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Project Sphinx:

Final Report

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27th January, 2008

Project Sphinx:

Final Report Executive Summary

The purpose of this report is to identify areas of research with observable and codable measures that could be utilized to identify and examine potential suspects in a security setting. Five areas were identified:

- *Detecting Deception*
 - A checklist of behavioural and verbal cues would be useful for the identification of suspects, and accuracy to detect deception will increase the more behavioural and verbal cues are noted. Implementation requires an understanding of how many and which behavioural and verbal cues need to be displayed before one can be confident that the target is being deceptive, and how much cultural, religious, racial, or ethnic differences affect deception detection.
 - Criteria-based Content Analysis examines the discrepancies in the content of statements given after a structured interview. With extensive training, it can be employed in examinations where it is possible to transcribe or record the interview and conduct an immediate analysis.
- *Profiling*
 - Criminal and geographic profiling could be valuable tools for identifying individuals who are engaging in criminal activity and ports that are more susceptible to criminal activity. These tools need to be created by the careful collection, collation and analysis of information at checkpoints. It is possible that some of the necessary databases may already exist and will only need to be incorporated into the larger database.
- *Facial Recognition*
 - Research has shown that the use of bright lighting, shone from an overhead source, and having the suspect maintain similarity in head position and expression can help with matching of a suspect to an image. Additionally, there may be a feature-based training program which can reduce problems with identifying other-race faces, and may improve facial recognition overall. It would be necessary to conduct an evaluation of how these cues will work in a port setting, and whether or not the training is practically effective.

- *Implicit Attitudes*
 - The implicit association test measures how much two concepts are related (e.g., terrorist activities and heroism) in an individual's mind. This test could be used during examination to determine whether or not a suspect supports a given target. The Kent Police Authority would need to first identify which targets and concepts are useful to adapt the test appropriately.
 - Research has shown that an individual's skin conductance response changes when presented with a familiar face. Additionally, this change occurs whether or not the individual is aware of seeing the face or not. This tool could be used during examination when potential associates of suspects are already known to the police. More research is required to discover whether or not this effect can be used in a setting where base-rate responses are already high due to stress.
- *Contextual Triggers*
 - Self-awareness cues (e.g., mirrors, video cameras) have been shown to increase anxiety relevant behaviours in individuals that are nervous. These self-awareness cues could be installed in a port setting and used to cause suspects experiencing anxiety to behave more nervously. If this was paired with deception detection training, then trained officers could identify these overly anxious individuals. Before this can be implemented, research should be conducted to test the effectiveness of these cues in a security setting.

Overview

Due to recent events, issues of border security have grown in importance. The Cabinet Office in their report, *Security in a Global Hub: Establishing the UK's new border arrangements*, identified five key principles necessary for successful border control (i.e., act early, target effort, manage bottlenecks, maximise depth and breadth of protection, reassure and deter). However, Project Sphinx (named after the mythological border guard) proposes that there is an as yet untapped sixth principle, specifically the detection of behaviour at the ground level.

This principle can be characterized in two stages (a) the quick and accurate identification of potential suspects by security personnel, and (b) the successful examination of identified suspects. The purpose of this report is to provide comprehensive and summary analyses of the literature with the following specific goals:

1. To bring together the different bodies of work in areas of interest in a focussed and comprehensible review,
2. To isolate areas of research that could be utilized in a security setting for the explicit purpose of identifying and examining potential suspects, and
3. To identify research that has observable and codable behavioural measures that could be easily used in a security setting.

An interim report was initially submitted on the 8th of December 2008 to the Kent Police Authority to briefly outline the basic findings of an initial literature search with the intention of identifying areas of specific interest to the Kent Police Authority in order to focus the conclusions of the work. The interim report identified seven areas of possible interest (i.e., contextual triggers, criminal profiling, facial recognition, detecting deception – behavioural cues, detecting deception – speech analysis, detecting deception – physiological responses,

and target familiarity with known suspects). Additionally, the interim report identified three other areas that had arisen from the initial search (i.e., work environment, adaptability and stress training, and detecting deception – training).

The subsequent meeting on 12th of December 2008 led to the inclusion of most of the areas of possible interest. Two exceptions were the use of psychophysiological measures to detect deception (i.e., polygraphs) and the use of voice familiarity as a measure of target familiarity with known suspects. Additionally, other areas of interest were requested to be included: the effect of racial differences on detecting deception, the use of the Implicit Association Test and eye-tracking as measures of familiarity with suspicious targets, and civilian reactions to the police force (especially in regards to individuals from different religious groups).

