SW(24) = 0.985$, $p = .965$, with skewness ($s = -0.183$) and kurtosis (-0.329). Accuracy of Detection of Deception Chart Analysis Scores Post-Training for All Cases was normally distributed $SW(24) = 0.953$, $p = .322$, with skewness ($s = 0.181$) and kurtosis (-0.605).

Behavioral Analysis

Accuracy of Detection of Deception – Truthful Subject FAINT scores Pre- FAINT training was normally distributed $SW(42) = 0.981$, $p = .688$, with skewness ($s = -0.255$) and kurtosis (-0.327). Accuracy of Detection of Deception – Truthful Subject FAINT scores Post- FAINT training was normally distributed $SW(42) = 0.970$, $p = .320$, with skewness ($s = -0.157$) and kurtosis (0.809). Accuracy of Detection of Deception – Deceptive Subject FAINT scores Pre- FAINT training was not normally distributed $SW(42) = 0.923$, $p = .008$. An inspection of skewness ($s = 1.388$) and kurtosis (3.206) statistics and histogram revealed that the variable was approximately normally distributed. Accuracy of Detection of Deception – Deceptive Subject FAINT scores Post- FAINT training was not normally distributed $SW(42) = 0.915$, $p = .004$. An inspection of skewness ($s = 0.831$) and kurtosis (-0.130) statistics revealed that the variable was approximately normally distributed.

Descriptive statistics for Study 3 personality variables are listed in Table 16.

Table 16

Descriptive Statistics of Study 3 Personality Variables

	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Conscientiousness	107	23	45	34.25	5.283
Openness to Experience	107	20	47	34.54	5.151
Agreeableness	107	19	45	34.19	5.331
Implicit Motive – Achievement	98	.000	24.719	9.254	4.366
Implicit Motive – Affiliation	98	1.828	21.739	9.313	4.550
Field Dependence Independence	107	1	18	12.13	4.790
Emotional Intelligence Dimension – Perceive and Understand	107	28	69	53.21	6.741

Analysis Based on US and Singapore Basic Trained Participants

Descriptive statistics for Basic Trained Examiners from Singapore and US Trained participants in this study are in Table 17.

Table 17

Descriptive Statistics for Singapore and US Basic Trained Participants

	Country	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>
Conscientiousness	SG	10	33.60	6.535	2.067
	US	41	36.07	4.819	.753
Openness to Experience	SG	10	36.30	4.084	1.291
	US	41	34.46	5.555	.868
Field Dependence Independence	SG	10	10.00	5.375	1.700
	US	41	11.24	5.004	.781
Implicit Motive – Achievement	SG	9	13.227	5.838	1.946
	US	40	9.803	4.201	.664
Average of scores of Simple Cases	SG	10	2.188	1.678	.531
	US	43	1.131	1.958	.299
Average of scores of Complex Cases	SG	10	-7.675	4.198	1.328
	US	43	-5.021	5.173	.789
Average of Scores of All Cases	SG	10	2.256	1.366	.432
	US	43	1.748	1.236	.189
Accuracy of Simple Cases	SG	10	53.048	8.918	2.82
	US	41	53.859	12.948	2.022
Accuracy of Complex Cases	SG	10	52.679	9.421	2.979
	US	41	55.466	13.434	2.098
Accuracy of All Cases	SG	10	52.093	8.178	2.586
	US	41	55.221	9.417	1.471

Note. SG denotes Singapore Basic Trained Participants

US denotes US Basic Trained Participants

Independent samples T-test were conducted to investigate difference in the personality dimensions and outcome variables for Singapore Basic Trained Participants and US Basic Trained participants of this study. The analysis showed that there was a significant

difference only for the mean scores of personality dimension implicit motive Achievement of Singapore Basic Trained Examiners ($M = 13.227$, $SD = 5.838$) and that of US Basic Trained Examiners ($M = 9.803$, $SD = 4.201$) ($p < 0.05$). The mean scores of Singapore Basic Trained Examiners and US Basic Trained Examiners were not significantly different for personality dimensions Conscientiousness when comparing Singapore Trained Examiners ($M = 33.60$, $SD = 6.535$) and US Basic Trained Examiners ($M = 36.07$, $SD = 4.819$), Openness to Experience when comparing Singapore Trained Examiners ($M = 36.30$, $SD = 4.084$) and US Basic Trained Examiners ($M = 34.46$, $SD = 5.555$), Field Dependence Independence when comparing Singapore Trained Examiners ($M = 10.00$, $SD = 5.375$) and US Basic Trained Examiners ($M = 11.24$, $SD = 5.004$), ($ps > 0.05$).

Analysis also showed that there was no significant mean differences of outcome measures Accuracy for Simple Cases for Singapore Basic Trained Examiners ($M = 53.048$, $SD = 8.918$) and US Basic Trained Examiners ($M = 53.859$, $SD = 12.948$), Accuracy for All Cases for Singapore Basic Trained Examiners ($M = 52.093$, $SD = 8.178$) and US Basic Trained Examiners ($M = 55.221$, $SD = 9.417$) and Accuracy for Complex Cases for Singapore Basic Trained Examiners ($M = 52.679$, $SD = 9.421$) and US Basic Trained Examiners ($M = 55.466$, $SD = 13.434$) ($ps > 0.05$).

In addition, there were no significant mean differences for Average Scores of Simple Cases for Singapore Basic Trained Examiners ($M = 2.188$, $SD = 1.678$) and US Basic Trained Examiners ($M = 1.131$, $SD = 1.958$), Average Scores of Complex Cases for Singapore Basic Trained Examiners ($M = -7.675$, $SD = 4.198$) and US Basic Trained Examiners ($M = -5.021$, $SD = 5.173$), Average Scores of All Cases for Singapore Basic Trained Examiners ($M = 2.256$, $SD = 1.366$) and US Basic Trained Examiners ($M = 1.748$, $SD = 1.236$) ($ps > 0.05$).

Analysis revealed that there were no significant mean differences for Singapore Basic Trained Examiners and US Trained Examiners for personality dimensions except for Implicit motive Achievement. Analysis also revealed that there were no significant mean differences between Singapore and US Trained Participants for outcome measures (accuracy of detection of deception average scores or decisions Deception Indicated (DI) or No Deception Indicated (NDI)). In view of these findings, Singapore and US Trained Participants were categorised as the Basic Trained group and in addition, implicit motive need for Achievement was included as a covariate in the regression analysis to control for the group differences. Refer to Table 18 for full analysis.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 18

Independent Samples T-Test of Mean Difference of Personality Variables Between US and Singapore Participants

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2- tailed)	Mean Difference	SE Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Conscientiousness	Equal variances assumed	2.997	.090	-1.355	49	.182	-2.473	1.826	-6.142	1.196
	Equal variances not assumed			-1.124	11.499	.284	-2.473	2.199	-7.289	2.342
Openness to Experience	Equal variances assumed	.835	.365	.980	49	.332	1.837	1.875	-1.931	5.604
	Equal variances not assumed			1.181	18.124	.253	1.837	1.556	-1.430	5.103
Field Dependence Independence	Equal variances assumed	.052	.821	-.695	49	.490	-1.244	1.790	-4.840	2.352
	Equal variances not assumed			-.665	13.076	.518	-1.244	1.871	-5.283	2.795

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Implicit Motive – Achievement	Equal variances assumed	3.465	.069	2.053	47	.046*	3.424	1.668	.0681	6.779
	Equal variances not assumed			1.665	9.945	.127	3.424	2.056	-1.161	8.009
Average Scores of Simple Cases	Equal variances assumed	.122	.728	1.574	51	.122	1.057	.671	-.291	2.404
	Equal variances not assumed			1.735	15.274	.103	1.057	.609	-.239	2.353
Average Scores of Complex Cases	Equal variances assumed	.399	.531	-1.507	51	.138	-2.654	1.761	-6.188	.881
	Equal variances not assumed			-1.718	16.050	.105	-2.654	1.544	-5.927	.619
Average Scores of All Cases	Equal variances assumed	.365	.549	1.149	51	.256	.508	.442	-.380	1.396
	Equal variances not assumed			1.078	12.656	.301	.508	.471	-.513	1.529
Accuracy of Simple Cases	Equal variances assumed	.820	.370	-.187	49	.853	-.811	4.340	-9.534	7.911
	Equal variances not assumed			-.234	19.475	.818	-.811	3.47	-8.062	6.44

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Accuracy of Complex Cases	Equal variances assumed	.696	.408	-.618	49	.540	-2.787	4.511	-11.853	6.279
	Equal variances not assumed			-.765	19.084	.454	-2.787	3.644	-10.411	4.837
Accuracy of All Cases	Equal variances assumed	.267	.608	-.964	49	.340	-3.128	3.245	-9.649	3.394
	Equal variances not assumed			-1.051	15.399	.309	-3.128	2.975	-9.455	3.199

Analysis by Training Groups Novice, Basic and Advanced

Descriptive statistics for personality variables for detection of deception by chart analysis by the three training groups namely Novice, Basic, Advanced Trained are presented in Table 19.

ANOVAs were conducted to investigate differences in personality dimensions across the three groups (Novice, Basic and Advanced Trained groups). The analyses showed that the training groups were significantly different in personality traits Field Dependence Independence $F(2,104) = 5.970, p = 0.04$, Conscientiousness $F(2, 104) = 4.975, p = 0.009$ and Implicit motive Achievement $F(2, 95) = 7.248, p = 0.01$. The full analysis results are presented in Table 20.

For personality trait Field Dependence Independence, Novice Examiners scored higher than Basic Trained Examiners ($p = 0.003$) and Advanced Trained Examiners ($p = 0.048$). For personality trait Conscientiousness, Basic Trained Examiners scored higher than Novice Examiners ($p = 0.07$). For personality dimension implicit motive Achievement Advanced Trained Examiners scored lower than Basic trained examiners ($p = 0.01$) and Novice Examiners ($p = 0.038$). The full analysis results are presented in Table 21.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 19

Descriptive Statistics of Personality Dimensions By Training Groups (Novice, Basic, Advanced)

		95% Confidence Interval for							
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	Mean		Minimum	Maximum
						Lower	Upper Bound		
						Bound			
Conscientiousness	Novice	23	31.57	5.426	1.131	29.22	33.91	24	44
	Basic Trained	51	35.59	5.220	.731	34.12	37.06	26	45
	Advanced Trained	33	34.06	4.643	.808	32.41	35.71	23	43
	Total	107	34.25	5.283	.511	33.24	35.26	23	45
Openness to Experience	Novice	23	34.96	4.426	.923	33.04	36.87	27	46
	Basic Trained	51	34.82	5.313	.744	33.33	36.32	21	45
	Advanced Trained	33	33.82	5.434	.946	31.89	35.74	20	47
	Total	107	34.54	5.151	.498	33.55	35.53	20	47

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

	Novice	23	14.96	3.082	.643	13.62	16.29	6	18
Field Dependence	Basic Trained	51	11.00	5.048	.707	9.58	12.42	1	18
Independence	Advanced Trained	33	11.91	4.673	.813	10.25	13.57	2	18
	Total	107	12.13	4.790	.463	11.21	13.05	1	18
<hr/>									
	Novice	23	9.659	3.459	.721	8.163	11.154	2.833	16.736
Implicit Motive –	Basic Trained	49	10.432	4.670	.667	9.091	11.773	4.438	24.719
Achievement	Advanced Trained	26	6.674	3.43	.673	5.289	8.06	.000	13.793
	Total	98	9.254	4.366	.441	8.378	10.129	.000	24.719
<hr/>									

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 20

ANOVA of Personality Scores across Training Groups (Novice, Basic, Advanced)

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>Sig.</i>
Conscientiousness	Between Groups	258.303	2	129.152	4.975	.009*
	Within Groups	2699.884	104	25.960		
	Total	2958.187	106			
Openness to Experience	Between Groups	25.283	2	12.642	.472	.625
	Within Groups	2787.277	104	26.801		
	Total	2812.561	106			
Field Dependence Independence	Between Groups	250.484	2	125.242	5.970	.004*
	Within Groups	2181.684	104	20.978		
	Total	2432.168	106			
Implicit Motive – Achievement	Between Groups	244.778	2	122.389	7.248	.001*
	Within Groups	1604.159	95	16.886		
	Total	1848.937	97			

* $p < .05$.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Table 21

Post-Hoc Pairwise Comparison of Personality between Training Groups (Novice, Basic, Advanced)

Dependent Variable	(I) Level of Training	(J) Level of Training	MD (I-J)	SE	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Conscientiousness	Novice	Basic Trained	-4.023*	1.280	.007	-7.14	-.91
		Advanced Trained	-2.495	1.384	.223	-5.86	.87
	Basic Trained	Advanced Trained	1.528	1.138	.548	-1.24	4.30
		Novice	4.023*	1.280	.007	.91	7.14
	Advanced Trained	Basic Trained	-1.528	1.138	.548	-4.30	1.24
		Novice	2.495	1.384	.223	-.87	5.86
Openness to	Novice	Basic Trained	.133	1.300	1.000	-3.03	3.30
		Advanced Trained	1.138	1.406	1.000	-2.28	4.56
Experience	Basic Trained	Advanced Trained	1.005	1.157	1.000	-1.81	3.82
		Novice	-.133	1.300	1.000	-3.30	3.03

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

	Advanced Trained	Basic Trained	-1.005	1.157	1.000	-3.82	1.81
		Novice	-1.138	1.406	1.000	-4.56	2.28
Field Dependence Independence	Novice	Basic Trained	3.957*	1.150	.003	1.16	6.76
		Advanced Trained	3.047*	1.244	.048	.02	6.07
	Basic Trained	Advanced Trained	-.909	1.023	1.000	-3.40	1.58
		Novice	-3.957*	1.150	.003	-6.76	-1.16
	Advanced Trained	Basic Trained	.909	1.023	1.000	-1.58	3.40
		Novice	-3.047*	1.244	.048	-6.07	-.02
Implicit Motive – Achievement	Novice	Basic Trained	-.773	1.039	1.000	-3.305	1.758
		Advanced Trained	2.984*	1.176	.038	.118	5.851
	Basic Trained	Advanced Trained	3.758*	.997	.001	1.328	6.187
		Novice	.773	1.039	1.000	-1.758	3.305
	Advanced Trained	Basic Trained	-3.758*	.997	.001	-6.187	-1.328
		Novice	-2.984*	1.176	.038	-5.851	-.118

* $p < .05$.

*Chart Analysis Accuracy of Training Groups – Decisions Deception Indicated (DI)
and No Deception Indicated (NDI)*

Descriptive statistics for Statistics of Three Levels of Training (Novice, Basic, Advanced Training) and Types of Cases (Simple, Complex, All Cases) are presented in Table 22.

ANOVAs were conducted to investigate training group differences in accuracy in each of three types of cases (All Cases, Simple Cases, and Complex Cases). The analyses showed that the training groups were not significantly different in their detection of deception – Decision (DI/NDI). The analysis results are presented in Table 23.

Table 22

Descriptive Statistics of Accuracy of Detection of Deception Decisions By Chart Analysis – Deception Indicated (DI) and No Deception Indicated (NDI) by Training Groups and Types of Cases

		95% Confidence Interval for Mean							
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	Lower	Upper Bound	Minimum	Maximum
						Bound			
Simple Cases	Novice	23	.591	.143	.030	.529	.653	.38	.83
	Basic Trained	51	.559	.112	.016	.527	.590	.33	.83
	Advanced Trained	30	.592	.102	.019	.554	.630	.44	.91
	Total	104	.575	.117	.011	.553	.598	.33	.91
Complex Cases	Novice	23	.294	.188	.039	.212	.375	.00	.67
	Basic Trained	51	.255	.172	.024	.207	.303	.00	1.00
	Advanced Trained	30	.216	.132	.024	.167	.265	.00	.64

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

	Total	104	.252	.166	.016	.220	.285	.00	1.00
	Novice	23	.592	.097	.020	.550	.634	.40	.82
	Basic Trained	51	.555	.073	.010	.535	.576	.38	.73
All Cases	Advanced								
	Trained	30	.571	.072	.013	.544	.598	.42	.74
	Total	104	.568	.079	.008	.553	.583	.38	.82

Table 23

ANOVA for Accuracy of Detection of Deception By Chart Analysis – Deception Indicated (DI) and No Deception Indicated (NDI) for All Training Groups (Novice, Basic, Advanced)

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>Sig.</i>
Simple Cases	Between Groups	.028	2	.014	1.023	.363
	Within Groups	1.384	101	.014		
	Total	1.412	103			
Complex Cases	Between Groups	.079	2	.039	1.445	.241
	Within Groups	2.755	101	.027		
	Total	2.834	103			
All Cases	Between Groups	.022	2	.011	1.780	.174
	Within Groups	.621	101	.006		
	Total	.643	103			

Chart Analysis Accuracy of Training Groups – Average Scores

Descriptive statistics scores by types of cases and examiner training – Novice, Basic Trained, Advanced Trained is shown in Table 24. ANOVAs were conducted to investigate training group differences in accuracy in each of three types of cases (All Cases, Simple Cases, and Complex Cases). The analyses showed that the training groups were significantly different in their detection of deception – Scores for simple cases $F(2, 103) = 6.435$, $p = 0.002$, and All cases $F(2,103) = 10.562$, $p = 0.000$. The analysis results are presented in Table 25. Post-hoc tests with Bonferroni correction were conducted to investigate the group differences for All Cases and Simple Cases. The analysis revealed that groups were not significantly different for Complex cases $F(2,103) = 1.025$, $p = 0.363$.

For Simple Cases, Basic Trained Examiners scored lower than the Advanced Trained Examiners ($p = .004$) and Novice Examiners ($p = 0.047$). For All Cases, the Basic Trained

Examiners scored lower than the both Novice Examiners ($p = .000$) and the Advanced Trained Examiners ($p = .038$). The full analysis results are presented in Table 26.

Table 24

Descriptive Statistics of Accuracy of Detection of Deception By Chart Analysis – Average Scores by Training Groups and Types of Cases

		95% Confidence Interval for							
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Simple Cases	Novice	23	2.610	2.780	.580	1.408	3.812	-1.50	7.88
	Basic Trained	53	1.330	1.939	.266	.796	1.865	-2.38	8.00
	Advanced Trained	30	2.894	1.693	.309	2.262	3.527	-.67	6.83
	Total	106	2.051	2.193	.213	1.628	2.473	-2.38	8.00
Complex Cases	Novice	23	4.474	2.583	.539	3.357	5.590	-1.13	9.75
	Basic Trained	53	2.345	1.973	.271	1.801	2.889	-3.50	7.38
	Advanced Trained	30	2.646	1.710	.312	2.008	3.285	-1.57	6.74
	Total	106	2.892	2.202	.214	2.468	3.316	-3.50	9.75

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

All Cases	Novice	23	3.547	2.148	.448	2.618	4.476	-1.13	7.63
	Basic Trained	53	1.844	1.264	.174	1.496	2.192	-.81	6.13
	Advanced Trained	30	2.731	1.100	.256	2.209	3.254	-1.20	5.63
	Total	106	2.465	1.665	.162	2.144	2.785	-1.20	7.63

Table 25

ANOVA for Accuracy of Detection of Deception By Chart Analysis – Average Scores for All Training Groups (Novice, Basic, Advanced)

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>Sig.</i>
Simple Cases	Between Groups	56.068	2	28.034	6.435	.002*
	Within Groups	448.683	103	4.356		
	Total	504.751	105			
Complex Cases	Between Groups	40.540	2	20.270	1.025	.363
	Within Groups	2037.328	103	19.780		
	Total	2077.869	105			
All Cases	Between Groups	49.511	2	24.755	10.562	.000*
	Within Groups	241.407	103	2.344		
	Total	290.918	105			

* $p < .05$.

Table 26

Post-Hoc Pairwise Comparison of Average Scores By Chart Analysis between Training Groups

Dependent Variable	(I) Level of Training	(J) Level of Training	MD (I-J)	SE	Sig.	95% Confidence Interval	
						Interval	
						Lower Bound	Upper Bound
Average scores of Simple Cases	Novice	Basic Trained	1.280*	.521	.047	.0113	2.548
		Advanced Trained	-.285	.578	1.000	-1.6925	1.1231
		Advanced Trained	-1.564*	.477	.004	-2.725	-.404
		Novice	-1.280*	.521	.047	-2.548	-.0113
	Advanced Trained	Basic Trained	1.564*	.477	.004	.404	2.725
		Novice	.285	.578	1.000	-1.123	1.693
		Advanced Trained	1.494	1.233	.685	-1.506	4.4938
	Novice	Basic	1.54	1.111	.536	-1.199	4.207
		Trained					
		Advanced Trained					
Complex Cases	Basic Trained	Advanced Trained	-.010	1.016	1.000	-2.483	2.463
		Novice	-1.504	1.111	.536	-4.207	1.199
		Advanced Trained					

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Average scores of All Cases	Advanced Trained	Basic	.010	1.016	1.000	-2.463	2.483
		Trained					
	Novice	Novice	-1.494	1.233	.685	-4.494	1.506
		Trained					
	Advanced Trained	Basic	1.703*	.382	.000	.773	2.634
		Trained					
	Novice	Advanced	.816	.424	.172	-.217	1.848
		Trained					
	Advanced	Advanced	-.887*	.350	.038	-1.739	-.0362
		Trained					
Average scores of All Cases	Basic Trained	Novice	-1.703*	.382	.000	-2.634	-.773
		Trained					
	Advanced	Basic	.887*	.350	.038	.0362	1.739
		Trained					
	Trained	Novice	-.816	.424	.172	-1.848	.217
		Trained					

* $p < .05$

Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI) and No Deception Indicated (NDI)

Regression analysis was done to investigate the effect of personality traits on accuracy of detection – Decisions (DI/NDI). Decision DI/NDI Simple Cases was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence, and the interaction of Implicit Motive – Achievement and Conscientiousness. The model was not found to be a good fit $F(7, 87) = 692, p = .679$. The personality variables did not explain the variance of the accuracy of detection – Decision (DI/NDI) simple cases. The estimated parameters are reported in Table 27.

Table 27

*Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI)
No Deception Indicated (NDI) for Simple Cases*

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	.453	.216		2.102	.038*
Conscientiousness	-.001	.006	-.062	-.220	.826
Openness to Experience	.003	.003	.141	1.315	.192
Field Dependence Independence	.002	.003	.080	.670	.505
Implicit Motive - Achievement	-.002	.020	-.067	-.093	.926
Interaction of Implicit motive Achievement X Conscientiousness	.000	.001	.191	.250	.803
Reference Group 1 (Novice)	-.017	.034	-.072	-.507	.614
Reference Group 2	.035	.039	.128	.887	.378

* $p < .05$

Regression analysis was done to investigate the effect of personality traits on accuracy of detection of deception –Decision DI/NDI for Complex Cases. Decision (DI/NDI) complex cases was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence, and the interaction of Implicit Motive – Achievement and Consciousness. The model was not found to be a good fit $F(7, 89) = 1.811$, $p = .095$. The estimated parameters are reported in Table 28.

Table 28

*Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI)
No Deception Indicated (NDI) for Complex Cases*

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	.123	.292		.423	.674
Conscientiousness	.009	.008	.288	1.074	.286
Openness to Experience	-.003	.004	-.084	-.818	.415
Field Dependence Independence	.004	.004	.110	.961	.339
Implicit Motive - Achievement	.007	.027	.176	.255	.800
Interaction of Implicit motive Achievement X Conscientiousness	.000	.001	-.457	-.623	.535
Reference Group 1 (Novice)	-.022	.046	-.065	-.476	.635
Reference Group 2	-.097	.053	-.253	-1.832	.070

Regression analysis was done to investigate the effect of personality traits on accuracy of detection of deception –Decision DI/NDI for All Cases. Decision (DI/NDI) All cases was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence, and the interaction of Implicit Motive – Achievement and Consciousness. The model was not found to be a good fit $F(7, 87) = 0.684, p = .0685$. The estimated parameters are reported in Table 29.

Table 29

Personality Traits as Predictors of Chart Analysis Accuracy – Decisions Deception Indicated (DI) No Deception Indicated (NDI) for All Cases

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	.455	.141		3.221	.002*
Conscientiousness	.002	.004	.147	.526	.600
Openness to Experience	.000	.002	.022	.205	.838
Field Dependence Independence	.003	.002	.157	1.326	.188
Implicit Motive - Achievement	.003	.013	.167	.232	.817
Interaction of Implicit motive Achievement X Conscientiousness	.000	.000	-.139	-.182	.856
Reference Group 1 (Novice)	-.018	.022	-.114	-.807	.422
Reference Group 2	.013	.026	.074	.511	.610

* $p < .05$

Personality Traits as Predictors of Chart Analysis Accuracy – Average Scores

Regression analysis was done to investigate the effect of personality traits on accuracy of detection – Average Scores Simple Cases was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence (FDI), and the interaction of Implicit Motive – Achievement and Conscientiousness. The model was found to be a good fit adjusted $R^2 = .110$, $F(7,87) = 2.664$, $p = .015$. Analysis revealed that compared to the Novice group the Basic trained group scores were lower by 1.196 on average. The estimated parameters are reported in Table 30.

Table 30

Personality Traits as Predictors of Accuracy of Detection of Deception by Chart Analysis – Average Scores for Simple Cases

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	-.098	3.653		-.027	.979
Conscientiousness	-.014	.107	-.033	-.127	.899
Openness to Experience	.081	.044	.185	1.853	.067
Field Dependence Independence	.000	.051	.001	.008	.994
Implicit Motive – Achievement	.002	.335	.004	.007	.995
Interaction of Implicit motive Achievement X Conscientiousness	.001	.010	.063	.088	.930
Reference Group 1 (Novice)	-1.196	.577	-.274	-2.074	.041*
Reference Group 2	.922	.671	.181	1.374	.173

* $p < .05$

Regression analysis was done to investigate the effect of personality traits on accuracy of detection – Average Scores Complex cases was regressed on Openness to Experience,

Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence (FDI), and the interaction of Implicit Motive – Achievement and Conscientiousness. The model was found to be a good fit adjusted $R^2=.211$, $F(7, 87) = 4.591$, $p = .000$ Field Dependence Independence (FDI) was found to be a significant predictor of accuracy of detection of deception – Average Scores. The estimated parameters are reported in Table 31.

Table 31

Personality Traits as Predictors of Accuracy of Detection of Deception by Chart Analysis – Average Score for Complex Cases

	<i>B</i>	<i>SE</i>	β	<i>t</i>	Sig.
(Constant)	-15.035	6.719		-2.238	.028*
Conscientiousness	.301	.196	.377	1.534	.129
Openness to Experience	-.052	.081	-.060	-.642	.523
Field Dependence Independence	.329	.094	.372	3.515	.001*
Implicit Motive – Achievement	.280	.616	.287	.453	.651
Interaction of Implicit motive Achievement X Conscientiousness	-.014	.018	-.520	-.773	.442
Reference Group 1 (Novice)	-1.138	1.060	-.133	-1.073	.286
Reference Group 2	-1.496	1.234	-.150	-1.213	.229

* $p < .05$.

Regression analysis was done to investigate the effect of personality traits on accuracy of detection – Average Scores All Cases was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence (FDI), and the interaction of Implicit Motive – Achievement and Conscientiousness. The model was found to be a good fit adjusted $R^2 = .174$, $F(7,87) = 3.830$, $p = .001$ Analysis revealed that

compared to the Novice group the Basic trained group scores were lower by 1.602 on average. The estimated parameters are reported in Table 32.

Table 32

Personality Traits as Predictors of Accuracy of Detection of Deception by Chart Analysis – Average Score for All Cases

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	.912	2.664		.342	.733
Conscientiousness	.024	.078	.077	.307	.760
Openness to Experience	.031	.032	.094	.980	.330
Field Dependence Independence	.044	.037	.129	1.194	.236
Implicit Motive – Achievement	.033	.244	.088	.136	.892
Interaction of Implicit motive Achievement X Conscientiousness	-.001	.007	-.062	-.090	.928
Reference Group 1 (Novice)	-1.602	.420	-.484	-3.811	.000*
Reference Group 2	-.259	.489	-.067	-.530	.598

* $p < .05$

Analysis of Training Effects on Accuracy of Chart Analysis – Average Scores

Descriptive statistics for Pre-Test Training and Post-Test Training for Novice and Basic Trained groups are reported in Tables 33 and 34 respectively. Polygraph chart scores reported by examiners for cases evaluated were utilized as a measure of their ability to detect psychophysiological cues to detect deception. Scores reported for all guilty cases were reverse coded to facilitate summation of chart scores across innocent and guilty cases.

Examiners with high average scores were deemed to be better in detection of deception cues

than examiners whose average scores were lower (e.g. examiner whose average score of +4 was deemed better in detection of deception cues by chart analysis than an examiner whose average score was - 4).

Table 33

Descriptive Statistics for *Accuracy of Detection of Deception by Chart Analysis for Novice Examiners – Mean Scores at T1 and T2 (n=14)*

	Minimum	Maximum	Mean	<i>SE</i>	<i>SD</i>
T1 Simple Case	-1.13	7.50	2.734	.601	2.248
T1 Complex Case	-10.75	3.00	-5.083	1.116	4.176
T1 All Case	1.63	7.63	3.885	.476	1.782
T2 Simple Case	-7.38	3.00	-1.661	.758	2.836
T2 Complex Case	-6.25	6.00	-.304	1.033	3.866
T2 All Case	-2.56	1.25	-.518	.348	1.301

Note. T1 denotes Pre-Test Training

T2 denotes Post-Test Training

The possible range of scores is between 48 and -48

Table 34

Descriptive Statistics for Accuracy of Detection of Deception by Chart Analysis for Basic Trained Examiners – Mean Scores at T1 and T2 (n=10)

	Minimum	Maximum	Mean	SE	SD
T1 Simple Case	-1.50	5.00	2.613	.648	2.048
T1 Complex Case	-13.50	35.00	-.800	4.252	13.446
T1 All Case	-.06	6.19	2.931	.694	2.193
T2 Simple Case	-.50	4.38	2.188	.531	1.678
T2 Complex Case	-15.00	-1.25	-7.675	1.328	4.198
T2 All Case	.00	4.19	2.256	.432	1.366

Note. T1 denotes Pre-Test Training

T2 denotes Post-Test Training

The possible range of scores is between 48 and -48

Regression analysis was done to investigate the effect of training on accuracy of detection – Scores for All, Complex and Simple cases. The scores at post training was regressed on Openness to Experience, Conscientiousness, Implicit Motive - Achievement, Field Dependence Independence (FDI), and the interaction of Implicit Motive – Achievement and Conscientiousness, scores at pre- training. Training level of the Novice and Basic Trained groups were introduced in the model with Novice as the reference group.

The regression model for Simple cases model was found to be a good fit adjusted $R^2 = 0.359$, $F(7, 15) = 2.758$, $p = 0.047$. The regression analysis showed that the expected mean score of the basic trained group post training was higher than the Novice group by 2.844. The estimated parameters are reported in Table 35.

Table 35

Personality and Pre-Training Chart Analysis Mean Scores as Predictors of Post-Training Scores – Simple Cases

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	-9.256	7.153		-1.294	.215
Mean Scores (Pre-Training)	-.397	.248	-.285	-1.603	.130
Conscientiousness	.254	.224	.536	1.131	.276
Openness to Experience	.158	.134	.212	1.177	.258
Field Dependence Independence	-.220	.204	-.349	-1.078	.298
Implicit Motive – Achievement	.451	.566	.735	.797	.438
Interaction of Implicit motive Achievement X Conscientiousness	-.019	.019	-1.210	-1.037	.316
Reference Group (Novice)	2.844	1.252	.476	2.272	.038*

* $p < .05$

The regression model for Complex cases model was found to be a good fit adjusted $R^2 = 0.466$, $F(7, 15) = 3.737$, $p = 0.015$. The regression analysis showed that the expected mean score of the basic trained group post training was lower than the Novice group by 8.202. The estimated parameters are reported in Table 36.

Table 36

Personality and Pre-Training Chart Analysis Mean Scores as Predictors of Post-Training Scores – Complex Cases

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	-4.765	12.271		-.388	.703
Mean Scores (Pre-Training)	-.158	.135	-.270	-1.165	.262
Conscientiousness	.512	.386	.587	1.326	.205
Openness to Experience	-.171	.245	-.125	-.697	.496
Field Dependence Independence	-.356	.431	-.306	-.827	.421
Implicit Motive – Achievement	1.054	.952	.930	1.107	.286
Interaction of Implicit motive Achievement X Conscientiousness	-.037	.032	-1.263	-1.183	.255
Reference Group (Novice)	-8.202	2.187	-.744	-3.750	.002*

* $p < .05$

The regression model for All cases model was found to be a good fit adjusted $R^2 = 0.394$, $F(7, 15) = 3.043$, $p = 0.033$. The regression analysis showed that the expected mean score of the basic trained group post training was higher than the Novice group by 2.566.

The estimated parameters are reported in Table 37.

Table 37

Personality and Pre-Training Chart Analysis Mean Scores as Predictors of Post-Training Scores – All Cases

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	β		
(Constant)	.846	4.278		.198	.846
Mean Scores (Pre-Training)	-.225	.173	-.244	-1.301	.213
Conscientiousness	.041	.131	.142	.310	.761
Openness to Experience	-.025	.080	-.055	-.308	.762
Field Dependence Independence	-.011	.121	-.028	-.088	.931
Implicit Motive – Achievement	-.021	.329	-.057	-.064	.950
Interaction of Implicit motive Achievement X Conscientiousness	-.002	.011	-.190	-.170	.867
Reference Group (Novice)	2.566	.747	.710	3.436	.004*

* $p < .05$

Results - Behavioral Analysis.

Descriptive Statistics for Basic, Advanced and Novice groups are shown in Tables 38, 39 and 40.

Table 38

Descriptive Statistics of Personality Variables and Pre- Post FAINT Scores For Basic Trained Group

	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Emotional Intelligence Dimension – Perceive and Understand	10	50	60	54.90	3.348
Agreeableness	10	21	41	36.20	5.770
Implicit Motive – Affiliation	9	2	18.676	8.509	5.349
FAINT Score Pre-Training for Truthful Subject	10	-5	29	11.90	10.979
FAINT Score Post-Training for Truthful Subject	10	8	23	15.40	5.275
FAINT Score Pre-Training for Deceptive Subject	10	-8	21	2.90	8.252
FAINT Score Post-Training for Deceptive Subject	10	-8	15	.20	8.011

Table 39

Descriptive Statistics of Personality Variables and Pre- Post FAINT Scores For Advanced Trained Group

	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Emotional Intelligence Dimension – Perceive and Understand	25	33	64	49.92	7.205
Agreeableness	25	24	42	36.40	3.979
Implicit Motive – Affiliation	19	2.392	20	10.515	4.545
FAINT Score Pre-Training for Truthful Subject	25	-6	22	9.16	8.071
FAINT Score Post-Training for Truthful Subject	23	1	25	17.00	5.427
FAINT Score Pre-Training for Deceptive Subject	24	-10	22	-.88	6.622
FAINT Score Post-Training for Deceptive Subject	23	-9	11	-1.39	5.671

Table 40

Descriptive Statistics of Personality Variables and Pre- Post FAINT Scores For Novice Group

	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Emotional Intelligence Dimension – Perceive and Understand	19	43	68	55.16	6.619
Agreeableness	19	20	38	31.79	4.117
Implicit Motive – Affiliation	19	1.934	21.739	8.365	5.303
FAINT Score Pre-Training for Truthful Subject	18	9	30	17.00	5.780
FAINT Score Post-Training for Truthful Subject	11	4	34	16.36	8.640
FAINT Score Pre-Training for Deceptive Subject	18	-8	7	-.22	4.519
FAINT Score Post-Training for Deceptive Subject	11	-8	10	.09	5.576

Figure 15. Plot of estimated marginal mean scores at pre-FAINT training (T1) and post-FAINT training (T2) for truthful subject

Figure 15 is a plot of the pre FAIMT Training and Post FAIMT training scores of the three training groups (Novice, Basic and Advanced Trained groups). ANCOVA was done with Post Training FAIMT scores as the dependent variable with covariates personality dimensions Emotional Intelligence facet Perceive and Understand, Agreeableness, Implicit motive Affiliation, Pre-FAINT training Score and Training Groups as the independent variables. Assumption of homogeneity of regression slope was not violated in the model. Analysis revealed that Post Training FAIMT scores were not significantly different amongst

the three training groups. Analysis revealed that the Pre-Training Score was predictor of Post FAINT training scores. Refer to Table 41 for the full ANCOVA results.

Table 41

Tests of Between-Subjects Effects for Truthful Subject Post-FAINT Training

Source	Type III SS	df	MS	F	Sig.
Corrected Model	389.252 ^a	6	64.875	1.835	.126
Intercept	67.131	1	67.131	1.899	.178
Emotional Intelligence Dimension – Perceive and Understand	92.843	1	92.843	2.626	.116
Agreeableness	87.534	1	87.534	2.476	.126
Implicit Motive – Affiliation	35.513	1	35.513	1.005	.324
FAINT Score Pre-Training for Truthful Subject	151.450	1	151.450	4.284	.047*
Training	79.247	2	39.623	1.121	.339
Error	1060.478	30	35.349		
Total	11277.000	37			
Corrected Total	1449.730	36			

a. $R^2 = .268$ (Adjusted $R^2 = .122$)

* $p < .05$

ANCOVA was done with Pre Training FAINT scores as the dependent variable with covariates personality dimensions Emotional Intelligence facet Perceive and Understand, Agreeableness, Implicit motive Affiliation, and Training Groups as the independent variables. Assumption of homogeneity of regression slope was not violated in the model. Analysis revealed that Pre- Training FAINT scores were not significantly different amongst the three training groups. Analysis revealed that the personality dimensions Agreeableness is

a negative predictor, Implicit motive Affiliation is a positive predictor, Emotional Intelligence facet Perceive and Understand is a positive predictor of Pre-training FAINT scores. Refer to Table 42 for the full ANCOVA results and Table 43 for parameter estimates.

Table 42

Tests of Between-Subjects Effects for Truthful Subject Pre-FAINT Training

Source	Type III SS	df	MS	F	Sig.
Corrected Model	1463.358 ^a	5	292.672	6.593	.000*
Intercept	140.276	1	140.276	3.160	.083
Emotional Intelligence Dimension – Perceive and Understand	186.258	1	186.258	4.196	.047*
Agreeableness	570.513	1	570.513	12.852	.001*
Implicit Motive – Affiliation	305.955	1	305.955	6.892	.012*
Training	29.051	2	14.525	.327	.723
Error	1775.620	40	44.391		
Total	10987.000	46			
Corrected Total	3238.978	45			

a. $R^2 = .452$ (Adjusted $R^2 = .383$)

* $p < .05$

Table 43

Parameter Estimates for Truthful Subject Pre-FAINT Training

Parameter	<i>B</i>	<i>SE</i>	<i>t</i>	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	22.143	11.510	1.924	.062	-1.120	45.406
Emotional Intelligence Dimension – Perceive and Understand	.334	.163	2.048	.047*	.004	.664
Agreeableness	-.878	.245	-3.585	.001*	-1.372	-.383
Implicit Motive – Affiliation	.539	.205	2.625	.012*	.124	.954
Basic	-2.076	2.941	-.706	.484	-8.020	3.869
Advanced	-1.900	2.748	-.691	.493	-7.455	3.654
Novice	0 ^a	.	.	.	.	.

a. This parameter is set to zero because it is a reference group

* $p < .05$

Figure 16. Plot of estimated marginal mean scores at pre-FAINT training (T1) and post-FAINT training (T2) for deceptive subject

Figure 16 is a plot of the mean pre Faint Training and Post Faint training scores of the three training groups (Novice, Basic and Advanced Trained groups) for deceptive subject. ANCOVA was done with Post-Training Faint scores as the dependent variable with covariates personality dimensions Emotional Intelligence facet Perceive and Understand, Agreeableness, Implicit motive Affiliation, Pre-FAINT training Score and Training Groups as the independent variables. Assumption of homogeneity of regression slope was not violated in the model. Analysis revealed that Post Training Faint scores were not significantly different amongst the three training groups. Analysis revealed that the Pre-

Training Score was predictor of Post-FAINT training scores. Refer to Table 44 for the full ANCOVA results.

Table 44

Tests of Between-Subjects Effects for Deceptive Subject Post-FAINT Training

Source	Type III SS	df	MS	F	Sig.
Corrected Model	822.779 ^a	6	137.130	5.659	.001*
Intercept	3.481	1	3.481	.144	.707
Emotional Intelligence Dimension – Perceive and Understand	25.295	1	25.295	1.044	.315
Agreeableness	1.326	1	1.326	.055	.817
Implicit Motive – Affiliation	21.138	1	21.138	.872	.358
FAINT Score Pre- Training for Deceptive Subject	651.671	1	651.671	26.891	.000*
Training	27.396	2	13.698	.565	.574
Error	702.777	29	24.234		
Total	1526.000	36			
Corrected Total	1525.556	35			

a. $R^2 = .539$ (Adjusted $R^2 = .444$)

* $p < .05$

ANCOVA was done with Pre-Training FAINT scores as the dependent variable with covariates personality dimensions Emotional Intelligence facet Perceive and Understand, Agreeableness, Implicit motive Affiliation, and Training Groups as the independent variables. Assumption of homogeneity of regression slope was not violated in the model. Analysis revealed that Pre-Training FAINT scores were not significantly different amongst the three training groups. Refer to Table 45 for the full ANCOVA results.

Table 45

Tests of Between-Subjects Effects for Deceptive Subject Pre-FAINT Training

Source	Type III SS	df	MS	F	Sig.
Corrected Model	218.449 ^a	5	43.690	1.426	.236
Intercept	82.391	1	82.391	2.689	.109
Emotional Intelligence Dimension – Perceive and Understand	43.460	1	43.460	1.419	.241
Agreeableness	25.106	1	25.106	.820	.371
Implicit Motive – Affiliation	.102	1	.102	.003	.954
Training	181.207	2	90.604	2.958	.064
Error	1194.751	39	30.635		
Total	1415.000	45			
Corrected Total	1413.200	44			

a. $R^2 = .155$ (Adjusted $R^2 = .046$)

Discussion

Chart Analysis.