This report comprises 7 sections:

| | |
|---|----|
| I. Detecting Deception..... | 6 |
| A. Behavioural cues..... | 8 |
| B. Speech analysis..... | 13 |
| 1. Criteria-based content analysis..... | 14 |
| 2. Reality monitoring scale..... | 16 |
| 3. Voice stress analysis..... | 19 |
| 4. General content analysis..... | 23 |
| C. Training and natural ability..... | 26 |
| II. Profiling..... | 32 |
| III. Facial Recognition..... | 42 |
| IV. Implicit Attitudes..... | 51 |
| A. Implicit association test..... | 51 |
| B. Facial familiarity..... | 57 |
| V. Contextual Triggers..... | 60 |
| VI. Other Areas of Possible Interest..... | 65 |
| A. Work environment..... | 65 |
| B. Stress & adaptability training..... | 67 |
| VII. Conclusions..... | 70 |
| References..... | 74 |
| Appendices | |
| A. List of cues for detecting deception adapted from DePaulo, et al. (2003) | 89 |
| B. Outline of the Officer Adaptive Thinking and Leadership, from White, et al. (2005) | 95 |
| C. Index of Tables and Figures | 98 |

I.) Detecting Deception

When attempting to identify liars, research has shown that there are three areas that can be used to indicate falsehood: (1) behavioural cues, (2) speech analysis and (3) physiological response (Vrij, Edward, & Bull, 2001). Behavioural cues are gestures and signals (e.g., arm gestures, blinking) that indicate that an individual is being deceptive. Speech analysis is the examination of verbal cues either by the detection of microtremors in the voice, or by the content analysis of the spoken words. The study of physiological responses focuses on physical indicators (e.g., skin conductance, heart rate) that have been shown to be associated with deceit.

However, not all of these areas have proven to be equally valid. Specifically, the study of physiological responses (better known as the polygraph) has been very controversial in both the research and wider communities (Gamer, Rill, Vossel, & Godart, 2006). This controversy has focused on several points, most notably which physiological indicator (e.g., skin conductance, respiratory suppression, arterial blood pressure) is the most accurate at detecting deception and which series of questions (e.g., the Guilty Knowledge Test, the Guilty Actions Test, the Comparison Question Test) are the most informative for eliciting a deceptive response. Most importantly, in a report to the US Congress, the American National Academy of Sciences (2002) stated that the tests of physiological responses as they are currently employed are unscientific and lack fixed standards. As a consequence of these controversies, the detection of deception from physiological responses will not be discussed further in this report.

Additionally, the use of Artificial Neural Networks (ANN) is a recent development in detecting deception (Hasoun, 1995). The ANN is computer software that has been programmed with the different known behavioural and verbal cues associated with deception. The computer can then be outfitted with video recording devices and make judgments of deception in real time (Rothwell, Bandar, O'Shea, McLean, 2006). Although this is a potentially exciting new area of deception detection, there is very little information regarding the accuracy of this system in general, or between the different available systems. Therefore, the ANN system will also not be discussed further in this report.

The most comprehensive discussion of cues to deception detection is DePaulo, Lindsay, Malone, Muhlenbruck, Charlton, and Cooper's (2003) meta-analysis.¹ DePaulo et al. identified 158 different cues to deception that are discernible to human perceivers (see Appendix A). However, not all of these cues were found by DePaulo et al. to predict deception at all times. Therefore, the following sections will discuss which cues were found to reliably predict deception and in which contexts. Then, it will finish with an examination of the feasibility of training individuals to be accurate in detecting these cues.

¹ A meta-analysis is a statistical technique that combines independent studies. It allows the researcher to make objective claims about the state of the literature.

A.) Behavioural Cues

Summary & Recommendation for Behavioural Cues

The research shows that there are a number of behavioural cues (i.e., presses lips, blinking, eye contact, foot/leg movements, chin raises, illustrators, cooperative, facial pleasantness, nervous/tense, pupil dilation, and fidgeting) that can be used for the identification of deception. Additionally, it has been suggested that accuracy to detect deception will increase the more behavioural cues are observed, although it is not known how many cues need to have been used to indicate deception.

Therefore, it is recommended that a checklist of the above behavioural cues would be useful for the identification of suspects, but only after the following questions have been answered: How many and which behavioural cues need to be displayed before you can be confident that the target is being deceptive? What cultural differences in behavioural cues exist in cultural, religious, racial, or ethnic populations of interest?