Study 3 comprised two dependent variables for detection of deception by polygraph chart analysis, namely decisions of No Deception Indicated (NDI) and Deception Indicated (DI), the second being scores across three types of case classifications. It is important to note that decisions of DI/NDI were derived when scores assigned by participants were transformed to decisions of DI/NDI using a cut score range of -4 and +2. Cases assigned with scores +2 and more were classified as No Deception Indicated. Cases assigned with score -4 or lower were classified as Deception Indicated. Participants of this study evaluated cases comprising three categories of cases namely Simple Cases, Complex Cases and All Cases.

Study results revealed that personality and training were not predictors of detection of deception when accuracy was coded as correct decisions DI and NDI. The data suggests that regardless of the levels of training the mean accuracy decisions of DI and NDI of Novice, Basic Trained and Advanced Trained Examiners were not significantly different across the three case classifications of Simple, Complex and All Cases. Study results showed that personality dimensions Conscientiousness, Openness to Experience, Cognitive style Field Dependence Independence, implicit motive Need for Achievement and the theoretically derived variable of interaction of Conscientiousness and need for Achievement were not predictors of detection of deception accuracy based on correct DI/NDI decisions.

In this study, accuracy of the examiner for detecting deception was defined as correct decisions of “deception indicated” and “no deception indicated”. However, the DI/NDI decision is but one component of the DACA study definition of performance. According to the DACA study, an accomplished examiner should “consistently produce correct DI/NDI decisions”, produce “few no opinion decisions”, “rarely have quality assurance issues”, and

are those whom “you would trust with your most difficult cases”. Thus, according to DACA, the frequency of correct DI/NDI decisions is considered alongside the frequency of “inconclusive decisions”. However, in the current study, “Inconclusive” decisions were not included in the computation of accuracy. Additionally, due to the cross-sectional nature of data collection, it was not possible to collect data with respect to the dimension of examiner performance related to “rarely have quality assurance procedures”.

Chart scores assigned by examiners was utilised as a measure of examiner’s accuracy of cue detection in this study. Study results revealed that detection of deception accuracy operationalised as scores (i.e. raters sensitivity to detection of deception cues), the mean scores of Basic Trained Examiners scores were lower than that of Novice and Advanced Trained Examiners for Simple and All Cases. Study results revealed that there was no mean difference in the scores reported by Novice, Basic Trained and Advanced Trained Examiners for Complex Cases. This result suggest that Basic Trained examiners evaluated less detection of deception cues for Simple and All Cases as compared to Novice and Advanced Trained Examiners. A within-subject study that was done to explore the training effects based on pre-post training research design with Novice and Basic Trained Examiners revealed that compared to Novice, Basic Trained examiners evaluated more detection of deception cues post training for Simple and All cases. However, Basic Trained examiners evaluated less deceptive cues post training for Complex cases i.e. guilty countermeasure cases.

The findings that of the between-subject design findings are different from that of within-subject study findings. The between-subject study suggest that Basic Trained examiners were comparable in their cue detection to that of Novice and Advanced Trained Examiners for detection of deception cues for Complex Cases but were less accurate in evaluating Simple or All Cases. Results obtained from the within-subject research design

indicate that compared to Novice, Basic Trained Examiners were more accurate in detection of cues of Simple and All Cases than that for Complex cases i.e. guilty countermeasure cases. Given results are different based on type of study methods considered, there is a need to further explore said findings.

Participants for the between- and within-subject study designs were drawn based on convenience sampling, as such participants were not randomly assigned to the Novice, Basic or Advanced Trained group or to the Novice and Basic Trained group for the within-subject study. Random assignment of subjects would have addressed possible confounds leading to the different results. It is important to note that random assignment was not feasible for Study 3 given the pre-requisites in professional training required to classify the participants as Novice, Basic and Advanced Examiners. However, of the two experimental methods, the absence of random assignment does not affect the internal validity of a within-subject study (Charness, Gneezy, Kuhn; 2011). While the internal validity of the within-subject study is not threatened by a lack of random assignment, a phenomena known as “demand effects” may distort data obtained from a within-subject study. Demand effect is the study participants’ behaviour through conscious or unconscious means to meet the expectations of the experimenter (White, 1977). Experimental methods to mitigate for demand effects on participants of the within-subject include that of administration of procedures within the same environment and utilising the same method of chart presentation by the same experimenter during the pre-test and post-test phases of the study 10 weeks apart for both the Novice and Basic Trained participants.

Study findings based on between-subjects study suggest that Basic Trained Examiners become lie bias as a result of the Basic training. This lie bias augurs well for Basic Trained Examiners to classify complex cases (i.e. guilty countermeasure cases) as accurately as

Novice and Advanced Trained Examiners. However, it is likely that receiving detection of deception training may bias examiners to be overly sensitive to and actively seek for deception cues, to the extent of overlooking or ignoring cues indicative of truth resulting in lower detection of cues of non-complex guilty cases. Masip et al. (2009) postulated that detection of deception training places a strong emphasis on detection of deception cues and this study seems to support such a hypothesis. The pre- training and post-training data however suggests different outcome of training postulated by Masip et al. (2009). The within-subject study suggests that Basic Trained examiners compared to Novice group acquire sensitivity to truthful cues thus resulting in them overlooking or ignoring deceptive cues. This can be evidenced by them scoring lower than Novice group participants when detecting guilty countermeasure cases and higher when evaluating non-complex guilty cases. However, it is likely that said bias is corrected when they acquire advanced training in polygraph chart analysis such as countermeasure detection training. Advanced training has an element of feedback component which is said to improve detection of deception cues by means of providing means to associate the reliability of detection of detection cues or indicators to detection of deception (Zukerman, Koester & Alton, 1984; Porter, McCabe, Woodworth & Peace, 2007). Research also suggests that feedback provides for trainees to realize their actual detection of deception capabilities as compared to their perceived capabilities to detect deception (Elaad, 2003). The confluence of the two is likely to correct the lie or truth bias effects of Basic Training.

Despite the divergent findings based on between- and within-subject study designs, the performance of Novice in this study suggest that persons provided with information of valid polygraph chart cues for detection of deception and rules for chart evaluation are sufficient to render decisions comparable if not better than Basic and Advanced trained

examiners. This suggests that the diagnostic criteria and chart evaluation scoring rules used in this study are valid and that diagnostic criteria and scoring rules are robust against countermeasures. Considering the Novice group was not trained in countermeasure detection and only had information on polygraph chart evaluation criteria, their ability to have comparable accuracy to that of basic trained and advanced trained examiners is an interesting finding. This finding suggests that the threats posed by countermeasure to the validity of polygraph testing can be mitigated with the use of valid detection of deception cues and scoring rules.

Study showed that personality dimensions Conscientiousness, Openness to Experience, Cognitive style Field Dependence Independence, implicit motive need for Achievement and the theoretically derived variable of interaction of Conscientiousness and need for Achievement were not predictors of detection of deception accuracy based on correct DI/NDI decisions. Study showed that of the personality dimensions Conscientiousness, Openness to Experience, Cognitive style Field Dependence Independence, implicit motive need for Achievement and the theoretically derived variable of interaction of Conscientiousness and need for Achievement, only Cognitive Style Field Dependence Independence is a predictor of detection of deception accuracy based on Scores for Complex Cases. This finding suggests that regardless of prior level of training, examiners who are Field Independent evaluated more cues of deception when evaluating Complex Cases (i.e. guilty countermeasure cases). Field Dependence Independence or FDI is a dimension of cognitive style ranging from highly analytical and differentiated processing of information (i.e. field-independence) to highly contextual and global processing (i.e. field-dependence) (Witkin, Goodenough & Oltmann, 1979). Study findings revealed that examiners with a disposition for highly analytical and differentiated processing were able to

detect more physiological cues indicative of deception when they evaluated complex cases. This despite test subjects utilising physical and mental countermeasures to change the results of their polygraph examination results. The finding that examiners high on the dimension of Field Dependence Independence were more accurate in detection of countermeasure attempts suggest that selection for polygraph examiners who are field independent could help to mitigate against threats of countermeasures employed by sophisticated subjects.

Behavioural Analysis – Forensic Assessment Interview Technique (FAINT)

Study 3 participants reported decisions based on verbal and nonverbal analysis pre- and post-FAINT training. Participants also reported scores based on truthful and deceptive behavioural cues pre- and post-FAINT training. Common to all participants, analysis of verbal and nonverbal behavioural cues were evaluated using a FAINT questionnaire while they observed two video recording of interviews one a truthful and another that of a deceptive subject. Both subjects were suspects for their involvement in a car theft. Study findings revealed that there was no significant difference in the pre-post FAINT decisions of truth or deception or FAINT scores based on verbal and nonverbal behavioural cues.

Of interest was that *Novice group* performance in terms of decisions of truth and deception and evaluation of truth and deceptive cues were not significantly different from that of the *Basic Trained* group and *Advanced Trained* group. This suggest that persons with no prior training in detection of deception can accurately evaluate verbal and nonverbal cues when they are provided with information on valid behavioural cues of detection of deception by means of structured assessment tool (i.e. use of FAINT questionnaire). Hauch et al. (2016) meta-analyses revealed that the effect of training is larger if it was based on verbal content cues. Vrij and colleague's (2000) findings reported that nonverbal cues are far more

“superior” than verbal cues in detection of deception. Findings from this study suggest that using a combination of verbal and nonverbal indicators as utilised in a FAINT protocol is likely to result in accurate detection of deception.

Broadly stated, Study 3’s findings on detection of deception analysis by means of verbal and nonverbal analysis revealed personality traits or training were not predictor of post-FAINT training scores. Results revealed that pre-FAINT training scores across all training groups was a predictor of post-FAINT training scores for truthful and deceptive subjects. Analysis revealed that regardless of prior training of participants, Novice, Basic Trained or Advanced Trained, personality dimension of Emotional Intelligence, Perceive and Understand, implicit motive Affiliation are positive predictors of the Pre-Faint scores reported for truthful subject. Big Five dimension Agreeableness was a negative predictor of pre-FAINT training score.

The pre-FAINT training score for truthful subject indicate that participants with a trait disposition of high in Agreeableness evaluated less truthful cues. This result suggest that persons with trait predisposition high in Agreeableness (i.e. behavioural tendencies that of being straightforward, tender minded, trusting and compliant) evaluated less verbal and nonverbal behavioural cues than persons low in Agreeableness (i.e. behavioural tendencies that of shrewd, autocratic, hard-hearted, and demanding) (Costa & McCrae, 1991). One possible explanation for this could be that persons high in trait Agreeableness disposition assessed cues in a compliant way for what they are and did not second guess the verbal and nonverbal behavioural cues they observed and in doing so, evaluated less verbal and nonverbal behavioural cues of truthfulness as compared to persons who are low in trait Agreeableness.

Persons high in Affiliation motive tend to notice social cues and are also sensitive to nonverbal signals such as facial expressions (Schultheiss, Pang, Torges, Wirth & Treynor, 2005). Study results suggest that examiners who are high in need for Affiliation will perform better in detection of truthfulness by analysis of verbal and nonverbal cues. This may be due to examiner's sensitivity to change of facial expressions, bodily movements and change in voice characteristics and ability to correlate said changes for behaviours that are indicative of truthfulness.

An examiner's emotional intelligence in terms of his sensitivity to variations of emotional expressions is important to detection of deception (Wojciechowski, Stolarski & Matthews, 2014). Examiners must be able to perceive simulated or suppressed emotional expressions that may be utilized by persons undergoing an interview. Study results suggest that an examiner's ability to perceive and understand emotions may explain for individual differences in examiner's ability to read and evaluate nonverbal cues.

5. General Discussion

This study was done to explore the effect of personality variables, and training on the accuracy of detection of deception. The primary goal of this study is to identify the qualities of a polygraph examiner who is a superior performer. An examiner detects deception by means of two modalities, namely analysis of psychophysiological data and analysis of verbal and nonverbal behaviour. A polygraph examiner's job is a complex one. Arising from this, selection and training of polygraph examiners is important to ascertain their suitability. This is all the more important, considering that two seminal studies by DACA (2006; 2007), identified that the variance in examiner performance cannot be accounted for by training interventions alone, and that examiner personality dimensions need to be considered. The said DACA studies employed competency modelling methods to derive their recommendations, however DACA did not provide empirical evidence or a theoretical framework to further theory on personality dimensions as correlates of work performance. Furthermore, the DACA research did not address the effects of personality or training on examiner performance specific to two detection of deception modalities, namely psychophysiological detection of deception and verbal and nonverbal analysis.

This study was undertaken to provide a theoretical framework and empirical evidence to address gaps in the research related to examiner qualities and training related to detection of deception. This study postulation was that detection of deception is a perceptual task and personality dimensions and training have effects on examiner job performance. Examiner job performance was operationalised as the ability of the examiner to accurately identify truth and deception by means of chart analysis and verbal and nonverbal analysis. This study explored personality variables that are within the conscious and unconscious realm of an examiner as determinants of accuracy in the detection of deception. Another key postulation

of this study was that detection of deception is a contextual task and that the interaction of person situation is an important aspect related to the contextual task of detection of deception. This person situation interaction was explored using the “if...then” contingency of personality as postulated by CAPS model (Mischel & Shoda, 1984). Specifically, this research explored the importance of the personality dimension traits, motives, cognitive style and emotional intelligence and their situational relevance specific to chart analysis and verbal and nonverbal behavioural analysis. Lastly, this study was conceptualized with job performance of an examiner having two facets, that of task performance and contextual performance. Considering this, training and personality was explored as variables that may effect task and contextual performance of an examiner’s ability to detect deception by means of two modalities of detection of deception.

In the first study, we aimed to identify key attributes of superior examiners as compared to average examiners. To overcome limitations of competency modelling and traditional job analysis, an integrative approach of attribute-based job analysis was utilized to identify examiner qualities that will enable them to be superior performers. Specifically, examiner attributes were developed premised on theoretical and empirical underpinnings to identify examiner traits, motives, cognitive style and emotional intelligence as variables of interest to predict superior polygraph examiner performance. Specifically, based on a survey amongst domain experts in field of credibility assessment and review of literature, variables Openness to Experience, Conscientiousness, implicit motive Achievement and cognitive style, Field Dependence Independence and their relevance for detection of deception by polygraph chart analysis was explored in this study. In addition, Agreeableness, implicit motive Affiliation and Emotional Intelligence facet Perceive and Understand were identified as relevant for detection of deception of verbal and nonverbal analysis in this study.

Study 2 explored the relationship(s) between personality dimensions — Conscientiousness, Openness to Experience, Field-dependence/Field-independence, need for Achievement (*nAch*), and *nAch X C* (interaction between need for Achievement and Conscientiousness) — on the accuracy in detection of deception by means of psychophysiological detection of deception or evaluation of polygraph charts based on a sample drawn from undergraduate population. Study 2 also examined the effects of different levels of training — Information only and Advanced Training — on the accuracy in analyzing polygraph charts to detect deception. Study 2 findings was that the interaction between Conscientiousness and implicit motive Achievement, also known as the channelling hypothesis, accounted for the variance in examiner performance in psychophysiological detection of deception. The specific behavioural proposition of the channelling hypothesis was conceptualised using the Cognitive Affective Processing System (CAPS) general framework proposed by Mischel and Shoda (1984). CAPS states that personal characteristics are not static factors in a person, but are dynamic and said characteristics interact with the situation to shape behaviour. A person's behaviour in a given situation, also known as behavioural signature, is a result of interactions and associations between thoughts and feelings (Mischel & Shoda, 1984). This study explored the proposition of the channelling hypothesis as the interaction between traits and motives giving rise to behavioural signature leading to superior performance of an examiner. This research provided data in support of the channelling hypothesis that Achievement motive is more positively related to the accuracy of deception detection when examiner is higher in Conscientiousness predisposition, than when trait Conscientiousness is low. In the detection of deception, specifically task-intrinsic factors related to performance of chart analysis (e.g. independent mastery of task), an examiner's implicit Achievement motive will energize his actions related to facets of his

conscientious behaviour. Implicit motive and trait interaction in this situation will lead to higher performance. On the contrary, an examiner high in implicit Achievement motive but low in Conscientiousness trait (i.e. not organized, distracted, haphazard manner of doing a task) will not be able to express his desire to achieve mastery of a task according to his internal standards – given this situation, an examiner's implicit motive cannot energize his behaviour. The resulting behavioural signature of the interaction between implicit motive and motive supportive trait is a possible explanation for description of superior performers in DACA (2006) as exhibiting behaviour that came across as internally consistent and natural.

Study 2 examined the effects of training and utilized at two levels of training, namely (1) information only and (2) information practice and feedback. Training that included information practice and feedback was operationalized as advanced training. Study 2 results showed there was no training effects related to the two levels of training. Study 2 findings shows that participants provided with information on detection of deception cues with opportunities to practice utilizing information provided to detect deception and thereafter feedback on their performance did not perform better than participants who were provided with information alone. This finding is contrary to earlier research findings related to effects of practice and feedback that was reported to improve detection of deception (Elaad, 2003; Porter, McCabe, Woodworth & Peace, 2007; Zukerman, Koester & Alton, 1984). A possible explanation for similar detection accuracy for both training groups in Study 2 could be that the practice and feedback paradigm provided in this study did not contribute towards participants' ability to associate the reliability of detection of deception indicators. Another explanation for the similar detection accuracy in this study amongst the two training groups could be that the feedback provided to participants did not help them to realize their actual detection of deception capabilities as compared to their perceived capabilities. Alternatively,

the similar detection accuracy in this study amongst the two training groups could be that information provided on valid detection of deception cues are sufficient towards rendering accurate decisions of truth or deception.

Study 3 explored the effects of personality and training on detection of deception via two detection of deception modalities, namely chart analysis and verbal and nonverbal analysis. Study 3 findings was that personality variables and training were not predictors of accuracy of detection of deception – decisions (DI/NDI) for chart analysis. Study 3 finding for accuracy of detection – Scores for chart analysis revealed cognitive style Field Dependence Independence was a predictor of Complex cases regardless of training levels of participants. Results indicated that examiners regardless of prior level of training examiners who are Field Independent evaluated more cues of deception when evaluating Complex Cases i.e. guilty countermeasure cases. Study findings revealed that examiners with a disposition for highly analytical and differentiated processing were able to detect more physiological cues indicative of deception when they evaluated complex cases. This despite examiners having to evaluate cases with ground truth of deceptive examinees utilising physical and mental countermeasures to influence the outcome of their polygraph examination results. The finding that examiners high on the dimension of Field Dependence Independence were more accurate in detection of deception cases despite countermeasure attempts by examinees suggest that selection for polygraph examiners who are field independent could help to mitigate against threats of countermeasures employed by sophisticated subjects.

The present research found a positive relationship between a high implicit Affiliation motive and detection of truthful subject using verbal and nonverbal cues. This research did

not uncover a relationship between implicit motive Affiliation and detection of deceptive subject. The role of implicit motive and detection of verbal and nonverbal cues can be explained by the perception- action link which can be described as “automatic and unmediated activation of behavioural patterns after the very simple perception of appropriate stimuli, whether these correspond to verbal messages or nonverbal behavioural cues” (Vinciarelli, Salamin, Polychroniou, Mohammadi & Origlia, 2012, p. 60). Persons high in the Affiliation motive derive satisfaction from social relationships and naturally orientate their behaviour to establish, nurture and maintain relationships (Schultheiss, 2008). Persons who have a high need for Affiliation orientate their attention towards nonverbal facial expressions signalling Affiliation and vigilance and avoidance behaviour towards nonverbal facial expressions that are indicative of hostility (Schultheiss & Hale 2007). Participants of this study were informed to analyse behaviour indicators associated with FAINT analysis as that of a truthful examinee being relaxed and confident and that of deceptive examinee being tense and defensive. Given said FAINT behavioural cues, examiners high in Affiliation motive regardless of their level of training were more sensitive in identifying cues exhibited by the truthful subject. A possible explanation may be that examiners high in need for Affiliation oriented their attention more towards the truthful subject as a result of which they were able to evaluate more truthful cues as compared to their avoidance of the deceptive subject.

This study also showed that personality trait Agreeableness is a negative predictor for truthful subject, indicating that participants with a trait disposition of low in Agreeableness evaluated more truthful cues pre-FAINT training. Persons whose trait disposition is low in Agreeableness exhibit facets of behavioural tendencies of shrewd, autocratic, hard-hearted and demanding (Costa & McCrae, 1991), and study findings suggest that participants with

said characteristics evaluated more verbal and nonverbal behavioural cues. One possible explanation for this could be that persons of this disposition assessed cues in a compliant way for what they are and do not second guess the verbal and nonverbal behavioural cues observed. An examiner's emotional intelligence in terms of his sensitivity to variations of emotional expressions is important to detection of deception (Wojciechowski, Stolarski & Matthews, 2014).

Examiners must be able to perceive simulated or suppressed emotional expressions that may be utilized by persons undergoing an interview. Study results suggest that an examiners' ability to perceive and understand emotions may explain for individual differences in examiners' ability to read and evaluate nonverbal cues. This research finding suggest that persons low in trait Agreeableness and high need for Affiliation motive and high in Emotional Intelligence facet Perceive and Understand are superior at verbal and nonverbal analysis to detect deception.