Behavioural cues are gestures and signals (e.g., arm gestures, blinking) that indicate that an individual is being deceptive. Additionally, research has shown that behavioural cues can be used to make rapid, real-time judgments of deception accurately (Vrij, Evans, Akehurst, & Mann, 2004). There has been no evidence of any one observable behavioural cue that can accurately and consistently identify deceit (DePaulo, et al., 2003; Vrij, Edward, & Bull, 2001). However, a review of the literature has shown that there is a catalogue of behaviours that can be used to reliably identify suspicious individuals (DePaulo, et al., 2003; Vrij, 2000).

DePaulo et al. (2003) identified seven behavioural cues that are used by deceivers: presses lips, chin raises, illustrators, cooperative, facial pleasantness, nervous/tense, pupil dilation, and fidgeting (see Table 1). Specifically, individuals engaged in deception pressed their lips, raised their chin and fidgeted more, used fewer illustrators, made more negative expressions, were more nervous, less cooperative, and their pupils were dilated.

Table 1. Behavioural cues to deception.

| # in App. A | Behavioural Cue | Explanation | When lying... |
|-------------|---------------------|--|--------------------------------|
| 001 | Presses Lips | (AU 23, 24) ² Press lips together | Pressed lips more |
| 003 | Illustrators | Hand movements accompany speech and illustrate it | Used fewer illustrators |
| 007 | Chin Raises | (AU 17) Chin & lower lip are pushed up | Raised chin more |
| 017 | Cooperative | Seems cooperative, helpful, positive, and secure | Less cooperative |
| 019 | Facial pleasantness | Shows more positive facial expressions (smiles) than negative (frowns or sneers) | Made more negative expressions |
| 026 | Nervous/tense | Seems nervous, tense; Makes nervous body movements | Was more nervous |
| 028 | Pupil Dilation | Pupil size, measured by a pupillometer | Increased pupil dilation |
| 033 | Fidgeting | Object and/or self- and/or facial fidgeting | Fidgeted more |

Adapted from DePaulo et al. (2003)

As well as independent cues, DePaulo et al. examined which behavioural cues were most often used in different contexts. Two of these contexts have direct relevance to the identification of potential suspects. Specifically, whether or not the deceiver was motivated (invested) in being believed, and whether or not the deceiver was lying about a transgression. As seen in Table 2, when the deceiver was motivated to lie convincingly, then deceivers made less eye-contact, and were more nervous. When the deception involved a transgression, then deceivers appeared to be tenser, blink more often, made fewer foot/leg movements, and fidgeted less.

² AU# indicates facial muscles that are engaged in this movement.

Table 2. Contextual modifiers of behavioural cues.

| # in App. A | Behavioural Cue | Explanation | Cue increases when deceiver is... |
|-------------|--------------------|--|---|
| 004 | Eye contact | Looks toward other person's eyes, uses direct gaze | Motivated to deceive make less eye-contact |
| 014 | Foot/leg movements | | Motivated or transgressed make fewer foot/leg movements |
| 026 | Nervous/tense | Seems nervous, tense; Makes nervous body movements | Motivated or transgressed appeared more nervous |
| 029 | Blinking | (AU 45) Eyes open and close quickly | Transgressed blinked less often |
| 033 | Fidgeting | Object and/or self- and/or facial fidgeting | Transgressed fidgeted less |

Adapted from DePaulo et al. (2003)

One weakness of the DePaulo et al.'s (2003) meta-analysis is that it examines the different cues as individual indicators. However, researchers have shown that these indicators tend to occur in combination with one another when an individual is being deceitful (DePaulo, Anderson, & Cooper, 1999; Vrij, 2000). This suggests that some of the indicators in Appendix A may be valid behavioural cues to deception, despite DePaulo et al.'s conclusions, but only when accompanied with other cues. For example, appearing nervous/tense is actually a catalogue of behaviours which include lack of eye contact, unusual movements and speech patterns. To date, there has not been any research that has examined which *combination* of behavioural cues nor how many behavioural cues would be most effective at detecting deception.

Weaknesses

- The identification of behavioural cues is highly subjective and some individuals may not be particularly good at identifying deception in others (Ekman, O'Sullivan, & Frank, 1999). However, it possible that this ability is identifiable and trainable

(DeTurck, & Miller, 1990; Frank, & Ekman, 1996; Vrij, 2004). This will be discussed later in section I.C. Training.

- Research has shown that there are definite racial and cultural differences in the exhibition of these behavioural cues. Specifically, Black American individuals make less eye-contact, smile more often, and use more illustrators and body movements than their White counterparts during non-deceptive interactions (Fugita et al., 1974; Ickes, 1984; LaFrance & Mayo, 1976; Vrij, Dragt, & Koppelaar, 1992; Winkel & Vrij, 1990; Vrij & Winckel, 1991). Additionally, foreign language users tend to avoid eye-contact during conversation (Fuertes, Potere, & Ramirez, 2002). These differences could make it difficult to apply behavioural cues to non-White British citizens.

If these differences were identified with-in the different cultural, religious, racial, or ethnic populations of interest, then they could be taken into account when using behavioural cues to detect deception. For example, in a cross-cultural study comparing lying behaviours of Americans and Jordanians, the two groups were shown to exhibit many of the same behavioural cues associated with deception (Bond, Omar, Mahmoud, & Bosner, 1990). However, whilst fairly good at identifying these behaviours in their own groups, Americans and Jordanians were not as capable at detecting deception in the other groups.

Feasibility to use Behavioural Cues by Kent Police Authority.

Before the use of behavioural cues by the Kent Police Authority would be feasible some questions would first need to be examined.

- How many and which behavioural cues need to be displayed before you can be confident that the target is being deceptive?
 - This question could be answered in one of two ways. First, a number of behavioural identification systems (e.g., Behavioural Assessment Screening System and Screening Passengers Observations Techniques) have already been created for the use of detection deception by security personnel. However, these systems have not been rigorously validated. If there is a behavioural system that the Kent Police Authority is particularly interested in then a series of experiments could test the validity and reliability of this behavioural system in both a controlled laboratory and port security setting.³

Second, if there is not a behavioural system of particular interest to the Kent Police Authority, then the behavioural indicators identified as being reliable by DePaulo et al. (2003) could be examined in a series of experiments designed to identify which collection of behavioural indicators reliably identify deceivers. Again, these studies should be conducted in both a controlled laboratory and port security setting.
- What cultural differences in behavioural cues exist in cultural, religious, racial, or ethnic populations of interest?
 - During the course of either of the series of experiments proposed above, additional variables of race, ethnic, culture, or religious background could be included. This should involve the comparisons with the largest minority populations in the United Kingdom (i.e., Asian and Black) as well as other

³ The BASS program is currently being evaluated by the Centre for the Protection of National Infrastructure.

cultural, religious or ethnic groups identified by Kent Police Authority as being the majority groups to pass through the ports.

However, once these conditions are met it should be simple to implement the use of behavioural cues as a way to identify potential suspects by the Kent Police Authority.

- The behavioural cues identified as being the most reliable would be disseminated to officers engaged in security identification through a series of training workshops.
- The behavioural cues could then be used as quick indicators of deception during brief, routine stops at checkpoints.
- The behavioural cues could also be used during examination.

B.) Speech Analysis

Summary & Recommendation for Speech Analysis

The Criteria-based Content Analysis analyzes the content of statements given after a structured interview. It would require some extensive training, but could be employed in examinations where it is possible to transcribe or record the interview.

The Reality Monitoring Scale also analyzes the content of statements, but may be easier to implement and use in real-time examinations. However, some questions would first need to be answered: Can RM be used during real-time interviews, or does it need to be recorded first? What is the minimum number of criteria needed to ascertain deception? Can RM be used reliably by others?

Voice Stress Analysis analyzes microtremors in speech that are associated with stress. The system is costly and has not been adequately validated yet, so it is not recommended.

General Content Analysis analyzes both the content of statements and speech patterns (i.e., talking time, speaking rate, word/phrase repetition, plausibility, discrepancy, verbal involvement, verbal immediacy, vocal immediacy, verbal uncertainty, and negative statements) to detect deception. A checklist of the above verbal cues would be useful for the identification of suspects, but only after the following questions have been answered: How many and which verbal cues need to be displayed before you can be confident that the target is being deceptive? What differences in behavioural cues exist in cultural, religious, racial, or ethnic populations of interest?

The analysis of verbal behaviour in deception is very complex and takes different forms.

Specifically, there seem to be two prominent lines of research one of which analyzes the

content of statements (i.e., Criteria-based Content Analysis – CBCA, Reality Monitoring Scale – RM), and the other analyzes the content of the speech patterns (i.e., Voice Stress Analysis – VSA). General Content Analysis analyzes both the content of statements and speech patterns.