Study 3 findings in summary for both the detection of deception modalities suggest that persons high in the dimension of cognitive style Field Dependence Independence are superior at detecting countermeasure cases and that persons low in trait Agreeableness and high need for Affiliation motive and high in Emotional Intelligence facet Perceive and Understand are superior at verbal and nonverbal analysis in detection of truthful subject. Applying the "if ...then" contingency of person situation interaction, personality variables are predictors of detection of deception under certain situational conditions. Taking a theoretical perspective, it suggests that personality dimensions come into relevance depending on the situational demand or complexity of the task at hand. Detection of deception of countermeasure cases is a situational demand that requires more complex processes during

which differentiated processing and analysis is required to render correct decisions based on chart analysis. Congruent to the same thought would be that detection of truthfulness is a more complex task requiring more cue sensitivity and attentional resources of the examiner. In terms of detection of deception based on behavioural analysis, Study 3 findings suggest examiners low in trait Agreeableness and high need for Affiliation motive and high in Emotional Intelligence facet Perceive and Understand are superior at verbal and nonverbal analysis to detect truthful subjects. It is possible that leakage of tell-tale physiological and behavioral signs related to truthful subject is perhaps less due to less internal physiological, emotional and cognitive responses of deception, thus requiring more sensitivity in detection of said cues.

Study 3 results provided mixed results on the effect of training on detection of deception. Study findings based on between-subject study design suggest that Basic Trained examiners were comparable in their cue detection to that of Novice and Advanced Trained Examiners for detection of deception cues for Complex Cases but were less accurate in evaluating Simple or All Cases. Results obtained from the within-subject study design indicate that Basic Trained Examiners, when compared with Novice, were more accurate in detection of cues of Simple and All Cases than Complex cases (i.e. guilty countermeasure cases). Depending on the study design utilised, Basic Trained Examiners can be said to become biased towards the detection of lies or detection of truth as a result of the basic training. However, results from between-subjects study findings suggest that such bias is corrected as they gain advanced training. Advanced training may provide for more practice and feedback to examiners which assist towards reinforcing the reliability of deception cues or indicators to detection of deception.

An interesting finding of Study 2 and Study3 was that participants who were provided with information only on cues of detection of deception on chart analysis data and verbal and nonverbal behavioural analysis performed as well as Advanced trained participants in study 2 and 3. The similarity of finding for both modalities of detection of deception across different samples, while need to be considered with caution, does suggest that information on valid detection of deception cues based on diagnostic features of polygraph chart analysis and use of a structured questionnaire as in FAINT protocol, will be sufficient to equip persons in the detection of deception in both modalities. Participants in this study evaluated the polygraph charts based on validated scoring features (APA, 2011). Furthermore, all participants in this study utilised the Empirical Based Manual Scoring System also known as ESS to assign scores based on the validated scoring features (Nelson, et. 2011). All participants in this study utilized the standardized FAINT Questionnaire (Nate & Gordon, 2007) when evaluating a case suspect's verbal and nonverbal behavior. The FAINT questionnaire included a guide on verbal and nonverbal features to evaluate and scores to be assigned for responses to questions asked during the FAINT interview.

This study utilized an attribute-based job analysis as an integrative approach that combines the strengths of job analysis as well as the strengths of competency modelling, and identified some personality characteristics that are relevant to the contextual task performance examiners engaged in the detection of deception. Review of existing research implied that unconscious cognitive processes are best suited for situational behavioural responses. This present research explored dimensions of the personality traits that are within the conscious realm of a person, as well as implicit motives that are within the unconscious realm of a person as predictors of performance to detect deception. This research adds to existing research findings that both conscious and unconscious qualities of a person are

involved in the performance of detection of deception related to contextual tasks. Conscientiousness and Agreeableness are trait dimensions that respondents are conscious of, and are able to state or describe verbally. Accordingly, the trait dimensions of Conscientiousness and Agreeableness can be measured with the use of a self-report questionnaire. Implicit motives Achievement and Affiliation, are latent motives that are not consciously accessible, and as such cannot be measured through self-report questionnaires. Implicit motives are conceptualized as associative networks that connect situational cues to basic affective reactions and implicit behavioural tendencies (McClelland et al., 1989). Implicit motives are subconsciously aroused, and they lead to affective preferences and implicit behavioural impulses (McClelland et al., 1989). Given that the need for Achievement and Affiliation motives are predictors of detection of deception, specifically that of psychophysiological and verbal and nonverbal deception cues, it can be stated that there is a place for intuitive processes in complex situations such as that in the detection of deception. Intuition, sometimes described as gut feeling, is an effortless decision making process which is unconscious, for the most part (Kahnemann & Frederick, 2002). Use of intuitive processes in complex situations, such as detection of deception will result in effective judgments and action alternatives (Gigerenzer & Todd, 1999).

5.1. Limitations of Research

This research was based on convenience sampling. This meant that sample size in this study did not reach desired numbers, especially in studies that involved within-subject study designs. It is recommended that future studies utilize bigger samples. The within-subject designs in this study was based on a sample drawn from Singapore participants. A within-subject study including participants from US will provide more information on the effects of training. While the training content in US and Singapore Schools are determined by

American Polygraph Association, the environment and teaching methods may be different. Environment in which training are conducted and methods of instruction are important factors to be considered in studies exploring training. The limited sample size did not allow for this study to explore interaction factors between personality variables and training. This is an important question, as personality dispositions may have effects on ease of learning skills and applying acquired skills.

Study 2 explored the effects of training, and the training variable could have been operationalized into three levels namely (1) information only, (2) information and practice, and (3) information, practice and feedback. The said three training levels utilized in a study will provide insights on the effects of the incremental training levels towards reinforcing the reliability of deception cues or indicators to detection of deception.

In this research, examiner performance was defined as the number of correct decisions of Deception Indicated and No Deception Indicated. DACA study definition of an accomplished examiner is that he (1) “consistently produce correct DI/NDI decisions”, produce (2) “few no opinion decisions”, (3) “rarely have quality assurance issues”, and are those whom (4) “you would trust with your most difficult cases”. A better measure of examiner performance construct including all four facets of performance could have been explored.

5.2 Future Directions

Kehr (2014) examined why equally skilled persons experience varying level of success at what they do at work. He proposed a model that integrated implicit and explicit motivation, perceived abilities and volitional control as variables to be considered to explain

the work place performance. An empirical study exploring the above variables will address current research gaps.

This study utilized implicit motives as predictors. Implicit motives are unconscious motives that are aroused by task intrinsic factors, such as the challenge of evaluating waveforms on a polygraph chart. However, motives which are aroused by task extrinsic factors and which are within an individual's self-concept or awareness need to be considered to explain behavior. Koestner et al. (1991) postulated that performance is best explained when "both aspects of motive strength (implicit and self-attributed) and both types of situational incentives (task intrinsic and social intrinsic) are taken into account" (p. 78). Ajzen (1988) stated that factors such as personal desires for outcome, belief what others want you to do and desires to do what others want, influence behavior. Explicit motives have been theorized to be oriented towards gaining approval from others, and enjoyment of the final product. Considered together, theory of planned behavior postulated by Ajzen (1988) and Koestner et al. (1991) provide for a theoretical framework to include implicit and explicit motives to better explain work place performance.

The interaction between implicit motives and explicit motives can be considered to elucidate the idea of a dual motive system and its effects on performance. In any situation, motivated behavior is determined by individual differences in explicit motives and implicit motives. Implicit achievement motives are psychogenic needs and develop so that the persons can fulfill their psychological well-being. Explicit motives are affected by what the person wants to do, based on their self-concepts, values and environmental factors. One way of understanding whether one's explicitly framed goals are congruent with their internalized motives is to examine the constructs of implicit and explicit motives and the theory of their congruence. When there is congruence between implicit and explicit motives (i.e. high

implicit motive level is matched by high explicit motive), performance is best. For example, when an individual has both high levels of implicit achievement and explicit achievement, his job performance will be better than when there is a mismatch (Shulthesiss & Brunstein, 1999; Shulthesiss, 2008; Shulthesiss, Jones et al., 2008). Specifically, the better performers could have set up goals for themselves that are more meaningful or naturally rewarding. When there is a discrepancy or incongruence between one's implicit and explicit motives, the person will not derive pleasure or satisfaction from his goal attainment (Brunstein, Schultheiss & Grassmann, 1998). Hence it is possible that some examiners, as earlier discussed in the DACA (2006) study, did not derive any sense of satisfaction in the process while engaging in their goal-directed behavior. Such chronic lack of satisfaction may eventually lead to fatigue and diminished performance, resulting in a failure to attain their goals.

This study conceptualized detection of deception as a perceptual task and that personality dimensions and training affect the accuracy of detection of deception. Another approach that can be explored is utilizing the Theory of Mind (ToM) which is the awareness that people have different psychological states (Korkmaz, 2011). Theory of Mind in relation to deception requires "an advanced theory of representation of the mind because it necessitates the ability to mentally represent false beliefs, a relatively advanced ToM ability, as well as being able to construct and impart such beliefs to others" (Mchugh, Barnes-Holmes, Barnes-Holmes, Stewart & Dymond, 2007, p. 157). In the context of examiner's ability to detect deception, the examiner needs to have the awareness that the examinee is indeed resonating between two mental states that of constructing and imparting a false belief while knowing the truth. The ability of the examiner to take on the examinee's perspective or from the examinee's point of view is known as perspective taking (Galinsky, Maddux, Gilin,

& White, 2008). Truthful subjects need not take engage in constructing or imparting false of false beliefs. Given this difference in the mental states of a subject who is intent on deception and person who is intent on telling the truth, detection of deception task of examiner distills down to examiner's ability of perspective taking. Specifically, research into the multidimensional construct of perspective taking (i.e. *cognitive* – imagining others' thoughts or motives from the person's point of view, *affective* – imagining other person's feelings from the other person's point of view, *appraisal related* – imagining how events are of relevance to the other person's point of view) (Williams, 2012) and its importance specific to examiner's role of detection of deception will broaden the spectrum of measures used to select superior examiners.

The finding that examiners low in trait Agreeableness performed better in detection of deception is of interest. Research has shown that trait Agreeableness is negatively correlated with constructs of Dark Triad namely *Psychopathy*, *Narcissism* and *Machiavellianism* (Paulhus & Williams, 2002; Stead & Fekken, 2014). Deception and callous manipulation is the core component of Dark Triad traits (Paulhus & Williams, 2002). While persons high in Dark Triad traits exhibit behaviours that are socially aversive in nature, recent research has focused on uncovering facets of the of Dark Triad traits that may be adaptive or advantageous in certain situations (Furnham & Trickey, 2011). Given this, it will be of interest to explore if persons high in Dark Triad traits, who are said to be deceptive and manipulative, are superior at lie detection (Wright, Berry, Catmur & Bird, 2015). Present research has revealed that persons low in trait Agreeableness are superior at detection of deception. Considering that Dark Triad traits are negatively correlated with trait Agreeableness, it would be of interest to explore if persons who score high in Dark Triad traits would possibly be superior at detection of deception.

Psychopathic traits are associated with high levels of impulsivity, pathological lying, deception and manipulation (Hare, 1991). The term successful psychopaths refers to “individuals who display personality traits of psychopathy, such as low emotional intelligence, low empathy, but who are still functional members of society and typically avoid incarceration” (Malmstrom, 2015, p. 6). Research on persons with psychopathic traits and ability to detect deception has been mixed. Lyons, Healy and Bruno (2013) reported a positive relationship between psychopathy and detection of deception with the said relationship moderated by gender. However, other studies exploring the relationship between psychopathy and detection of deception did not report any significant findings (Paulhus & Williams, 2002; Peace & Sinclair, 2012; Wright, Berry, Catmur & Bird, 2015; Malmstrom, 2015).

Dark Triad trait Narcissism are associated with behaviors such as grandiosity, entitlement dominance and superiority (Furnham, Richards & Paulhus, 2013). Amongst the behavioural tendencies, “narcissists tend to be overconfident at everything they do, regardless of how good they are, report at being far more competent than others at tasks” (Jonason & Middleton, 2015, p. 671). Research has revealed that persons with dark triad disposition Narcissism have superior skills in reading facial expressions and emotions (Konrath, Corneille, Bushman, & Luminet, 2014). It will be of interest to explore the relationship between Narcissism and detection of deception, as the latter involves reading of facial expressions and emotions. To date research has revealed that persons high in Dark Triad trait Narcissism are significantly poor in detection of deception by means of analysis of emails (i.e. detect lie in writing) or by means of videotaped analysis of behavior (Zarins & Konrath, 2014)

Dark Triad trait Machiavellianism is associated with behaviors such as being cynical and interpersonal manipulation (Paulhus & Williams, 2002). Research suggests that persons with Machiavellianism trait characteristics are better able to attain social success on convincing and exploiting others. Emery (2016) reported that persons who score high in Machiavellianism trait are likely to be hired than persons who scored low in Machiavellianism despite them lying about their qualifications. However, in terms of lie detection abilities, Geis and Moon (1981) reported that there was no difference for persons high or low in trait Machiavellianism.

In summary, existing research does not seem to suggest that there is a strong relationship between Dark Triad personality traits and detection of deception. However, future research could explore the possibility of channeling hypothesis of implicit motives through Dark triad traits. Research reported by Jonason and Ferrell (2016) that all three dark traits are associated with motivations of power and dominance and that Narcissism is associated with Affiliation. It will be of interest to see the effects on detection of deception through the interaction of implicit motives and Dark Triad traits.

Persons who score low in Agreeableness can also be characterized as person low in trust or belief in the sincerity and good intention of others (John, Donahue & Kentle, 1991). This research finding that persons who have low propensity to trust have superior detection of deception abilities is contrary to that reported by Carter and Weber (2010). The latter study reported that persons who have a high propensity to trust were better at detection of deception than persons who have low propensity to trust. Carter and Weber (2010) theorized that persons who have a high propensity to trust need to reduce their vulnerability in social interactions by being able to identify persons who are not trustworthy. The need to identify

persons who are not trustworthy may develop the expertise of lie detection abilities. On the contrary, persons who have a low propensity to trust others, generally do not trust others as such do not spend time and effort to identify persons who are untrustworthy. The lack of time and effort to identify persons who are untrustworthy may result in them not developing their expertise to detect deceit in others. Given the divergent findings, future research could further explore the effects of propensity to trust as a personality variable of interest in the detection of deception.

There is also a need to adopt new approaches towards establishing truth and deception during the polygraph test process. Presently, polygraph examiner renders a diagnostic decision independent of the verbal and nonverbal analysis. Said process encompasses an implicit assumption that psychophysiological measurements obtained during the polygraph chart recording process is the primary channel of “leakage” that needs to be evaluated. The assumption of the polygraph evaluation process needs to be reviewed premised on the leakage hypothesis, to include verbal and nonverbal analysis as observable correlates of deception. This study has shown that behavioral assessment such as the FAINT assessment (Gordon & Fleisher, 2006), can be utilized for behavioral cues which can then be quantified for analysis. An approach towards considering polygraph decisions as weighted index measure of physiological and behavioral cues may provide more discriminant information to detect truth and deception.

Masip et al. (2009) have postulated that the detection of deception training places a strong emphasis on detection of deception cues, however this study findings did not provide conclusive findings. This study finding also revealed such a bias is corrected when examiners gained advanced training. Future studies will need to look at the construct of

examiner performance from theoretical and practitioner perspective by including dimensions that was not operationalized in this study.

Conclusion

This study postulation was that detection of deception is a perceptual task and personality dimensions and training have effects on examiner job performance. Examiner job performance was operationalised as the ability of the examiner to accurately identify truth and deception by means of chart analysis and verbal and nonverbal analysis. This study hypothesised that examiner personality variables traits, motives, cognitive style and emotional intelligence shape the perception of examiners as they perform contextual tasks of detection of deception.

Figure 17. Personality Dimensions of Relevance to Detection of Deception

Specifically, personality traits Conscientiousness and Agreeableness, Implicit motives need for Achievement and Need for Affiliation, Emotional Intelligence dimension of Perceive and Understand were found to be predictors of detection of deception.

Another key postulation of this study was that detection of deception is a contextual task and that the interaction of person situation is an important aspect related to the contextual task of detection of deception. This person situation interaction was conceptualised using the “if...then” contingency of personality as postulated by CAPS model (Mischel & Shoda, 1984). Specifically, this research provides support that there is specificity of personality constructs such as traits, motives, cognitive style and emotional intelligence to the situational performance in the detection of deception. Figure 17 shows the personality dimensions that are relevant to detection of deception in this study.

Chart Analysis

This research provided support that examiners with cognitive style of field independence are superior in detection of deception by chart analysis despite countermeasure attempts. It is proposed that the selection of polygraph examiners who are field independent could help to mitigate against sophisticated examinees who employ countermeasures. This research provided support that examiners who are high in implicit motive Achievement and high in trait Conscientiousness are superior at detection of deception by means of chart analysis. The training effects in this study provided a mixed result between a between-subjects study and within-subject study. Depending on the study design utilised, Basic Trained Examiners can be said to become biased towards the detection of lies or detection of truth as a result of the basic training. However, results from between-subjects study findings suggest that such bias is corrected as they gain advanced training. Study results suggest that persons with information on valid cues of detection of deception are as accurate in detecting deception using polygraph chart analysis as Advanced trained examiners. However, such conclusion pertaining to training level required to detect deception has to be tread with caution as existing research has provided support that practice and feedback improves the

detection of deception task. Refer to Figure 18 for personality and training effects on detection of deception (Chart Analysis)

Figure 18. Personality and Training Effects on Detection of Deception (Chart Analysis)

Behavioural Analysis - Forensic Assessment Interview Technique (FAINT)

This study provided support that persons low in trait Agreeableness and high need for Affiliation motive and high in Emotional Intelligence facet Perceive and Understand are superior at verbal and nonverbal analysis to detection of truthful subject. Applying the “if ...then” contingency of person situation interaction personality variables are predictors of detection of deception under certain situational conditions. In terms of detection of deception based on behavioural analysis, study findings suggest examiners low in trait Agreeableness and high need for Affiliation motive and high in Emotional Intelligence facet Perceive and

Understand are superior at verbal and nonverbal analysis to detect deception of truthful subjects. It is possible that leakage of tell-tale physiological and behavioral signs related to truthful subject is perhaps less due to less internal physiological, emotional and cognitive responses of deception, thus requiring more sensitivity in detection of said cues. This study findings suggest that persons with no prior training in detection of deception can accurately evaluate verbal and nonverbal cues when they are provided with information on valid behavioural cues of detection of deception by means of structured assessment tool (i.e. use of FAIMT questionnaire). Figure 19 shows personality and training effects on detection of deception (FAINT).

Figure 19. Personality and Training Effects on Detection of Deception (FAINT)

This study has provided theoretical and empirical evidence that Examiner personality and training effect the accuracy of detection of deception. Detection of deception is a complex

and multi-dimensional task, and training alone does not fully account for examiner performance in detection of deception. Examiner personality to meet the situational demands of the task in terms of his traits, motives, cognitive style, emotional intelligence explains for the difference in job performance between that of a superior examiner and an average examiner. This study has identified several examiner qualities that are enduring and stable over time. These qualities when used as selection criteria will be predictive of examiner job performance in the long term. Selecting and training of examiners based on personality dimensions proposed in this study will serve towards the screening and selection of superior performers.

REFERENCES

- Aamodt, M. G., & Heather, C. (2006). Who can best catch a liar?: A meta-analysis of individual differences in detecting deception. *Forensic Examiner, 15*(1), 6-11.
- Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44*(1), 1-26.
- Barrick, M. R., & Mount, M. K. (1993). Autonomy as a moderator of the relationship between the Big Five personality dimensions and job performance. *Journal of Applied Psychology, 78*(1), 111-118.
- Barrick, M. R., & Mount, M. K. (2005). Yes, Personality Matters: Moving on to more important matters. *Human Performance, 18*(4), 359-372.
- Barrick, M. R., Mount, M. K., & Strauss, J. P. (1993). Conscientiousness and performance of sales representatives: Test of the mediating effects of goal setting. *Journal of Applied Psychology, 78*(5), 715-722.
- Bartram, D. (2005). The Great Eight Competencies: A criterion-centric approach to validation. *Journal of Applied Psychology, 90*, 1185-1203.
- Bernard, L. C., & Lac, A. (2014). The incremental validity of motive "Traits of Action:" Predicting behavior longitudinally. *Individual Differences Research, 12*(3), 79-100.
- Bing, M. N., LeBreton, J. M., Davison, H. K., Migetz, D. Z., & James, L. R. (2007). Integrating implicit and explicit social cognitions for enhanced personality assessment: A general framework for choosing measurement and statistical methods. *Organizational Research Methods, 10*(1), 346-389.

- Bish, A. J., & Kabanoff, B. (2014). Star performers: Task and contextual performance are components, but are they enough? *Asia Pacific Journal Of Human Resources*, 52(1), 110-127. doi:10.1111/1744-7941.12017
- Blanton, E. L. (2004). The influence of students' cognitive style on a standardized reading test administered in three different formats. *Electronic Theses and Dissertations*. Paper 4.
- Borman, W. C., & Motowidlo, S. J. (1993). Expanding the criterion domain to include elements of contextual performance. In N. Schmitt, & W. C. Borman (Eds.), *Personnel selection in organizations* (pp. 71-98). San Francisco: Jossey-Bass.
- Bruner, J. (1960). *The Process of Education*. Cambridge, MA: Harvard University Press.
- Brunstein, J. C., Maier, G. W. (2005). Implicit and self-attributed motives to achieve: two separate but interacting needs. *Journal of Personality and Social Psychology*, 89(2), 205-222.
- Brunstein, J. C., Schultheiss, O. C., & Grassmann, R. (1998). Personal goals and emotional well-being: The moderating role of motive dispositions. *Journal of Personality & Social Psychology*, 75(2), 494-508.
- Buller, D. B., & Burgoon, J. K. (1996). Interpersonal Deception Theory. *Communication Theory*, 6(3), 203–242. doi:10.1111/j.1468-2885.1996.tb00127.x
- Canobi, K. H., Reeves, R. A., & Pattison, P. E. (1998). The Role of conceptual understanding in children's addition problem solving. *Developmental Psychology*, 34(5), 882–891.

- Carter, N. L., and Weber, J. M. (2010). Not Pollyannas: Higher generalized trust predicts lie detection ability. *Soc. Psychol. Pers. Sci.* 1, 274–279. doi: 10.1177/1948550609360261
- Carver, C. S., & Scheier, M. F. (2012). *Perspectives on personality* (7th ed.). Boston, MA: Pearson.
- Costa, P. T., Jr., & McCrae, R. R. (1992). *The NEO-PI-R: Professional manual*. Odessa, FL: Psychological Assessment Resources.
- Defense Academy for Credibility Assessment (DACA). (2006). *Assessment of optimal interrogation approaches*.
- Defense Academy for Credibility Assessment (DACA). (2007). *Assessment of psychophysical detection of deception pretest*. Battelle Memorial Institute: Columbus, OH.
- DePaulo, B. M., & Pfeifer, R. L. (1986). On-the-job experience and skill at detecting deception. *Journal of Applied Social Psychology*, 16, 249-267.
- DePaulo, B. M., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., & Cooper, H. (2003). Cues to Deception. *Psychological Bulletin*, 129(1), 74-118. doi: 10.1037/0033-2909.129.1.74
- Depaulo, B. M., Wetzel, C., Sternglaz, R. W., & Wilson, M. J. W. (2003). Verbal and Nonverbal Dynamics of Privacy, Secrecy and Deceit. *Journal of Social Issues*, 59(2), 391-410.

- Diefendorff, J. M., Croyle, M. H., & Gosserand, R. H. (2005). The dimensionality and antecedents of emotional labor strategies. *Journal of Vocational Behavior*, 66, 339-357.
- Dunn, W. S., Mount, M. K., Barrick, M. R., & Ones, D. S. (1995). Relative importance of personality and general mental ability in managers' judgements of applicant qualifications. *Journal of Applied Psychology*, 80(4), 500-509.
- Ekman, P. (1985). *Telling Lies: Clues to deceit in the marketplace, marriage and politics*. New York: W. W. Norton
- Ekman, P. (1999). "Basic Emotions". In Dalglish, T., Power, M. *Handbook of Cognition and Emotion*. Sussex, UK: John Wiley & Sons.
- Ekman, P., & Friesen, W. V. (1969). Nonverbal Leakage and Clues to Deception. *Psychiatry*, 32(1), 88-106.
- Ekman, P., & O'Sullivan, M. (1991). Who can catch a liar? *American Psychologist*, 46, 913-920.
- Elaad, E. (2003). Is the inference rule of the "control question polygraph technique" plausible? *Psychology, Crime and Law*, 9(1), 37-47. doi:10.1080/10683160308143
- Emery., K. (2016) *Applying Machiavellianism to the Detection of Deception: Do High Machs Make Better Liars?* PhD Theses. Adler School of Professional Psychology, ProQuest Dissertations Publishing, 2016. 10181698
- Enos, F., Benus, S., Cautin, R. L., Graciarena, M., Hirschberg, J. B., & Shriberg, E. (2006). *Personality Factors in Human Deception Detection: Comparing Human to Machine*

- Performance*. Columbia University Academic Commons, Retrieved from <http://hdl.handle.net/10022/AC:P:20907>.
- Epstein, S., Lipson, A., Holstein, C., & Huh, E. (1992). Irrational reactions to negative outcomes: Evidence for two conceptual systems. *Journal of Personality and Social Psychology*, 62, 328-339.
- Ericsson, K. A., & Smith, J. (Eds.). (1991). Toward a general theory of expertise: Prospects and limits. Cambridge, England: Cambridge University Press.
- Flanagin, A. J., & Metzger, M. J. (2008). *Digital Media and Youth: Unparalleled Opportunity and Unprecedented Responsibility* (pp. 5-28). Cambridge, MA. The MIT Press.
- Fogg, B. J., (2003). *Prominence-interpretation theory: explaining how people assess credibility online*. In Proceedings of CHI'03, Extended Abstracts on Human Factors in Computing Systems. pp. 722-723.
- Freund, P. a., & Holling, H. (2011). Who wants to take an intelligence test? Personality and achievement motivation in the context of ability testing. *Personality & Individual Differences*, 50(5), 723-728. doi:10.1016/j.paid.2010.12.025
- Furnham, A., & Trickey, G. (2011). Sex differences in the dark side traits. *Personality and Individual Differences*, 50, 517–522.
- Furnham, A., Richards, S. C., & Paulhus, D. L. (2013). The Dark Triad of Personality: A 10 Year Review. *Social and Personality Psychology Compass*, 7: 199–16. doi:10.1111/spc3.12018

- Galinsky, A.D., Maddux, W.W., Gilin, D., & White, J.B. (2008). Why it pays to get inside the head of your opponent: The differential effects of perspective-taking and empathy in negotiations. *Psychological Science*, 19(4), 378-384.
- Gaspar, J. P., & Schweitzer, M. E. (2013). The emotion deception model: A review of deception in negotiation and the role of emotion in deception. *Negotiation and conflict management research*, 6(3), 160–179.
- Geis, F. L., & Moon, T. H. (1981). Machiavellianism and deception. *Journal of Personality and Social Psychology*, 41(4), 766-775.
- Glicksohn, J. J., & Rechtman, S. (2011). Profiling the profilers: Who is watching our backs? *Personality & Individual Differences*, 50(5), 755-758.
doi:10.1016/j.paid.2010.12.010
- Glicksohn, J., & Bozna, M. (2000). Developing a personality profile of the bomb disposal expert: The role of sensation seeking and Field Dependence Independence. *Personality And Individual Differences*, 28, 85-92.
doi:10.1016/S0191-8869(99)00083-5
- Goodenough, D. R. (1978). Field dependence. In H. London & J. E. Exner (Eds.), *Dimensions of personality* (pp. 165-216). New York: Wiley.
- Gordon, N. J., & Fleisher, W. L. (2006), *Effective interviewing and interrogation techniques* (2nd ed.). Amsterdam: Academic Press.
- Grandey, A. (2003). When "the show must go on": Surface and deep acting as predictors of emotional exhaustion and service delivery. *Academy of Management Journal*, 46(1), 86-96.

- Grubin, D. (2016). Treatment of sex offenders: Strengths and weaknesses in assessment and intervention. Polygraph testing of sex offenders. *Polygraph*, 45(2), 97-116.
- Handler, M., Honts, C. (2015). A Literature Review of Polygraph Countermeasures and the Comparison Question Technique. *Polygraph*, 44(2), 129-139.
- Hare, R. D. (1991). *The Hare Psychopathy Checklist—Revised*. Toronto, Ontario, Canada: Multi-Health Systems.
- Hartwig, M., Granhag, P. A., & Strömwall, L. (2007). Guilty and innocent suspects' strategies during interrogations. *Psychology, Crime, & Law*, 13, 213-227.
- Hauch, V., Sporer, S. L., Michael, S. W., & Meissner, C. A. (2016). Does training improve the detection of deception? A meta-analysis. *Communication Research*, 43(3), 283-343. doi:10.1177/0093650214534974
- Honts, C. R., & Reavy, R. (2015). The comparison question polygraph test: A contrast of methods and scoring. *Physiology & Behavior*, 143, 15-26.
doi:10.1016/j.physbeh.2015.02.028
- Honts, C. R., Susan, L. A., & Gordon, A. K. (2001). Effects of spontaneous countermeasures used against the Comparison Question Test. *Polygraph*, 30(1), 1-9.
- Hörmann, H. & Maschke, P. (1996). On the relation between personality and job performance of airline pilots. *The International Journal of Aviation Psychology*, 6(2), 171-178.
- Horvath, F. S. (1973). Verbal and nonverbal cues to truth and deception during polygraph examinations. *Journal of Police Science and Administration*, 1(2), 138–152.

- Iacono, W. G. (2008). Effective Policing: Understanding How Polygraph Tests Work and Are Used. *Criminal Justice and Behavior*, 35(1), 1295-1308. doi: 10.1177/0093854808321529
- Inquisit 2.0.60616 [Computer software]. (2006). Seattle, WA: Millisecond Software.
- Intelligence Senate Select Committee on Intelligence. (1994). An assessment of the Aldrich H. Ames espionage case and its implications for U.S. Retrieved July 22, 2016 from http://www.fas.org/irp/congress/1994_rpt/ssci_ames.htm.
- Isenhardt, C., Dieperink, E., Thuras, P., Fuller, B., Stull, L., Koets, N., & Lenox, R. (2014). Training and maintaining motivational interviewing skills in a clinical trial. *Journal Of Substance Use*, 19(1-2), 164-170. doi:10.3109/14659891.2013.765514
- Jackson, D. N. (1984). *Personality Research Form* (3 Ed.). Port Huron, MI: Sigma Assessment Systems, Inc.
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory - Versions 4a and 5*. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.
- Jonason P. K., Ferrell J. D. (2016). Looking under the hood: the psychogenic motivational foundations of the dark triad. *Pers. Individ. Differ.* 94, 324–331. 10.1016/j.paid.2016.01.039
- Jonason, P., & Middleton, J. (2015). Dark Triad: The “Dark Side” of Human Personality. *International Encyclopedia of the Social & Behavioral Sciences*. 10.1016/B978-0-08-097086-8.25051-4.

- Judge, T. A., Higgins, C. A., Thoresen, C. J., Barrick, M. R. (1999). The Big Five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, 52(3), 621-652.
- Kahneman, D., & Frederick, S. (2002). In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics of intuitive judgment*. New York: Cambridge University Press.
- Kamp, J. D., Hough, L. M. (1988). Utility of temperament for predicting job performance. In L.M. Hough (Eds.), *Literature review: Utility of temperament, biodata, and interest assessment for predicting job performance*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Kehr, H. M. (2004). Integrating implicit motives, explicit motives, and perceived abilities: The compensatory model of work motivation and volition. *Academy Of Management Review*, 29(3), 479-499.
- Kelley, R. & Caplan, J. (1993). *How Bell Labs Creates Star Performers*. Harvard Business Review (July-August 1993), 71(4), 128-139.
- Kelley, R. (1999). *How To Be A Star At Work*. Crown Publishing Group.
- Koestner, R., Weinberger, J., & McClelland, D. C. (1991). Task-Intrinsic and Social-Extrinsic Sources of Arousal for Motives Assessed in Fantasy and Self-Report. *Journal of Personality*, 59, 57-82.
- Köllner, M.G., & Schultheiss, O.C. (2014). Meta-analytic evidence of low convergence between implicit and explicit measures of the needs for achievement, Affiliation, and power. *Frontiers in Psychology*, 5, 826. doi: 10.3389/fpsyg.2014.00826

- Konrath, S., Corneille, O., Bushman, B. J., & Luminet, O. (2014). The relationship between narcissistic exploitativeness, dispositional empathy, and emotion recognition abilities. *Journal of Nonverbal Behavior*, 38(1), 129-143.
- Korkmaz, B. (2011). Theory of Mind and Neurodevelopmental Disorders of Childhood. *Pediatric Research*, 69, 101R-108R.
- Lang, J. B., Zettler, I., Ewen, C., & Hülshager, U. R. (2012). Implicit Motives, Explicit Traits and Task and Contextual Performance at Work. *Journal of Applied Psychology*, 92, 1201-1217.
- Langens, T. A. (2007). Congruence between implicit and explicit motives and emotional well-being: The moderating role of activity Inhibition. *Motivation & Emotion*, 31(1), 49-59. doi:10.1007/s11031-006-9038-5
- Lawrence, S., & Jordan P. (2009). Testing an explicit and implicit measure of motivation. *International Journal Of Organizational Analysis*, 17(2): 103.
- Leontiev, D. A. (2012). From drive to need and further: What is human motivation about? In D. A. Leontiv (Ed.), *Motivation, Conscientiousness and Self-regulation* (pp. 9-25). New York: Nova Science Publishers.
- Lewicki, P., Hill, X., & Bizot, E. (1988). Acquisition of procedural knowledge about a pattern of stimuli that cannot be articulated. *Cognitive Psychology*, 20, 24-37.
- Lyons, M., Healy, N., & Bruno.. D. (2013). It takes one to know one: Relationship between lie detection and psychopathy *Personality and Individual Differences*, 55(6), 676-679

- Magnus, K., Diener, E., Fujita, F., & Pavot, W. (1993). Extraversion and neuroticism as predictors of objective life events: A longitudinal analysis. *Journal of Personality and Social Psychology*, 65(5), 1046–1053.
- Malmstrom, M. (2015). *Personality Traits and Deception Detection Ability Among College Students with Primary Psychopathic Traits*. Master's Theses. 4598.
- Markus, L. H., Cooper-Thomas, H. D., & Allpress, K. N. (2005). Comfounded by competencies? An evaluation of the evolution and use of competency models. *New Zealand Journal of Psychology*, 34, 117-126.
- Masip, J., Garrido, E., & Herrero, C. (2009). Heuristic versus systematic processing of information in detecting deception: questioning the truth bias. *Psychological Reports*, 105, 11-36.
- Mayer, J. D., & Salovey, P. (1997). What is emotional intelligence? In P. Salovey & D. Sluyter (Eds.), *Emotional development and emotional intelligence: Implications for educators* (pp. 3-31). New York: Basic Books.
- McClelland, D. C. (1973). Testing for competence rather than for "intelligence". *American Psychologist*, 28(4), 1-14.
- McClelland, D. C. (1973). Testing for Competence Rather Than for "Intelligence". *American Psychologist*, 28(1), 1-14.
- McClelland, D. C. (1980). Motive dispositions: The merits of operant and respondent measures. In L. Wheeler (Ed.), *Review of personality and social psychology* (pp. 10-41). Beverly Hills, CA: Sage.

- McClelland, D. C. (1995). *Scientific psychology as a social enterprise*. Working paper, Boston University.
- McClelland, D. C., Koestner, R., & Weinberger, J. (1989). How do self-attributed and implicit motives differ? *Psychological Review*, 96(4), 690-702. doi:10.1037/0033-295X.96.4.690
- McCornack, S. A. (1997). The generation of deceptive messages: Laying the groundwork for a viable theory of interpersonal deception. In J. O. Greene (Ed.), *Message production: Advances in communication theory* (pp. 91-126). Mahwah, NJ: Lawrence Erlbaum.
- McHugh, L., Barnes-Holmes, Y., Barnes-Holmes, D., Stewart, I., & Dymond, S. (2007). Deictic relational complexity and the development of deception. *The Psychological Record*, 57, 517–531.
- Meissner, C. A., & Kassin, S. M. (2002). "He's guilty!": Investigator bias in judgments of truth and deception. *Law and Human Behavior*, 26, 469-480.
- National Research Council (2003). *The polygraph and lie detection*. Washington, DC: The National Academies Press. doi: 10.17226/10420.
- Nelson, R., & Krapohl, D. (2011). Criterion Validity of the Empirical Scoring System with Experienced Examiners: Comparison with the Seven-Position Evidentiary Model Using the Federal Zone Comparison Technique. *Polygraph*, 40(2), 80-85.
- Nelson, R., Handler M., Shaw P., Gougler M., Blalock B., Russell C., et al. (2011). Using the Empirical Scoring System. *Polygraph*. 40(2), 67-78.

- O'Boyle Jr., E. H., Forsyth, D. R., Banks, G. C., & McDaniel, M. A. (2012). A meta analysis of the Dark Triad and work behavior: A social exchange perspective. *Journal Of Applied Psychology*, 97(3), 557–579.
- Palmatier, J. J., & Rovner, L. (2015). Credibility assessment: Preliminary Process Theory, the polygraph process, and construct validity. *International Journal Of Psychophysiology*, 95(1), 3-13. doi:10.1016/j.ijpsycho.2014.06.001
- Pang, J. S. (2010). Content coding methods in implicit motive assessment: Standards of measurement and best practices for the Picture Story Exercise. In O.C. Schultheiss & J. C. Brunstein (Eds.), *Implicit motives* (pp.119-150). New York, NY: Oxford University Press.
- Pang, J. S., & Schultheiss, O. C. (2005). Assessing implicit motives in U. S. college students: Effects of picture type and position, gender and ethnicity, and cross-cultural comparisons. *Journal of Personality Assessment*, 85(3), 280-294.
- Paulhus, D. L., & Williams, K. M. (2002). The Dark Triad of personality: Narcissism, Machiavellianism and psychopathy. *Journal of Research in Personality*, 36(6), 556-563.
- Porter, S., McCabe, S., Woodworth, M., & Peace, K. A. (2007). “Genius is 1% inspiration and 99% perspiration”...or is it? An investigation of the effects of motivation and feedback on deception detection. *Legal and Criminological Psychology*, 12, 297–309.
- Ramsay, J., & Pang, J. (2013). Set ambiguity: A key determinant of reliability and validity in the picture story exercise. *Motivation & Emotion*, 37(4), 661-674.
doi:10.1007/s11031-012-9339-9

- Rémy, L., & Gilles, P. (2014). Relationship between field dependence-independence and the g factor: What can problem-solving strategies tell us? *European Review Of Applied Psychology*, 64(2), 77. doi:10.1016/j.erap.2014.02.001
- Sabourin, M. (2007). The Assessment of Credibility: An Analysis of Truth and Deception in a Multiethnic Environment. *Canadian Psychology*, 48(1), 24-31.
- Sackett, P. R., & Laczo, R. M. (2003). Job and work analysis. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Handbook of psychology* (Vol. 12, pp. 21-37). Hoboken, NJ: Wiley.
- Sanchez, J. I., & Levine, E. L. (2001). The analysis of work in the 20th and 21st centuries. In N. Anderson, D. S. Ones, H. K. Sinagil, & C. Viswesvaran (Eds.), *Handbook of Industrial, work, and organizational psychology* (pp. 70-90). London: Sage.
- Sanchez, J. I., & Levine, E. L. (2009). What is (or should be) the difference between competency modeling and traditional job analysis? *Human Resource Management Review*, 19, 53-63. doi:10.1016/j.hrmr.2008.10.002
- Schippmann, J. S., Ash, R. A., Battista, M., Carr, L., Eyde, L. D., Hesketh, B., Kehoe, J., ... Prien, E. P. (2000). The practice of competency modeling. *Personnel Psychology*, 53, 703-740.
- Schultheiss, O. C., & Brunstein, J. C. (1999). Goal imagery: Bridging the gap between implicit motives and explicit goals. *Journal of Personality*, 67, 1-38.
- Schultheiss, O. C., & Hale, J. A. (2007). Implicit motives modulate attentional orienting to facial expressions of emotion. *Motivation & Emotion*, 31(1), 13-24. doi:10.1007/s11031-006-9042-9

- Schultheiss, O. C., & Pang, J. S. (2007). Implicit measures of motivation and personality. In R. W. Robins, R. C. Fraley & R. Krueger (Eds.), *Handbook of research methods in personality psychology* (pp. 322-344). New York: Guilford.
- Schultheiss, O. C., Jones, N. M., Davis, A. Q., & Kley, C. (2008). The role of implicit motivation in hot and cold goal pursuit: Effects on goal progress, goal rumination, and depressive symptoms. *Journal of Research in Personality*, 42, 971-987.
- Schultheiss, O. C., Pang, J. S., Torges, C. M., Wirth, M. M., & Treynor, W. (2005). Perceived facial expressions of emotion as motivational incentives: Evidence from a differential implicit learning paradigm. *Emotion*, 5(1), 41-54.
- Schultheiss, O. C., Yankova, D., Dirlikov, B., & Schad, D. J. (2009). Are implicit and explicit motive measures statistically independent? A fair and balanced test using the Picture Story Exercise and a Cue- and Response-Matched Questionnaire Measure.
- Shaw, J., Porter, S., & ten Brinke, L. (2013). Catching liars: training mental health and legal professionals to detect high-stakes lies. *Journal Of Forensic Psychiatry & Psychology*, 24(2), 145-159. doi:10.1080/14789949.2012.752025
- Singer, J. L. (1984). *The human personality*. San Diego, CA: Harcourt Brace Jovanovich.
- Singh, P. (2008). Job analysis for a changing workplace. *Human Resource Management Review*, 18, 1887-1899. doi:10.1016/j.hrmr.2008.03.004
- Snyder, M. (1974). Self-monitoring of expressive behavior. *Journal of Personality and Social Psychology*, 30(4), 526-537
- Spencer, L. M., & Spencer, S. M. (1993). *Competence at work: Models for superior performance*. New York: Wiley.

Sporer, S. L., & Schwandt, B. (2006). Paraverbal indicators of deception: A meta-analytic synthesis. *Applied Cognitive Psychology*, 20, 421-446.

Steller, M., & Köhnken, G. (1989). Criteria-Based Content Analysis. In D. C. Raskin (Ed.), *Psychological methods in criminal investigation and evidence* (pp. 217-245). New York: Springer-Verlag.