1.) *Criteria-based Content Analysis*

CBCA is based on the assertion that statements made from memory have different content than statements made from imagination (Steller & Kohnken, 1989). After a structured interview, interrogators analyze the content of the suspect's responses using the 19 dimensions (see Table 3). Stories that include several of the dimensions, especially those in General Characteristic and Specific Content areas, are considered to be too complex to have been easily fabricated (Vrij, 2005). Additionally, individuals trying to deceive others are more likely to omit statements that include dimensions of Motivated-related Content as they are generally concerned with the impression they are portraying through their story (Vrij, 2005).

In DePaulo et al.'s (2003) meta-analysis (see Appendix A: 074-091) some of the *CBCA* criteria were often present when an individual was being deceptive (see Table 3). However, DePaulo et al.'s meta-analysis examined each criterion separately, whilst the *CBCA* was specifically designed as a cumulative checklist. This suggests that the *CBCA* as a whole may be a reliable form of ascertaining whether or not someone is being deceptive, but it is important that some of the criteria that have been found to independently detect deception are present in the deceiver's story.

Table 3. Dimensions of the CBCA (Criterion marked with an * were used often by deceivers in DePaulo et al.'s (2003) meta-analysis).

| General Characteristics | Descriptions of Criteria |
|------------------------------------|--|
| Logical structure* | Consistency, coherence of statements; set of different, independent details that form coherent account |
| Unstructured production | Narratives presented in unstructured way |
| Quantity of details* | Abundance of details |
| Motivation-Related Contents | |
| Spontaneous corrections* | Spontaneous correction of own statement |
| Admitting lack of memory* | Admission of lack of memory |
| Self-doubt | Raise doubt/objection about own testimony |
| Self-depreciation | Use unfavourable, self-incriminating details |
| Pardoning others | Provide explanation/rationalization for offender |
| Specific Contents | |
| Contextual embedding | Statements place event in its spatial, temporal context |
| Description of interactions | Descriptions of interrelated actions and reactions |
| Reproduction of conversation | Verbatim reproduction of dialogue |
| Unexpected complications | Report an unforeseen interruption, difficulty, or spontaneous termination of the event |
| Unusual details | Detail is realistic, but has a low probability to occur |
| Superfluous details | Vivid and concrete descriptions of extra details |
| Details misunderstood | Inclusion of actions/details not understood by the witness but understood by the interviewer |
| Related external associations* | Reference to events, relationships external to the event |
| Subjective mental state | Report of own cognition, emotion during the event |
| Another's mental state | Statements infer the cognitive, emotional state of others from event |
| Offence-specific Elements | |
| Details of the offence | Knows about details characteristic of the offence |

Adapted from Vrij (2005) & Zaparniuk, Yuille, & Taylor (1995)

Weaknesses

- The CBCA is generally used with transcribed or video-taped information. This means that it will not be as useful for immediate situations of deception detection.
- It is impossible to perform CBCA on very short statements. Therefore, interviewers need to be skilled at eliciting full responses from suspects in order to conduct a CBCA analysis. Additionally, the style of the interview is important. In an examination of three often used interview styles (i.e., accusatory, information gathering and behavioural analysis), the accusatory style was related to more false

accusations and greater confidence in the false accusations by officers (Vrij, Mann, Kristen & Fisher, 2007).

Feasibility to use CBCA by Kent Police Authority.

It would take some time and effort to implement the use of CBCA as a way to identify potential suspects by the Kent Police Authority.

- Officers would need to be chosen to attend a workshop on CBCA analysis. The workshop itself would probably not take more than a day, but the officers would need to be recertified periodically to ensure that the force as a whole is interpreting the analysis consistently.
- CBCA could then be used during examination. Examinations do not need to occur in a controlled environment, however the suspect's responses would need to be transcribed or taped for later analysis. Depending on the length of the examination and amount of material obtained, analysis should be able to be concluded within the nine hours that a suspect could be legally held.

2.) *Reality Monitoring Scale*

RM is a construct interested in the perceptual differences between actual and imagined events (Johnson & Raye, 1981) that has been shown to relate to deception (Vrij, Edward, & Bull, 2001). Specifically, *RM* assumes that as actual events are experienced with the senses, memories of actual events should contain more sensory (sight, sound), contextual (time, location) and emotional information. Additionally, statements about events that are not real should contain thoughts or interpretations about the event but no "real" information (e.g., I remember that I was thinking about whether or not I knew him).