Stevens, G. W. (2012). A Critical Review of the Science and Practice of Competency Modeling. *Human Resource Development Review*, 12(1), 86-107. doi: 10.1177/1534484312456690

Takšić, V. (2005). *Basic psychometric properties of Emotional Skills and Competence Questionnaire (ESCQ) in Croatian samples*. Oral presentation in the symposium “Cross-cultural validation of Emotional Skills and Competence Questionnaire (ESCQ)”, at the 9th European Congress of Psychology, Granada, Spain.

Vinciarelli, A., Salamin, H., Polychroniou, A., Mohammadi, G., Origlia, A. (2012). From Nonverbal Cues to Perception: Personality and Social Attractiveness. *Cognitive Behavioral Systems*, 7403, Springer Verlag, pp. 60-72.

Vrij, A. (2008). *Detecting lies and deceit: Pitfalls and opportunities*. Chichester: Wiley.

Vrij, A. (2014). Interviewing to detect deception. *European Psychologist*, 19(3), 184-194. doi:10.1027/1016-9040/a000201

Vrij, A., & Graham, S. (1997). Individual differences between liars and the ability to detect lies. *Expert Evidence: The international digest of human behaviour science and law*, 5, 144-148.

- Vrij, A., Granhag, P. A., Mann, S., & Leal, S. (2011). Outsmarting the liars: Towards a cognitive lie detection approach. *Current Directions in Psychological Science*, 20(1), 28-32.
- Vrij, A., van der Steen, J., & Koppelaar, L. (1995). The effects of street noise and field independence on police officers' shooting behavior. *Journal of Applied Social Psychology*, 25(19), 1714-1725.
- Wathen, C. N., & Burkell, J. (2002). Believe it or not: Factors influencing credibility on the Web. *Journal of the American Society for Information Science and Technology*, 53(2), 134-144.
- Weldy, C. R., Rapp, J. T., & Capocasa, K. (2014). Training Staff to Implement Brief Stimulus Preference Assessments. *Journal Of Applied Behavior Analysis*, 47(1), 214-218.
- Williams, M. (2012). Perspective taking building positive interpersonal connections and trustworthiness one interaction at a time. In K. S. Cameron & G. M. Spreitzer (Eds.), *The Oxford handbook of positive organizational scholarship*, 462-473. New York, NY: Oxford University Press.
- Winter, D. G. (1994). *Manual for scoring motive imagery in running text*. Unpublished instrument, University of Michigan, Ann Arbor.
- Winter, D. G., John, O. P., Stewart, A. J., Klohnen, E. C., & Duncan, L. E. (1998). Traits and Motives: Toward an Integration of Two Traditions in Personality Research. *Psychological Review*, 105(2), 230-250.
- Witkin, H. A., Dyk, R., Faterson, H. F., Goodenough, D. R., & Karp, S. A. (1962). *Psychological Differentiation*, New York: John Wiley & Sons.

Witkin, H. A., Goodenough, D. R., & Oltmann, P. K. (1979). Psychological differentiation: Current status. *Journal of Personality and Social Psychology*, 37(7), 1127-1145.

Wojciechowski, J., Stolarski, M., Matthews, G. (2014). Emotional Intelligence and Mismatching Expressive and Verbal Messages: A Contribution to Detection of Deception. *PLoS ONE*, 9(3). doi:10.1371/journal.pone.0092570

Wright, G. R. T., Berry, C. J., Catmur, C., & Bird, G. (2015). *Good Liars Are Neither 'Dark' Nor Self-Deceptive*. *PLoS ONE* 10(6): e0127315. doi:10.1371/journal.pone.0127315

Young, T. L., & Hagedorn, W. B. (2012). The effect of a brief training in motivational interviewing on trainee skill development. *Counselor Education & Supervision*, 51(2), 82-97. doi:10.1002/j.1556-6978.2012.00006.xfigure

Zarins, S., & Konrath, S. (2014). *RUNNING HEAD: NARCISSISM AND LIE DETECTION*
Tell a tall tale and watch a narcissist fail: Narcissism and lie detection via email.

Zuckerman, M., DePaulo, B. M., & Rosenthal, R. (1981). Verbal and nonverbal communication of deception. In L. Berkowitz (Ed.), *Advances in experimental social psychology*, 14, (pp. 1–59). New York: Academic Press.

Zuckerman, M., Koestner, R., & Alton, A. (1984). Learning to detect deception. *Journal of Personality and Social Psychology*, 46, 519-528.

APPENDICES

Appendix A

Comparison Question Test (CQT)

Validity and Reliability Of Polygraph

Issues pertaining to the validity and reliability of polygraph testing have been an area of keen review and research (OTA,1983; NAS, 2002). A review that was carried out by the Office of Technology in 1983 and a study by the National Academy Science in 2002 converge on the issue of threats posed by countermeasures to the validity of polygraph testing.

The issue of subjects undergoing criminal or intelligence testing using purposeful techniques, or countermeasures, to defeat the polygraph testing, especially the comparison question testing, has been an area of key concern among polygraph examiners.

The cause for examiners' concern for countermeasure threats against the Comparison Question Test (CQT) stems from the fact that it is the most commonly used technique in the field (Kircher & Raskin, 1988) amongst many other testing techniques (i.e. relevant irrelevant technique, peak of tension test, guilty knowledge test and comparison question testing).

1.1 CM Threats - Criminal and Intelligence Testing

Subjects who successfully utilize techniques to defeat polygraph testing reduce the effectiveness of the test and its investigative utility. The impact of subjects who successfully defeat the test or bring about a false negative error is different in a criminal testing environment as compared to an intelligence-testing environment. In criminal cases, polygraph evidence is normally used as an additional forensic tool in an array of other forensic evidence to try a case.

However, in security and intelligence related areas where polygraph tests are at times used as the sole measure to assess loyalty aspects of intelligence operatives, subjects who defeat the testing and continue to have access to classified information and operations pose a serious threat to a nation's security and well being. The serious damage caused by the continued espionage activities of Aldrich Ames, a CIA operative who reportedly used countermeasures to defeat CIA intelligence polygraph tests, is a case in point.

1.2 Comparison Question Theory and Diagnostic Rules

When polygraph testing is carried out using the Comparison Question Test (CQT), a subject's physiological responses to a set of "control" or comparison questions and a set of relevant or crime questions are compared in order to determine the subject's truthfulness (Horvath, 1988). Simply stated, more consistent and pronounced responses to comparison questions rather than to relevant questions leads to a decision of truthfulness, whereas consistently greater responses to relevant than to comparison questions will lead to a decision of deception.

To further illustrate the CQT theory and diagnostic rule, in a case involving the theft of \$500 from a Quality Dairy Store, a suspect undergoing a polygraph examination may be asked "Have you ever stolen anything of value even one time in your entire life?" as a comparison question and "Did you steal the missing \$500?" as a relevant or crime question. The CQT theory is based on the assumption that an innocent subject will show a greater differential reaction to the comparison question than to the relevant question and that a deceptive subject will show a greater differential reaction to the relevant question rather than the comparison question (Honts, Raskin, & Kircher, 1994).

1.3 CQT Scoring Rules

The differential reactions observed between the comparison question are quantified using semi-objective numerical scoring rules. Using this numerical scoring, comparisons are made between a control and relevant question pair for each physiological parameter and either a positive score or a negative score is then assigned. Using a three-point scale of -1, 0, or 1, a positive score is assigned when a greater reaction is observed to the comparison question and a negative score is assigned when the reaction to the relevant question is greater. A score of zero is assigned in the event that no differential reactions are observed between a relevant and comparison question pair. Thereafter, the respective control/relevant scores for each parameter are added up for each question pair. This evaluation process is repeated for each of the charts collected during a polygraph examination. The final examination total score is obtained by adding the scores for each question on each of the charts collected.

Based on the CQT theory, innocent subjects would end up with positive examination scores, as they would show greater differential response to the comparison questions compared to relevant questions. Accordingly, guilty subjects would end up with negative examination scores, as they would show greater differential response to relevant questions or crime related questions. Although critics of polygraph testing disagree with the notion that innocent and guilty subjects will show such differential responses in real world polygraph testing, mean numerical scores obtained from laboratory studies lend support to the CQT theory. Mean numerical scores of innocent and guilty subjects, as shown in Table 1, clearly suggest that innocent subjects responded to a greater extent to the comparison questions than to the relevant questions.

Table 1

Mean Numerical Scores of Innocent and Guilty Subjects Reported in Laboratory Experiments Examining the Comparison Question Technique Using a Simulated or Mock Crime

Number	Author(s)	Mean Numerical Scores	
		Innocent	Guilty
1.	Barland & Raskin	3.5	-8.39
2.	Bradley & Janisse [A]	1.92	- 1.98
3.	Bradley & Ainsworth	5.0	-3.5
4.	Dawson [B]	6.0	-9.5
5.	Driscoll, Honts, & Jones [C]	10.4	-10.7
6.	Hammond [E]	3.44	-9.42
7.	Honts, Hodes, & Raskin [Exp 1]*	4.0	-12.0
8.	Honts, Hodes, & Raskin [Exp 2]*	4.0	-12.0
	Raskin [Exp 2]		
9.	Honts*	7.8	-3.4
10.	Horvath [Exclusive CQ]	18.5	-12.0
11.	Horvath [Nonexclusive CQ]	18.8	-24.5
12.	Patrick and Iacono	1.42	-14.33
13.	Palmatier [Exclusive CQ]	0.53	-7.47
14.	Palmatier [Non-exclusive CQ]	10.07	-12.1
15.	Podlesny & Raskin [Exclusive CQ]	13.6	- 11.7
16.	Podlesny & Raskin [Non exclusive CQ]	14.8	- 6.3
17.	Podlesny and Truslow	14.5	-9.86
18.	Raskin & Hare	9.4	-11.1
19.	Rovner	18.1	-12.6

[A] Results reported based on GSR parameter

[B] Results reported based on initial answer test

[C] Results reported based on CQ tests

[D] Results reported based on blind evaluator's decisions

[E] Results reported based on experienced examiner's decisions

* Data reported exclude countermeasure treatment groups

1.4 Strategies to Defeat CQT

Persons who are lying about the crime questions, however, may employ countermeasures during a CQT. That is, they try to “defeat” or “beat” the test. This can be done in one of two ways. First, physiological responses to relevant questions may be suppressed, relative to the comparison question responses. Secondly, physiological responses to comparison questions may be “artificially” enhanced as compared to the relevant questions. In either instance, the use of the above strategies is intended to show a greater differential response to the comparison questions than to the relevant questions. The objective of doing so is to change the outcome of a polygraph examination from that of “deception indicated” to “no deception indicated.” This results in what is termed a false negative outcome, or a deceptive person reported as truthful. Out of the two strategies, CQT critics have explicitly stated that enhancing one’s reaction to the comparison question is the more effective method (Lykken, 1998).

Literature Review

2.1 Definition of Countermeasure

There are several definitions for the term “countermeasure,” however, for the purposes of this study, countermeasures will be defined as “deliberate techniques which a subject use in an attempt to appear non deceptive when his physiological responses are being monitored during a polygraph examination” (Matte, 1998).

2.2 CQ Testing and Error Rates

In CQ testing, as in all diagnostic testing, two types of errors can possibly occur. In polygraph testing, a false positive error occurs when an innocent person is assessed to be guilty while a false negative error occurs when a guilty subject is deemed to be innocent.

The robustness of CQT testing with respect to false positive and false negative errors has been widely debated by both opponents and proponents of polygraph testing. Critics' contention is that the innocent and guilty alike would know which are the relevant or crime questions during the question review and accordingly will be concerned or aroused by these questions (Ben-Shakkar & Furedy, 1990; Iaconno, 2001). This, critics say, would give rise to a high false positive rate in real world testing. Based on laboratory studies, false positive rates reported in at least 3 studies, as shown in Table 2.1, support the critics' view.

Table 2.1

Number of Subjects, False Positive Errors, False Negative Errors and Inconclusives For Laboratory Experiments Examining the Comparison Question Technique Using a Simulated or Mock Crime

of S.N.	Author(s)	No. of Innocent (N)	No. (%) of False Positives	No. of Guilty (N)	No. (%) False
1.	Barland & Raskin	36	6 (16.7%)	36	3 (8.3%)
2.	Bradley & Janisse [A]	96	6 (9.4%)	96	13 (13.5%)
3.	Bradley & Ainsworth	8	1 (12.5%)	32	6 (18.8%)
4.	Dawson [B]	12	3 (25%)	12	0 (0.0%)
5.	Driscoll, Honts, & Jones [C]	20	0 (0.0%)	20	0 (0.0%)
6.	Forman & McCauley [D]	16	5 (31.3%)	22	2 (9.5%)
7.	Gatchel, Smith, & Kaplan	14	0 (0.0%)	14	1 (7.1%)
8.	Ginton, Daie, Elaad, & Ben-Shakkar	13	1 (7.7%)	2	0 (0.0%)
9.	Hammond [E]	30	3 (10.0%)	32	1 (3.1%)
10.	Honts, Hodes, & Raskin [Exp 1]	12	4 (33.3%)	36	3 (8.3%)
11.	Honts, Hodes, & Raskin [Exp 2]	19	4 (21.1%)	38	9 (23.7%)
12.	Honts	20	3 (15.0%)	100	29 (29.0%)
13.	Honts, Raskin & Kircher	10	2 (20%)	20	7 (35%)

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

14.	Horowitz	15	3 (20%)	15	2 (13.3%)
15	Kircher	50	3 (6.0%)	50	3 (6.0%)
16	Horvath	20	4 (20%)	20	3 (15%)
17.	O'Toole	16	4 (25%)	64	15 (23.4%)
18.	Patrick & Iacono	24	8 (33.3%)	24	3 (12.5%)
19.	Palmatier [Zone]	30	8 (26.7%)	30	3 (10%)
20	Palmatier [MGQT]	30	9 (30%)	30	6 (20%)
21.	Podlesny & Raskin	20	1 (5%)	20	3 (15%)
22.	Podlesny and Truslow	24	1 (4.2%)	72	9 (12.5%)
23.	Raskin & Hare	24	2 (8.33%)	24	0 (0%)
24.	Rovner	36	5 (13.9%)	36	3 (8.3%)
25.	Widaki & Horvath	60	1 (2%)	20	1 (5%)
26	Yankee & Grimsley	36	0 (0%)	36	4 (11%)

[A] Results reported based on GSR parameter

[B] Results reported based on initial answer test

[C] Results reported based on CQ tests

[D] Results reported based on blind evaluator's decisions

[E] Results reported based on experienced examiner's decisions

Studies by Honts et al. (Expt. 1), Forman and McCauley, Patrick and Iaconno, and Palmatier (MGQT) report false positive rates of 30% and above. However, in a seminal study, Horvath (1988) examined the more fundamental question as to the utility with the use of comparison questions to discriminate between the truthful and deceptive as compared to when no comparison questions are used in a polygraph test. His research conclusion was as follows:

“...findings show that CQ testing relative to testing without comparison questions has empirically demonstrated advantages; comparison question testing enhances the ability to make use of physiological data to discriminate more effectively between truthful and deceptive subjects. Moreover, as field examiners have maintained, the use of comparison questions reduces the probability of false positive errors” (Horvath, 1988, p. 207)

In essence, Horvath's study provides empirical evidence that the inclusion of comparison questions, albeit not being able to eradicate false positive errors completely, does provide an effective psychological control for the emotional impact of being asked the crime-related questions. A similar finding to that of Horvath was reported in Horowitz's (1989) study. In addition to the above, there is also empirical evidence that strongly suggests that the probability of identifying truthful subjects can be increased by using a variation of the comparison question asked during the testing, i.e. use of non exclusive comparison questions as compared to use of exclusive comparison questions (Horvath 1988; Palmatier, 1991). Existing research carried out in a laboratory environment also suggests that innocent subjects do not respond strongly to crime related questions even if the said crime questions are made transparent to them (Bradley, Maclaren & Black, 1996).

In general, countermeasure strategies used by guilty subjects to alter their test data can be classified under two broad categories, namely general state and specific state countermeasures.

2.3 General State Countermeasures

General state countermeasures are deliberate techniques employed to change the general physiological state of the individual during the polygraph examination (Honts, 1987). Consumption of alcohol and pharmaceuticals has been considered to reduce a person's physiological and psychological functioning (Reid & Inbau, 1977). This psychological and physiological impairment experienced by intoxicated subjects may affect the differential responses to the relevant questions (i.e. crime related questions) and to the comparison questions, which may lead to the wrong classification of a deceptive person being rendered innocent of the crime (i.e. subjects' reduced responses to crime questions relative to their responses to comparison questions would lead to the classification of deceptive subjects as innocent). The effect of alcohol intoxication and the effects of a beta blocking drug "Propanolol," both general state countermeasures, have been researched by Bradley and Ainsworth (1984) and Gathel, Smith and Kaplan (1984). A review of the studies is as follows:

2.3.1. Effects Of Alcohol

Bradley and Ainsworth's 1984 Subjects in the intoxication conditions received a 1.0 ml/kg of body weight dose of vodka with 40% alcohol content.

O'Toole, Yuille, Patrick and Iaconno (1989) also reported similar findings in their study. However, in their study, O'Toole et al. reported that subjects under the influence of alcohol during the commission of the crime were also detected at rates better than chance.

2.3.2. Effects of Pharmaceuticals – Propanolol

Gatchel, Smith and Kaplan (1984) studied the effects of propanolol, a beta-blocking drug used for the treatment of cardiovascular and anxiety related disorders, on the accuracy of CQ testing. Together, both studies seem to suggest that general state countermeasures are ineffective against the CQT.

2.4 Specific State Countermeasures

Specific state countermeasures, or point countermeasures, are another category of deliberate activities employed at specific points during the polygraph examination. These specific point activities can be executed by means of mental or physical activities targeted at either suppressing reactions to the relevant questions or enhancing reactions to the comparison questions.

Out of the two strategies, either that of suppressing reactions to the relevant questions or that of enhancing reactions to comparison questions, CQT critics have explicitly stated that enhancing one's reaction to the comparison questions is the more effective method. Lykken (1998) captures the essence of the above statement as follows:

“People could learn to attenuate their relevant responses and beat the lie detector in that fashion – but that is very difficult for most people and probably impossible for many. A much more effective method of beating the lie detector, however, is to augment one's reaction to the comparison questions” (Lykken D.T, 1998, p. 274).

Dawson's (1980) study findings also support Lykken's statement. Guilty subjects who had used their training in the Stanislavsky method of using their personal memories and sensory experiences to create emotional states in order to dissociate from the testing situation, mock crime or both were not able to defeat the testing. It would seem that enhancing reactions to the comparison questions holds more promise in defeating the comparison question test.

Existing literature suggests that comparison questions are vulnerable to point countermeasure when applied by subjects who had received at least "mid-level" sophistication in countermeasure use. To facilitate analysis of existing studies, working definitions of low, mid and high-level countermeasure use will be defined and existing countermeasure literature will be reviewed under the said categories:

- a. Low-level countermeasures - countermeasure maneuvers (i.e. physical or cognitive or a combination of the techniques) employed without any systematic training.
- b. Mid-level countermeasures – countermeasure maneuvers employed with prior information and systematic training in the unobtrusive and timely use of a single method or a combination of countermeasure techniques to evade detection during a polygraph examination.
- c. High-level countermeasures – countermeasure maneuvers employed with prior systematic training and feedback obtained during practice polygraph tests during which a trained individual or polygraph examiner works with the subject to perfect countermeasure maneuvers employed by subjects

2.4.1 Effects Of Low-Level Countermeasures

Existing countermeasure literature suggests that subjects employing spontaneous countermeasures cannot defeat the CQT (Rovner, 1979; Honts, Raskin, Kircher & Hodes 1988; Dawson 1980; Honts, Amato, & Gordon, 2001).

While Rovner's study provided evidence of the effect of detailed information on CQT, Dawson's 1980 research suggests that subjects experienced in the use of a specific mental countermeasure, without any form of systematic training likewise cannot defeat the CQT. In Dawson's (1980) study, 24 actors trained in the Stanislavsky method of using personal memories of sensory experiences in order to create emotional states took. Accordingly, Dawson stated that "the physiological results suggest that these mental countermeasure maneuvers, employed by subjects who were formally trained and practiced in such techniques, were ineffective, in the present situation." (Dawson, 1980, p. 15).

Existing research also suggests that, in the absence of systematic training, no one single type of countermeasure (i.e. cognitive or physical countermeasure) or combination of countermeasure maneuvers can increase the probability of subjects being able to defeat the comparison question test (Rovner 1979; Honts 1987; Honts, Raskin, Kircher & Hodes, 1988).

2.4.2 Effects of Mid-Level Countermeasures

Most of the current research on the effects of mid-level countermeasures on CQT, except for one study, seems to suggest that subjects who employ mid-level countermeasures can successfully defeat the polygraph test. Polygraph critics such as Lykken have suggested that guilty subjects given prior information about CQT and training in simple countermeasures will be able to defeat the CQT. Although the said hypothesis was not

substantiated in studies by Lykken (1998), the results of the Honts (1986) study suggests that this may be the case. “

Contrasted against the above findings, results from an experiment by Honts, Hodes and Raskin (1985) suggest that the CQT is robust against mid-level countermeasure maneuvers.

Test results revealed that the said countermeasures utilized in this study were generally unsuccessful. Researchers concluded, “the lack of physical countermeasure on either the categorical decisions or on the semi objective scores of the two examiners may be interpreted as supportive of the accuracy and robustness of the CQT” (Honts, Hodes & Raskin, 1985, pp. 182).

Appendix B

List of Traits Important to a Polygraph Examiner (DACA, 2006)

1. Must be willing to admit and learn from mistakes. Must be able to handle feedback and constructive criticism.
2. Willing to use a time of self-reflection following each interview to determine what was done to cause the examinee to open up.
3. Must be willing to learn from everybody; willingness to learn new/different approaches.
4. Must be detail oriented. Attention to detail is important.
5. Intensity, passion, desire, and attitude – experts have these.
6. Adaptability – can't be rigid
7. Flexibility and fortitude – needed qualities.
8. Must have a natural curiosity; a natural inquisitiveness about people.
9. Capable of putting people at ease. Easy to talk to.
10. Know how to keep their (the examiner's) ego in check.
11. Must be fair and impartial/non-judgmental.
12. Must be honest. Must be sincere.
13. Must care about what you do.
14. Must believe in what you do.
15. Must have understanding and compassion for examinees
16. Must have a way with words; be able to use the right words to the desired effect.
17. Must have the ability to talk a long time in the post-test.
18. Helps to be demonstrative.
19. Must be careful about revealing emotion (anger, shock, frustration)
20. Persistence and perseverance.
21. Sense of humor.

22. Being a Type A helps.
23. Must have the ability to think on your feet. Ability to improvise.
24. Able to confront people when necessary.
25. Have an outgoing personality
26. Must be self-motivated; be a self-starter.
27. Ability to make on-the-fly decisions (concerning questions and follow-on questions)
28. "Establishing rapport is necessary but not trainable."

Appendix C

**Importance of competency indicative of superior interrogator performance (DACA,
2007)**

Competency Indicative of Superior Interrogators	Average Rating of Importance
1. Data Assembly	3.75
2. Data Integration	3.75
3. Psychological Stage Setting	2.75
4. Trust Building	4.50
5. Managing Direction and Pace	4.25
6. Listening and Attending	3.75
7. Key Behavior Recognition	3.25
8. Non-Verbal Savvy	3.00
9. Event Detail Establishment	3.00
10. Inconsistency Awareness	3.50
11. Interrogation Adaptability	4.75
12. Strategy Adjustment	4.00
13. Psychological Leveraging	4.00
14. Interrogation Gamesmanship	4.50
15. Interrogation Risk Management	3.25
16. Courtroom/Legal Knowledge Integration	1.75
17. Tenacity & Persistence	4.50

Appendix D

Big Five Inventory

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? You will need to indicate how much you agree or disagree with each statement by clicking a number from 1 to 5 from the following scale:

1. Strongly disagree
2. Disagree
3. Neither disagree nor agree
4. Agree
5. Strongly agree

There are no "right" or "wrong" answers, so select the number that most closely reflects you on each statement. Take your time and consider each statement carefully. Once you have completed all questions click "Submit" at the bottom.

I see myself as someone who...

1. ...Is talkative

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

2. ...Tends to find fault with others

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

3. ...Does a thorough job

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

4. ...Is depressed, blue

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

5. ...Is original, comes up with new ideas

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

6. ...Is reserved

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

7. ...Is helpful and unselfish with others

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

8. ...Can be somewhat careless

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

9. ...Is relaxed, handles stress well

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

10. ...Is curious about many different things

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

11. ...Is full of energy

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

12. ...Starts quarrels with others

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

13. ...Is a reliable worker

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

14. ...Can be tense

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

15. ...Is ingenious, a deep thinker

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

16. ...Generates a lot of enthusiasm

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

17. ...Has a forgiving nature

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

18. ...Tends to be disorganized

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

19. ...Worries a lot

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

20. ...Has an active imagination

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

21. ...Tends to be quiet

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

22. ...Is generally trusting

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

23. ...Tends to be lazy

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

24. ...Is emotionally stable, not easily upset

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

25. ...Is inventive

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

26. ...Has an assertive personality

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

27. ...Can be cold and aloof

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

28. ...Perseveres until the task is finished

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

29. ...Can be moody

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

30. ...Values artistic, aesthetic experiences

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

31. ...Is sometimes shy, inhibited

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

32. ...Is considerate and kind to almost everyone

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

33. ...Does things efficiently

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

34. ...Remains calm in tense situations

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

35. ...Prefers work that is routine

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

36. ...Is outgoing, sociable

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

37. ...Is sometimes rude to others

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

38. ...Makes plans and follows through with them

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

39. ...Gets nervous easily

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

40. ...Likes to reflect, play with ideas

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

41. ...Has few artistic interests

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

42. ...Likes to cooperate with others

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

43. ...Is easily distracted

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

44. ...Is sophisticated in art, music, or literature

Strongly Disagree 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Strongly Agree

Appendix E

Emotional Skills and Competency Questionnaire (ESCQ)

This is not a test to examine your knowledge; therefore there is no wrong answer.

We are interested in how you usually feel and think.

Answer the questions immediately without thinking too much about them.

Answer how much the given claims apply to you by circling the appropriate number.

Claim Evaluation

1) I am able to maintain a good mood even if something bad happens.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

2) Putting my feelings and emotions into words comes easily to me.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

3) I can maintain a good mood, even when the people around me are in a bad mood.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

4) Unpleasant experiences teach me how not to act in the future.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

5) When somebody praises me, I work with more enthusiasm.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

6) When something doesn't suit me, I show this immediately.

1	2	3	4	5
---	---	---	---	---

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Never Seldom Occasionally Usually Always

7) When I don't like a person, I find ways to let him/her know.

1 2 3 4 5

Never Seldom Occasionally Usually Always

8) When I am in a good mood, it is difficult to bring my mood down.

1 2 3 4 5

Never Seldom Occasionally Usually Always

9) When I am in a good mood, every problem seems soluble.

1 2 3 4 5

Never Seldom Occasionally Usually Always

10) When I am with a person who thinks highly of me, I am careful about how I behave.

1 2 3 4 5

Never Seldom Occasionally Usually Always

11) I study and learn best, when I am in a good mood and happy.

1 2 3 4 5

Never Seldom Occasionally Usually Always

12) If I really want to, I will solve a problem that may seem insoluble.

1 2 3 4 5

Never Seldom Occasionally Usually Always

13) When I meet an acquaintance, I immediately notice his/her mood.

1 2 3 4 5

Never Seldom Occasionally Usually Always

14) When I see how someone feels, I usually know what has happened to him

1 2 3 4 5

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

Never Seldom Occasionally Usually Always

15) I am able to tell the difference if my friend is sad or disappointed.

1 2 3 4 5

Never Seldom Occasionally Usually Always

16) I can easily think of a way to approach a person I like.

1 2 3 4 5

Never Seldom Occasionally Usually Always

17) I am capable to list the emotions that I am currently experiencing.

1 2 3 4 5

Never Seldom Occasionally Usually Always

18) I am able to detect my friend's mood changes.

1 2 3 4 5

Never Seldom Occasionally Usually Always

19) I can easily think of a way to make my friend happy on his/her birthday.

1 2 3 4 5

Never Seldom Occasionally Usually Always

20) I do not have difficulty to persuade a friend that there is no reason to worry.

1 2 3 4 5

Never Seldom Occasionally Usually Always

21) I am able to express my emotions well.

1 2 3 4 5

Never Seldom Occasionally Usually Always

22) I can recognize most of my feelings.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

23) I am capable to describe my present emotional state.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

24) I can say that I know a lot about my emotional state.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

25) If I observe a person in the presence of others, I can determine precisely her or his/her emotions.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

26) I do not have difficulty to notice when somebody feels helpless.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

27) My behavior is a reflection of my inner feelings.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

28) People can tell what mood I am in.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

29) I try to control unpleasant emotions, and strengthen positive ones.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

30) There is nothing wrong with how I usually feel.

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

31) I do my duties and assignments as soon as possible, rather than think about them

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

32) I usually understand why I feel bad.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

33) I try to keep up a good mood.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

34) I am able to tell somebody's feelings by the expression on his/her face.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

35) I can detect my friends' concealed jealousy.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

36) I notice when somebody tries to hide his/her bad mood.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

37) I notice when somebody feels guilty.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

PERSONALITY, TRAINING AND DETECTION OF DECEPTION

38) I notice when somebody tries to hide his/her real feelings.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

39) I notice when somebody feels down.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

40) As far as I am concerned, it is normal to feel the way I am feeling now.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

41) I have found it easy to display fondness for a person of the opposite sex.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

42) I notice when somebody's behavior varies considerably from his/her mood.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

43) I can easily name most of my feelings.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

44) I am able to express how I feel.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

45) I know how to pleasantly surprise each of my friends.

1	2	3	4	5
Never	Seldom	Occasionally	Usually	Always

Appendix F

Group Embedded Figures Test

By Philip K. Oltman, Evelyn Raskin,
& Herman A. Witkin

Name _____

Sex _____

Today's date _____

Birth date _____

INSTRUCTIONS: This is a test of your
ability to find a simple form when it is
hidden within a complex pattern.

Here is a simple form which we have labeled "X":

This simple form, named "X", is hidden within the
more complex figure below:

Try to find the simple form in the complex figure
and trace it *in pencil* directly over the lines of the
complex figure. It is the SAME SIZE, in the SAME
PROPORTIONS, and FACES IN THE SAME
DIRECTION within the complex figure as when it
appeared alone.

When you finish, turn the page to check your
solution.

This is the correct solution, with the simple form traced over the lines of the complex figure:

Note that the top right-hand triangle is the correct one; the top left-hand triangle is similar, but faces in the opposite direction and is therefore *not* correct.

Now try another practice problem. Find and trace the simple form named "Y" in the complex figure below it:

Look at the next page to check your solution.

Solution:

In the following pages, problems like the ones above will appear. On each page you will see a complex figure and under it will be a letter corresponding to the simple form which is hidden in it. For each problem, look at the BACK COVER of this booklet to see which simple form to find. Then try to trace it in pencil over the lines of the complex figure. Note these points:

1. Look back at the simple forms as often as necessary.
2. ERASE ALL MISTAKES.
3. Do the problems in order. Don't skip a problem unless you are absolutely "stuck" on it.
4. Trace ONLY ONE SIMPLE FORM IN EACH PROBLEM. You may see more than one, but just trace *one* of them.
5. The simple form is always present in the complex figure in the SAME SIZE, the SAME PROPORTIONS, and FACING IN THE SAME DIRECTION as it appears on the back cover of this booklet.

Do not turn the page until the signal is given

FIRST SECTION

Find Simple Form "B"

Find Simple Form "G"

Go on to the next page

SECOND SECTION

Find Simple Form "G"

Find Simple Form "A"

Go on to the next page

THIRD SECTION

Find Simple Form "F"

Find Simple Form "G"

Go on to the next page

SIMPLE FORMS

Appendix G

Sample Pictures for Picture Story Exercise (PSE)

Appendix H

Personality Research Form

Please respond True (T) or False (F) for each item

1. I am quite independent of the people I know.
2. I feel confident when directing the activities of others.
3. I choose hobbies that I can share with other people.
4. I would make a poor military leader.
5. I seldom put out extra effort to make friends.
6. I would like to be a judge.
7. I go out of my way to meet people.
8. I avoid positions of power over other people.
9. I don't really have fun at large parties.
10. I try to control others rather than permit them to control me.
11. People consider me to be quite friendly.
12. I don't like to have the responsibility for directing the work of others.
13. I would not be very good at a job that required me to meet people all day long.
14. I would like to play a part in making laws.
15. I truly enjoy myself at social functions.
16. I have little interest in leading others.
17. When I see someone I know from a distance, I don't go out of my way to say hello.
18. In an argument, I can usually win others over to my side.
19. I spend a lot of time visiting friends.
20. I feel uneasy when I have to tell people what to do.
21. Sometimes I have to make a real effort to be sociable.
22. The ability to be a leader is very important to me.
23. My friendships are many.
24. Most community leaders do a better job than I could possibly do.
25. I don't spend much of my time talking with people I see every day.

26. I am quite effective at getting others to agree with me.
27. I trust my friends completely.
28. I am not very insistent in an argument.
29. Often I would rather be alone than with a group of friends.
30. I would like to be an executive with power over others.
31. I try to be in the company of friends as much as possible.
32. I would not want to have a job enforcing the law.
33. People should be more involved with their work.
34. I seldom set standards that are difficult for me to reach.
35. I enjoy difficult work.
36. I have rarely done extra studying in connection with my work.
37. I will not be satisfied until I am the best in my field of work.
38. I try to work just hard enough to get by.
39. I would work just as hard whether or not I had to earn a living.
40. I do not let my work get in the way of what I really want to do.
41. My goal is to do at least a little bit more than anyone else has done before.
42. In my work I seldom do more than is necessary.
43. I often set goals that are very difficult to reach.
44. People seldom think of me as a hard worker.
45. As a child I worked a long time for some of the things I earned.
46. It really doesn't matter to me whether or not I become one of the best in my field.
47. I don't mind working while others are having fun.
48. I am not really very certain what I want to do or how to go about doing it.

Appendix I

NUS Study of Detection of Deception, 2003

This study was done specifically to explore whether responses to polygraph interviews would differ when innocent and guilty participants were explicitly told to use countermeasures (or not to use them). Countermeasures refer to deliberate mental or physical procedures used by examinees to change their physiological data recordings during the collection of physiological data in a polygraph examination.

Seventy-two undergraduate students recruited from the NUS campus were randomly assigned to two treatment conditions, namely Programmed Innocent and Programmed Guilty groups. Participants in Programmed Innocent group did not commit a mock crime while. Participants in the Programmed Guilty group committed a mock crime involving the theft of an envelope from the office of a professor. Participants in the Programmed Innocent group were further randomly assigned to one of three subgroups, namely Innocent Control, Innocent Mental Countermeasure or Innocent Physical Countermeasure. Participants in the Programmed Guilty Group were randomly assigned to Guilty Control, Guilty Mental Countermeasure and Guilty Physical Countermeasure subgroups.

Participants in the Programmed Guilty Countermeasure Groups and Programmed Innocent Countermeasure Groups received information and training in the use of a physical or mental countermeasure procedure to influence the outcome of their polygraph examination. Participants in the Innocent and Guilty Control subgroups did not receive any training or information to influence the outcome of their polygraph examination. During their training, participants belonging to the Innocent and Guilty Countermeasure subgroups received the same information and training in the use of their countermeasure procedures while listening to a recording of a polygraph test question sequence. The polygraph test

question sequences that were used during the practice tests were similar to the question sequences that were asked during their actual polygraph examination. Participants assigned to the Innocent and Guilty Countermeasure Physical subgroups were trained to curl their toes upon recognition of comparison questions. Participants assigned to the Innocent and Guilty Countermeasure Mental subgroups were trained to execute the mental task of counting backwards by 7s from a number greater than 200 upon recognition of the comparison questions (Honts, 1986; Honts, Amato & Gordon, 2001)

The NUS participants in all treatment groups of the mock crime study were administered a polygraph examination according to the Marcy General Question Technique Protocol (Marcy MGQT) and were told that they would be paid SGD 50 if they were deemed truthful by the polygraph examiner. The payment of SGD 50 was made to increase the participants' motivation to attain a truthful outcome in their polygraph examination. The polygraph examinations were administered by a trained polygraph examiner who was advanced-certified in the Marcy General Question Technique.

Digital Polygraph Charts

The polygraph charts used in this study were obtained using the Lafayette LX 4000 polygraph instrument, a system that is currently utilized in both US and Singapore law enforcement agencies. The Lafayette Instrument Company of Lafayette, Indiana, USA, manufactures the said polygraph instrument. The polygraph instrument consists of a set of standard polygraph sensors and Data Acquisition Subsystem (DAS) connected to a laptop computer by means of a USB cable. The DAS was used to receive physiological data from sensors attached to the test subjects' body as well as the polygraph chair, and to transmit the data to the computer by means of a USB cable for recording and display.

During the examinations, participants' thoracic (chest) and abdominal breathing patterns were monitored by means of two pneumograph tubes (sensors). One of the pneumograph tubes was positioned around the participants' chest and another was positioned around the abdomen. Galvanic Skin Resistance (GSR) was recorded in DC mode through two stainless electrodes attached to the first and third finger of the participants' left hand. Cardiovascular activity was recorded with the use of a standard pneumatic blood pressure cuff wrapped around the upper left arm of participants. The pressure within the cuff was adjusted to obtain optimal recording and on the average, the pressure in the blood pressure cuff was set between 60-70 mm/hg. The cuff was massaged two to three times after inflating it to ensure that the air in the pressure cuff was evenly distributed. During physiology data collection, participants in this study were asked three relevant or crime specific questions (e.g., *Did you take that envelope from Dr Chin's office?*) and two comparison (control) type questions (e.g., *Not connected with the theft of envelope, did you ever take something that did not belong to you?*) and four neutral stimulus questions (e.g., *Are you now in Singapore?*).

Appendix J

FAINT Training

In the Forensic Assessment Interview Technique (FAINT) training, participants were taught how to utilise verbal and nonverbal behaviours to evaluate deception. According to the technique, there are clusters of behavioural cues which characterize truthful individuals and deceptive individuals. Through the use of still images and videos, participants were taught how to identify verbal and nonverbal behavioural manifests of truthful versus deceptive case suspects. For example, behavioural manifests of truthful suspects include appearing “relaxed and confident” and “increased use of illustrators³” while those of deceptive suspects include appearing “tense and defensive” and the “use of adaptors⁴” (refer to Figure J1 full description of the behavioural manifests of truth and deception).

Participants were trained to evaluate a case suspect’s verbal and nonverbal behaviour using a standardized FAINT questionnaire. In this questionnaire, the suspect’s responses to key questions related to the case (e.g. “did you steal that car”, or “why do you think someone would do something like this”) will be evaluated using precise scoring criteria (e.g. answering “no” without hesitation or use of adaptors). Based on the FAINT questionnaire, an overall score will be computed for each case suspect. A decision of DI will be rendered for scores less than 4 and decision of NDI will be rendered for scores of more than 9. Any score in between led to a decision of INC.

³ Illustrators are defined as nonverbal behaviours that help the listener understand the speaker’s verbal communication. For instance, nonverbally touching one’s chest, implying, “Look at me, I have nothing to hide”, as one verbally states, “I didn’t do it!” is a sample of an illustrator.

⁴ Adaptors are nonverbal gesticulations that do not help the listener understand the speaker’s verbal message. They may even interfere with the listener’s ability to comprehend what is being said. For example, the act of covering one’s mouth as he speaks is an adaptor.

BOX 9.2	
FAINT: NONVERBAL BEHAVIOR INDICATIVE OF TRUTH AND DECEPTION	
Truthful	Deceptive
Relaxed and confident	Tense and defensive
Face to face body alignment	Evasive body alignment
Increased use of illustrators	Use of adaptors
Natural and settled foot and body positions	Tense, repetitive, restless foot and body movements

Figure J1. Clusters of nonverbal cues indicative of truth and deception.

Criterion measures of interest in this research are participant's accuracy and sensitivity in the detection of deception. Accuracy of a participant's ability to detect deception is computed with the proportion of their correct decisions to total decisions made. Sensitivity of a participant to verbal and nonverbal behavioural cues is computed with the magnitude of scores in his correct decisions. In the case if an examiner has no correct decisions both his accuracy and sensitivity would be zero.

Figure J2. Nonverbally touching one's chest, implying, "Look at me, I have nothing to hide", as one verbally states, "I didn't do it!" is a sample of an illustrator.

Figure J3. Use of an adaptor.

Figure J4. Displacement activities such as pulling of socks may be indicative of deception.

Figure J5. Hostile posture.

Appendix K

Study 1 Questionnaire

Listed below are traits that may make a good polygraph examiner. Please rate the importance of each trait. In the last question, please feel free to list other traits which have not been described in the survey.

	Description	Not Important at All	1	2	3	4	5	6	7	8	9	Very Important
1	They are likely to approach strangers at a party and introduce themselves; take the lead to organize a project	1	2	3	4	5	6	7	8	9	10	
2	They are likely to take the time to learn something simply for the joy of learning; look for stimulating activities that break out their routines	1	2	3	4	5	6	7	8	9	10	
3	They are likely to accept the good and bad in their lives without complaining or bragging	1	2	3	4	5	6	7	8	9	10	
4	They tend to emphasize the good qualities of other people when the person talks about them; lend things to people they know	1	2	3	4	5	6	7	8	9	10	
5	They are the type who would arrive early for appointments; study hard and get the highest grades in class	1	2	3	4	5	6	7	8	9	10	
6	They prefer autonomous mastery of challenging tasks	1	2	3	4	5	6	7	8	9	10	
7	They prefer social closeness with others	1	2	3	4	5	6	7	8	9	10	
8	They like to have impact on others	1	2	3	4	5	6	7	8	9	10	
9a)	Their perception of an object tends to be influenced by its background	1	2	3	4	5	6	7	8	9	10	
9b)	Their perception of an object is rarely influenced by its background	1	2	3	4	5	6	7	8	9	10	
10	Of the two perception styles 9a) and 9b), which do you think is more important in making a good polygraph examiner? (Please circle one of the below)											
	9a) 9b)											
11	Do you think there are any other qualities of a good polygraph examiner which has not been described above? Please list them in the space below.											