RM is used as a basic checklist of the presence of sensory, contextual and emotional information. For example, a suspect states that “I saw a man in a blue coat leave the package by the stairs right after ferry blew the horn and began boarding the cars. I remember thinking that it was a little unusual and it made me nervous.” This statement would be rated as having one sound detail (blew the horn), five visual details (man, blue, coat, package, cars), one time detail (right after ferry blew the horn and began boarding the cars), one location detail (by the stairs), and one emotional detail (it made me nervous). Honesty is then rated as the presence of each of the criteria. As this suspect has provided a statement with each of the criteria (sound, visual, time, location, and emotion) he is most likely telling the truth.

Weaknesses

- The RM is generally used with transcribed or video-taped information. However, RM analysis requires the examiner to compile a fairly simplistic and straightforward checklist that may not be possible to use during real-time interviews. To date, there has been no examination of whether or not it is possible to use RM during real-time interviews.
- Most research with the RM has been conducted with the comparison of liars and truth tellers. This research suggests that truth tellers use more of the RM criteria than those being dishonest. However there has been no examination of how many criteria need to be used to indicate honesty.
- Currently, RM has only been explored in the laboratory of one researcher. Although this researcher is well respected in the field, the lack of other confirmation brings the reliability of using RM for the detection of deception into

question. Additionally, in DePaulo et al.'s meta-analysis, none of the included RM scales were found to be reliably associated with deception (see Appendix A: 092-097).

Feasibility to use RM by Kent Police Authority.

Before the use of RM by the Kent Police Authority would be feasible some questions would first need to be examined.

- Can RM be used successfully during real-time interviews, or does information need to be transcribed or recorded?
 - This question could be answered by analyzing the RM content of deceptive individuals both during and after they are examined. IF RM can be used effectively during examination then accuracy rates should be the same or better during examination as after.
- What is the minimum number of criteria that need to be missing in order to ascertain an individual is being deceptive?
 - In order to answer this question, individuals could be trained to use different sets of number of RM indicators to ascertain deception (e.g., five visual, one time, one location, and one emotional versus fifteen suggests honesty visual, three time, three location, and three emotional suggests honesty). The subsequent coding of different stories could then be compared for accuracy. The number of indicators associated with the highest rates of accuracy would then be used as guidelines during security investigations.
- Can the use of RM be validated in other contexts and used reliably by others?
 - The examination of either of the above studies would provide validation for RM as an effective tool for detecting deception in different contexts.

However, once these conditions are met it should be fairly simple to implement the use of RM as a way to identify potential suspects by the Kent Police Authority.

- Officers would need to be trained to use RM analysis. Most studies suggest that this is fairly quick and easy to do.
- RM can currently be used during examination. Examinations do not need to occur in a controlled environment, however, depending on the outcome of the experiments, the suspect's responses may need to be transcribed or taped for later analysis. Research suggests that analysis should be fairly quick, therefore it should be able to be concluded well within the nine hours that a suspect could be legally held.

3.) *Voice Stress Analysis*

The VSA measures microtremors in the voice associated with deception (Gamer, Rill, Vossel, & Godart, 2006; Lippold, 1970; Streeter, Krauss, Geller, Olson, & Apple, 1977). Various computer software programs are available that can detect these microtremors and allow trained analysts to determine veracity of a suspects statements. Researchers have been interested in the VSA because the systems are relatively simple and inexpensive, and testing can be conducted without the awareness of the person being questioned.

VSA equipment is sold in a variety of packages, with some suppliers selling each piece separately for the consumer that may already own some of the equipment, and others selling it as a complete package that is only compatible with the package equipment. The primary suppliers of VSA equipment are:

- National Institute of Truth Verification – NITV-CVSA

- handhelds for \$9995 (~£6800)
- laptops from \$8895-\$11995 (~£6100-£8200)
- six day training session \$1295 (~£900) per person (3 day re-certification required every 2 years at \$295 (~£200))
- <http://www.cvs1.com/>
- Dektor Corporation – PSE 5128
 - software (reloadable onto any computer) and recorder for \$6500 (~£4500)
 - seven day training session \$1400 (~£1000) per person
 - <http://www.dektorpse.com/>
- Diogenes Company – DDVSA
 - software (reloadable onto any computer except Apple) and device(?) for \$5000 (~£3500)
 - ten day training session \$2500 (~£1700) per person (re-certification CD required every 3 years at \$300(~£205))
 - <http://www.dektorpse.com/>

Weaknesses

- Most researchers have found that VSA does not detect deception any better than chance (Gamer et al., 2006; Hollien, Harnseberger, Martin, & Hollien, 2008). These findings have been argued against by makers of the software, many of whom come from the research community, who say that the software only works in realistic settings that would cause the microtremors. DePaulo et al.'s (2003) meta-analysis may support this assertion as it showed that a collapsed grouping of general vocal tension, measured with either the PSE or Mark II analyzers was reliably identified with deception. However, it is impossible to say which was

more important for predicting deception, general vocal anxiety or one of the two analyzers.

Additionally, not all of the different systems available have been used in these validation tests. Most testing has examined the PSE series of VSAs as this was the group that originally invented the software and tested the research. So, some packages may be more reliable than others.

Feasibility to use VSA by Kent Police Authority.

Before the use of VSA by the Kent Police Authority would be feasible a question would first need to be examined.

- Does VSA reliably detect deception?
 - This question would be difficult to examine. Makers of VSA equipment suggest that they are only accurate in real-world situations where deception is important and meaningful. However, it is very difficult in these situations to establish whether or not the individual is being deceptive before the examination.

Two possible studies could be conducted in an attempt to answer this question in an ecologically valid (e.g., realistic) way. First, examinations in the port security setting could be evaluated for changes in microtremors with VSA equipment. At the same time, the examinations could be evaluated for other known indicators of deception (e.g., behavioural cues, CBCA). If the conclusions reached by the changes in microtremors were highly associated

with the other indicators of deception then this would suggest that VSA is a valid detector of deception.

Second, in a more controlled experiment, individuals could be asked to be deceptive about a topic that has significant personal meaning. They could then be told that they will be given a reward if they are successful in deceiving the examiner. By making the topic personal, and providing an incentive in being good at being deceptive, this should increase the realism of the deceptive behaviour. If the VSA analyses can accurately identify the known deceivers this would suggest that VSA is a valid detector of deception.

However, once this question was answered it would take time, effort and money to implement the use of VSA as a way to identify potential suspects by the Kent Police Authority.

- The system would have to be purchased at a cost of about £3500-8200.
- Someone would have to attend the 6-10 day training sessions in the USA at a cost of about £900-1700.
- Depending on the package the training may not be transferable to other officers, and may require a recertification every 2-3 years at a cost of about £200. This recertification may also require a trip to the states.
- Once trained the VSA could then be used during examination. For most of the software options examinations would need to occur in a room with access to a computer, though this could be a laptop. Depending on the quality of the microphone system the environment may need to be fairly quiet. However, there is a handheld model offered by NITV which may be useful during initial identification.

4.) *General Content Analysis*

Quite a few studies have identified various independent verbal markers that analyze either the content of the statements or changes in speech pattern (e.g., Anolli, & Ciceri, 1997; Bond, Kahler, & Paolicelli, 1985; Ekman, O'Sullivan, Friesen, & Scherer, 1991; Porter, & Yuille, 1996). However, unlike the CBCA and the RM the analyses do not tend to be theoretically grounded, or detailed (Vrij, Edward, Bull, 2001). This is unfortunate as many of these verbal markers would be easy to implement and would provide a deception checklist similar to that developed with behavioural cues. Additionally, research has shown that verbal cues can be used to make rapid, real-time judgments of deception accurately (Vrij, Evans, Akehurst, & Mann, 2004).

As seen in Table 5, DePaulo et al. (2003) identified two changes in speech pattern associated with deception (i.e., talking time and word/phrase repetition) and seven statement content cues (i.e., plausibility, discrepancy, verbal involvement, verbal immediacy, vocal immediacy, verbal uncertainty, and negative statements).

Specifically, individuals engaged in deception talked less, repeated words more often. Deceivers also told less plausible, less involved, less direct, more discrepant, more distant, and more negative stories, of which they were more uncertain. As well as independent cues, DePaulo et al. examined whether or not the deceiver was lying about a transgression affected any of the verbal cues. When the deception involved a transgression, then deceivers talked more quickly.

Table 4. Verbal cues to deception (Only occurred during a transgression if marked with an *).

| # in App. A | Verbal Cue | Explanation | When lying... |
|---------------------------|----------------------------|---|---------------------|
| Changes in Speech Pattern | | | |
| 100 | Talking Time | Proportion of the total time of the interaction spent talking or is talkative | Talked less |
| 103 | Speaking rate | Number of words/syllables per unit time | *Talked quicker |
| 106 | Word & phrase repetition | Words or phrases are repeated with no intervening pauses or speech errors | Repeated more often |
| Content of Statements | | | |
| 127 | Plausibility | The message seems plausible, likely, or believable | Less plausible |
| 128 | Discrepant, ambivalent | Internally inconsistent, discrepant; sources (e.g., face vs. voice) contradict; is ambivalent | More discrepant |
| 129 | Verbal & vocal involvement | Describe personal experience, or events in revealing way; vocally expressive, involved | Less involved |
| 130 | Verbal immediacy | Tries to distance from the listener, content of the communication, act of conveying communication | More distant |
| 136 | Verbal & vocal immediacy | Respond in ways that seem direct, relevant, clear, and personal | Less direct |
| 139 | Verbal & vocal uncertainty | Uncertain, insecure, or not dominant, assertive, or emphatic; Difficulty answering question | More uncertain |
| 141 | Negative statements | Message is negative or includes negative comments/complaints | More negative |