Appendix L

Email Invite to Student Participants

E-MAIL INVITE TO NTU STUDENTS

***INVITATION TO PARTICIPATE IN A STUDY TO EXPLORE
PERSONALITY CHARACTERISTICS CONTRIBUTING TOWARDS YOUR
ACCURACY OF DETECTION OF DECEPTION BY READING POLYGRAPH (LIE
DETECTOR) CHARTS***

Greetings,

This e-mail serves as an invitation to you to take part in a study to explore personality characteristics contributing towards your accuracy in detection of deception by means of reading polygraph (lie detector) chart data to assess a person's innocence or guilt.

Your participation in this study is strictly voluntary. Please note that you have the liberty to terminate your participation in this study at any point of time for any reason with no repercussions. No individual level data will be presented in any reports or presentations.

This study will be done in will be done in two Phases. Phase 1 will require to read a STUDENT PARTICIPATION CONSENT FORM and if you agree to participate in this study you will be required to indicate your informed consent and thereon will be required to answer a questionnaire via internet link. Likewise you can click a NO answer upon reading the STUDENT PARTICIPATION CONSENT FORM and you will be navigated out of the study website. All in Phase 1 will approximately take about 35-40 minutes to complete. Phase 2 of study will require a ONE time visit to a HSS classroom to fill in 3 sets of questionnaires and score polygraph charts obtained from 12-14 persons who were either guilty or innocent of a crime. You will paid SGD 30 for your time and effort in assisting us in this study. If you wish to take part in this study, please proceed on to read STUDENT PARTICIPATION CONSENT FORM that you will be required to answer.

Thank you

V. Cholan

STUDENT PARTICIPATION CONSENT FORM

***STUDY OF PERSONALITY CHARACTERISTICS CONTRIBUTING TOWARDS
POLYGRAPH (LIE DETECTOR) CHART ACCURACY***

Overview of Study

We are conducting a study to understand Personality characteristics contributing towards detection of deception by means of scoring sets of polygraph (Lie Detector) charts. This study will be done in a single visit to HSS building. During your visit, you will be asked to complete a set of questionnaire and thereafter score polygraph chart data of 12-14 individuals to assess their innocence or guilt of a crime. No prior knowledge or skills in polygraph chart scoring will be required as you will be trained in the use of US Polygraph Test Data Analysis Scoring Criteria using 3 point scale (+1, 0 or -1). This study does not utilize any form of deception and **no individual level performance or data**, be it your answers to questionnaires or scoring of chart data/responses will be reported or presented to anyone.

You will be paid SGD 30 at the end of the study session. Please note that your participation in this study is voluntary and you can withdraw from this study at any point for any reason without any penalty. The information collated in this study will be kept strictly confidential. No individual level data will be reported.

If you wish to take part in this study, please read the following to know more about the study proceedings, your rights and contact persons.

Study Proceedings

Overview - This study will be done in **2 Phases** and you will be required to fill in 4 questionnaires related to your personality and read polygraph charts that were obtained from 12-14 persons.

Phase 1 will require you to read a STUDENT PARTICIPATION CONSENT FORM and if you agree to participate in this study you will be required to indicate your informed consent and thereon will be required to answer a questionnaire via internet link. Likewise you can click a NO answer after reading the STUDENT PARTICIPATION CONSENT FORM and you will be navigated out of the study website.

All in Phase 1 will approximately take about 35-40 minutes to complete.

Phase 2 of study will require a **ONE** time visit to a HSS classroom to fill in 3 sets of questionnaires and score polygraph charts obtained from 12-14 persons who were either guilty or innocent of a crime.

You will be paid **SGD 30** for your time and effort in assisting us in this study. No prior preparation, knowledge or skills are required for your polygraph chart reading exercise as you will be trained to assess polygraph charts before your chart scoring exercise. As part of the study you will be asked to rate your confidence of your decisions of innocence or guilt based on polygraph charts of 12-14 persons.

Participation and Your Rights

Participation in this study is completely voluntary and you may withdraw from this study at any point of time for any reason without any penalty or consequences. Please feel free to raise any concerns at any time during the study to a study co-ordinator who will be present during the session.

The physical risk and mental stress involved during this study is no more than what you will experience in daily life and during your daily student tasks, but should you face questions you do not feel comfortable answering, you may disregard them. There is no penalty for your withdrawal and you may do so at any point during the study. However, please note that SGD 30 will be awarded to you only upon your completion of study questionnaires and chart scoring data.

Confidentiality of Information and Study Reports

The information collated in this study will be kept strictly confidential. All data will be processed using identification codes. At no time will you be individually identified, be it person or organization that you are through any of the collected data or generated information. The results of the study may be used in future written reports and/or conference presentations. It is important to note that no data at the individual level will be reported.

Contact Persons

Do feel free to contact the project supervisors, Professor Joyce Pang at joycepang@ntu.edu.sg, or +65 6790-6745, or V.Cholan at cholanjoshv@gmail.com should you have any additional queries with regards to the objectives and methods of this study. For enquires on research ethics, please contact the NTU Institutional Review Board: <http://research.ntu.edu.sg/GuidelinesnForms/Pages/Guidelines.aspx>, or at IRB@ntu.edu.sg

Thank you.

Study coordinator:

V.Cholan

Mobile : 91819743

E-mail: cholanjoshv@gmail.com

ACKNOWLEDGEMENT

Co- Principal Investigator - I wish to state that I have explained all procedures and answered all queries truthfully raised by _____

Name _____

Signature _____

Date _____

Examiner/ Participant - I have read and understood the above. I wish to state that the above mentioned has explained all procedures and all my queries. I wish to state that I voluntarily give my informed consent to participate in this study.

Name: _____

Signature : _____

Date : _____

Appendix M

Study 3 Email Invites to Study 3 Participants

E-MAIL INVITE TO TRAINEE POLYGRAPH EXAMINERS

INVITATION TO PARTICIPATE IN A STUDY TO EXPLORE

EXAMINER CHARACTERISTICS CONTRIBUTING TOWARDS THEIR EXPERTISE

Greetings Trainee Examiners,

This e-mail serves as an invite to you, Trainee Polygraph Examiners, in a study to explore examiner characteristics contributing towards their expertise in the field of polygraph. From my perspective, three important factors namely, people, process and place are essential for the continued success of a credibility assessment programme. Generally, we have done well in terms of process and place and we now need your help to go beyond the often used “relevant experience” factor to further understand the “people” or examiner dynamics to enhance and replicate credibility assessment in particular polygraph assessment expertise.

The focus of this study is just that – to explore and study of examiner characteristics contributing towards their polygraph expertise. Your participation in this study is strictly voluntary. Please note that you have the liberty to terminate your participation in this study at anytime for any reason without **any** jeopardy to your completion of your Basic Polygraph Training. Your performance in this study is not graded and **will NOT affect** your grades or completion of your Basic Polygraph Training. You are at liberty to raise any concerns or questions you have with your respective Programme Managers in regards to your participation in this study. Examiner related information that will be collated in this study will be kept strictly confidential. No individual level data or the organization that you are from will be presented in any reports or presentations.

To ensure that the terms and commitment are contractual and documented, please see a copy of EXAMINER PARTICIPATION CONSENT FORM that you will be required to sign if you so wish to take part in this study.

Thank you

V. Cholan

***STUDY OF POLYGRAPH EXAMINER CHARACTERISTICS CONTRIBUTING
TOWARDS THEIR EXPERTISE***

Overview of Study

We are conducting a study to understand Polygraph Examiner characteristics contributing towards their expertise. This study will be done in 4 Phases.

Evaluation of Polygraph Charts

During Phase 1 of the study, you will be asked to complete a set of **four** Personality related questionnaires and thereafter evaluate 24 sets of polygraph charts **before** the start of your Basic Polygraph Course with MINDEF Centre for Credibility Assessment (MINDEF CCA).

Phase 2 of the study will require you to score the same set of 24 polygraph charts (MARCY MGQT 3 Relevant Question Format) based on US Federal Test Data Analysis Scoring Criteria **at the end** of your 11 week Basic Polygraph Course. Phase 1 and Phase 2 will be carried out at MINDEF CCA, Mandai Camp.

Evaluation of Forensic Assessment Interviews

Phase 3 and 4 of this study will require you to score 2 X Video recordings of a Forensic Assessment Interview Technique **before and after your** training in the use of Forensic Assessment Interview Technique (FAINT). The FAINT technique will require you to evaluate verbal and nonverbal cues in the detection of deception and score the video recorded interviews using the FAINT questionnaire. Phase 3 and Phase 4 of this study will be carried out at MINDEF CCA, LR1, Blk 308, Gombak Drive.

This study does not utilize any form of deception and no examiner individual level performance or data, be it your answers on the questionnaires during any of the Study Phases or scoring of chart data/responses to questionnaires, will be reported or presented to anyone.

Please note that your participation in this study is voluntary and you can withdraw from this study at any point for any reason without any penalty. The information collated in this study will be kept strictly confidential. No individual level data or the organization that you are from will be presented in any reports or presentations.

If you wish to take part in this study, please read the following to know more about the study sessions, your rights and contact persons.

Participation and Your Rights

Participation is completely voluntary and you may withdraw from this study at any point of time for any reason without any penalty or consequences. Please feel free to raise any concerns at any time during the study to your respective Agency Programme Managers to

address any concerns that you may have. The physical risk and mental stress involved is no more than what you will experience in daily life and during your daily professional tasks, but should you face questions you do not feel comfortable answering, you may disregard them. There is no penalty for your withdrawal and you may do so at any point during the study.

Confidentiality of Information and Study Reports

The information collated in this study will be kept strictly confidential. All data will be processed using identification codes; at no time will you be individually identified, be it person or organization that you are from through any of the collected data or generated information. The results of the study may be used in future written reports and/or conference presentations. It is important to note that no data at the individual level or the organization that you are from will be reported or presented during said presentations.

Contact Persons

Do feel free to contact the project supervisors, Professor Joyce Pang at joycepang@ntu.edu.sg, or +65 6790-6745, or Ms Yvette Yong via MINDEF intranet should you have any additional queries with regards to the objectives and methods of this study. For enquires on research ethics, please contact the NTU Institutional Review Board: <http://research.ntu.edu.sg/GuidelinesnForms/Pages/Guidelines.aspx>, or at IRB@ntu.edu.sg

Thank you.

Study coordinator:

V.Cholan

Mobile : 91814764

E-mail: cholanjoshv@gmail.com

ACKNOWLEDGEMENT

Co- Principal Investigator - I wish to state that I have explained all procedures and answered all queries truthfully raised by _____ (Examiner/ Participant 's Name)

Name _____

Signature _____

Date _____

Examiner/ Participant - I have read and understood the above. I wish to state that the above mentioned has explained all procedures and all my queries. I wish to state that I voluntarily give my informed consent to participate in this study.

Name: _____

Signature : _____

Date : _____

E-MAIL INVITE TO POLYGRAPH EXAMINERS

***INVITATION TO PARTICIPATE IN A STUDY TO EXPLORE
EXAMINER CHARACTERISTICS CONTRIBUTING TOWARDS THEIR EXPERTISE***

Greetings Examiners,

This e-mail serves as an invite to you, Polygraph Examiners, in a study to explore examiner characteristics contributing towards their expertise in the field of polygraph. As you may well know, we have often discussed about processes and polygraph procedures but not much has been said about examiner characteristics that we know is key to conduct of good examinations. From my perspective, three important factors namely, people, process and place are essential for the continued success of a credibility assessment programme. Generally, we have done well in terms of process and place and now we need your help to go beyond the often used “relevant experience” factor to further understand the “people” or examiner dynamics to enhance and replicate credibility assessment in particular polygraph assessment expertise.

The focus of this study is just that – to explore and study of examiner characteristics contributing towards their polygraph expertise. Your participation in this study is strictly voluntary and subject to approval of your respective Programme Managers. Please note that you have the liberty to terminate your participation in this study at anytime for any reason without any jeopardy to your standing as a polygraph examiner in our community. Examiner related information that will be collated in this study will be kept strictly confidential. No individual level data or the organization that you are from will be presented in any reports or presentations.

To ensure that the terms and commitment are contractual and documented, please see a copy of EXAMINER PARTICIPATION CONSENT FORM that you will be required to sign if you so wish to take part in this study.

Thank you

V. Cholan

EXAMINER PARTICIPATION CONSENT FORM

STUDY OF POLYGRAPH EXAMINER CHARACTERISTICS CONTRIBUTING TOWARDS THEIR EXPERTISE

Overview of Study

We are conducting a study to understand Polygraph Examiner characteristics contributing towards their expertise. This study will be done in 2 Phases.

Evaluation of Forensic Assessment Interviews

Phase 1 and 2 of this study will require you to score 2 X Video recordings of a Forensic Assessment Interview Technique **before and after your** training in the use of Forensic Assessment Interview Technique (FAINT) respectively. The FAINT technique will require you to evaluate verbal and nonverbal cues in the detection of deception and score the video recorded interviews using the FAINT questionnaire. Phase 1 and Phase 2 of this study will be carried out at MINDEF CCA, LR1, Blk 308, Gombak Drive.

Please note that your participation in this study is voluntary and you can withdraw from this study at any point for any reason without any penalty. The information collated in this study will be kept strictly confidential. No individual level data or the organization that you are from will be presented in any reports or presentations.

If you wish to take part in this study, please read the following to know more about the study sessions, your rights and contact persons.

Participation and Your Rights

Participation is completely voluntary and you may withdraw from this study at any point of time for any reason without any penalty or consequences. Please feel free to raise any concerns at any time during the study to your respective Agency Programme Managers to address any concerns that you may have. The physical risk and mental stress involved is no more than what you will experience in daily life and during your daily professional tasks, but should you face questions you do not feel comfortable answering, you may disregard them. There is no penalty for your withdrawal and you may do so at any point during the study.

Confidentiality of Information and Study Reports

The information collated in this study will be kept strictly confidential. All data will be processed using identification codes; at no time will you be individually identified, be it person or organization that you are from through any of the collected data or generated information. The results of the study may be used in future written reports and/or conference presentations. It is important to note that no data at the individual level or the organization that you are from will be reported or presented during said presentations.

Contact Persons

Do feel free to contact the project supervisors, Professor Joyce Pang at joycepang@ntu.edu.sg, or +65 6790-6745, or Ms Yvette via MINDEF CCA intranet should you have any additional queries with regards to the objectives and methods of this study. For enquires on research ethics, please contact the NTU Institutional Review Board: <http://research.ntu.edu.sg/GuidelinesnForms/Pages/Guidelines.aspx>, or at IRB@ntu.edu.sg

Thank you.

Study coordinator:

V.Cholan

Mobile : 91819743

E-mail: cholanjoshv@gmail.com.sg

ACKNOWLEDGEMENT

Co- Principal Investigator - I wish to state that I have explained all procedures and answered all queries truthfully raised by _____

(Examiner/ Participant 's Name)

Name _____

Signature _____

Date _____

Examiner/ Participant - I have read and understood the above. I wish to state that the above mentioned has explained all procedures and all my queries. I wish to state that I voluntarily give my informed consent to participate in this study.

Name: _____

Signature : _____

Date : _____

Appendix N

FAINT Questionnaire

POSTURE/DEMEANOR (+1 Truthful/0 Inconclusive/-1 Deceptive) Score: (+) (0) (-)
If using MITT do it now and issue one overall score: Score: (+) (0) (-)

ELICITED VERBAL RESPONSES

1a. Where do you work?

1b. How long have you worked there/here?

2. What do you do?

3. How do you like working there/here?

(Positive Answer/No Hesitation-Adaptors-Coding) Score: (+3) (0)

4. What is this polygraph test about?

(Strong Language: Steal/Theft/Rape) Score: (+2) (-2)

5. Why were you selected to take the test?

(Includes self as Suspect) Score: (+1) (0)

6. How do you feel about being tested?

(Positive Answer with No Hesitation/No Adaptors) Score: (+2) (0)

7. Please write/tell me in detail what you know about this and how you would explain it.

(Explains Crime with Strong Language/Proper Use of Pronouns) Score: (+1) (-2)

8. If you were the investigator, how would you conduct the investigation?

Score: (+1) (0) (-1)

9. What are the five most important causes that would have created this situation?

Score: (+1) (0) (-1)

10. Did you ever think about doing something like this?

(No Hesitation-Adaptors) Score: (+1) (-1)

11. (Comparison) During the first ____ years of your life did you ever _____?

12. Did you?

Score: (+1) (0) (-1)

13. (Comparison) In your entire life did you ever?

14. Who would you suspect?

Score: (+3) (0)

15. Who would you vouch for?

Score: (+2) (0)

16. When the person who did this is caught (if a person did do something like this), what do you think should happen to them?

(Strong Punishment: fired/prosecution) Score: (+2) (-1)

17. Would you give them a second chance?

("No" with out any hesitation) Score: (+2) (-1)

18. How do you think the polygraph test will come out today?

(Positive Answer) Score: (+2) (-1)

19. Would there be any reason evidence would turn up indicating you did this?

("No with out any Hesitation-Hedges) Score: (+2) (-1)

20. Would you be willing to chip in to pay for _____

Score: (+3) (-1)

21. Did you tell anyone about what happened and that you had to be tested?

22. Why do you think someone would do something like this?

(Negative/Condescending/I don't know) **Score: (+1) (0)**

23. Do you think it was done deliberately, or could it have been accidental?

Score: (+3) (0)

24. Do you know for sure who did this?

("No," with no hesitations or adaptors) **Score: (+2) (0)**

25. In your entire life, did you ever tell a lie to get out of trouble?

26. Did you lie about whether or not you did this?

Score: (+) (0) (-)

27. If you had been the examiner, and had three questions to ask to resolve this problem, what would you have asked?

(Asks a strong relevant question: "Did I do it.") Score: (+1) (0)

TOTAL SCORES FROM ALL PAGES: _____ DETERMINATION: NDI ? DI

Appendix O

Post-video Evaluation Questionnaire

NAME: _____

In your assessment of the video, how many times did you use the following to evaluate?

#1 **Gaze Aversion** – Participant looked away from the interviewer

How many times did you observe this? _____

#2 **Illustrators - Frequency of arm and hand movements which were designed to modify and/or supplement what was being said verbally**

How many times did you observe this? _____

#3 **Adaptors - Frequency of hand and scratching the head, wrists, rubbing one's hand together etc.**

How many times did you observe this? _____

#4 **Frequency of Hand and Finger Movements**

How many times did you observe this? _____

#5 **Speech Hesitations: Frequency of saying “ah” or “mm” between words**

How many times did you observe this? _____

#6 **Speech Errors: Frequency of word and /or sentence repetition, sentence change, sentence incompleteness, and slips of the tongue**

How many times did you observe this? _____

#7 **Latency Period: period of time between the question being asked and the answer given**

How many times did you observe this? _____

Thank you for your participation

Appendix P

Polygraph Chart Evaluation

Question types. Essentially, participants evaluated physiological reactions displayed on two types of questions in the polygraph charts, the relevant and comparison questions. Relevant questions are specific questions about a crime. A relevant question in a murder investigation could be: ‘On Mar 12, did you shoot Scott Fisbee? (Iacono & Patrick 1997). Essentially, the degree to which the examinee reacts to the relevant questions is of interest. The physiological responses to the relevant questions are compared against those to the comparison questions to derive a numerical score for the relevant test question.

Scoring features. Participants in this study were provided with four digital polygraph charts per case file and were asked to evaluate data collected in the three physiological channels, pneumograph, electrodermal and cardiograph channels using validated test data analysis features (APA, 2011). The evaluation window of physiological data recorded during the asking of relevant and comparison questions were limited to 15 seconds from question onset. Each of the physiology parameter is evaluated independently.

Pneumograph. Pneumograph channel records breathing patterns of an individual across time. Examiners look out for scoring features of the pneumograph tracings at specific points on the chart to derive scores. Scoring features specific to breathing, such as slowing of breathing rate, are evaluated (please see Figure A1 for a more comprehensive illustration of pneumograph scoring features).

Scoring Feature for Pneumograph

Figure A1. Scoring features for pneumograph channel.

Electrodermal. Electrodermal channel measures sweat gland activity across time. The scoring feature of this channel is the maximum level of sweat gland activity displayed in response to a particular question (please refer to Figure A2 for illustration of EDA scoring features).

Scoring Feature for Electrodermal

Figure A2. Scoring features for electrodermal channel.

Scoring Feature for Cardiograph

7/11

Figure A3. Scoring features for cardiograph channel.

Cardiograph. The cardiograph measures fluctuations in blood pressure over time. The scoring feature is the amount of rise in blood pressure at specific points in the chart (please refer to Figure A3 for an illustration of cardio scoring features).

Numerical scoring based on each data channel. Based on the evaluation of scoring features described above, examiners assign a numerical scores to each relevant test question (Please refer to Appendix 3 for an illustration of how scoring features are utilized to derive a numerical score).

Figure A4. Sample of Polygraph Chart.

Participants' decisions. Decisions of *No Deception Indicated* (NDI), *Deception Indicated* (DI) or *Inconclusive* (INC) were rendered based on the sum of scores on the test questions. If the sum was greater than +2, a decision of NDI was rendered which meant that the participant deemed that the suspect in the mock crime is truthful and thus innocent of the crime. If the sum was less than -4 a decision of DI was rendered which meant that the

participant deemed the suspect in the mock crime to be deceptive in his polygraph test hence is guilty of the mock crime. Chart score totals between +2 and -4 would result in a decision of Inconclusive (INC) which meant the participant could not arrive at a decision of innocence or guilt of the suspect in the mock crime because it did not meet either threshold of the decisive scores.