Adapted from DePaulo et al. (2003)

Weaknesses

- General Content Analysis is an amalgamation of verbal cues that are generally studied independently. There is no research indicating how these cues could be used as a unified checklist.
- The identification of verbal cues is highly subjective and some individuals may not be particularly good at identifying deception in others (Ekman, O'Sullivan, & Frank, 1999). However, it is possible that this ability is identifiable and trainable (DeTurck, & Miller, 1990; Frank, & Ekman, 1996; Vrij, 2004). This will be discussed later in section I.C. Training.
- Again, racial and cultural differences may be an issue. Specifically, Black American individuals exhibit more speech disruptions, paused more often,

laughed more often, and had more pitch variations than their White counterparts during non-deceptive interactions (Fugita et al., 1974; Ickes, 1984; LaFrance & Mayo, 1976; Vrij, Dragt, & Koppelaar, 1992; Winkel & Vrij, 1990). Additionally, foreign language users tend to pause longer before answering, speak at a varying pace, and answer questions less directly (Fuertes, Potere, & Ramirez, 2002). These differences could make it difficult to apply verbal cues to non-White British citizens. However, if these differences were identified with-in the different cultural, religious, racial, or ethnic populations of interest, then those differences could be taken into account when using verbal cues to detect deception.

Feasibility to use General Content Analysis by Kent Police Authority.

Before the use of General Content analysis by the Kent Police Authority would be feasible some questions would first need to be examined.

- How many and which verbal cues need to be displayed before you can be confident that the target is being deceptive?
 - This question could be answered by examining the verbal indicators identified as being reliable by DePaulo et al. (2003) in a series of experiments. These studies should be conducted in both a controlled laboratory and a port security setting.
- What differences in verbal cues exist in cultural, religious, racial, or ethnic populations of interest?
 - During the course of the series of experiments proposed above, additional variables of race, ethnic, culture, or religious background could be included. This should involve the comparisons with the largest minority populations in the United Kingdom (i.e., Asian and Black) as well as other cultural, religious

or ethnic groups identified by Kent Police Authority as being the majority groups to pass through the ports.

However, once these conditions are met it should be simple to implement the use of behavioural cues as a way to identify potential suspects by the Kent Police Authority.

- The verbal cues identified as being the most reliable would be disseminated to officers engaged in security identification through a series of training workshops.
- The verbal cues could then be used as quick indicators of deception during brief, routine stops at checkpoints.
- The verbal cues could also be used during examination.

C.) Training & Natural Ability

Summary & Recommendation for Deception Training

The use of training for the detection of deception is controversial. There is some evidence that training improves accuracy, whilst others have argued that it simply increases suspicion and therefore increases both accurate detection of deception and inaccurate mistrust of honest individuals.

Additionally, whether or not some individuals have a natural ability to detect deception is also controversial. There is evidence that natural ability exists, but others have questioned the methodologies used to detect natural ability.

Deception training could be implemented as a regular workshop as part of normal officer training. However, two questions need to be first answered: What catalogue of cues should officers be trained in, and does combining the different training techniques improve accuracy? Is there a reliable way to test for a natural ability of accurately detecting deception?

Ekman, O'Sullivan, and Frank (1999) have suggested that certain individuals may be 'naturally' good at identifying deception in others. Specifically, individuals who are in careers with a specific interest in detecting deception (i.e., US federal officers, interrogators of the sheriff's department, and forensic clinical psychologists) tend to be more accurate than

their cohorts (e.g., US federal judges, other police officers, or academic psychologists). It seems likely that selection bias accounts for these findings, and that those individuals who are good at detecting deception are naturally drawn to and promoted into these positions.

However, it is also possible that the training and experience provided from their positions increases their accuracy at detecting deception.

Most evidence seems to suggest that it is natural ability that allows some people to be so accurate. First, the amount of time in the job does not seem to be related to more accurate deception detection (Ekman, O'Sullivan, & Frank, 1999). Second, not everyone in the careers with a specific interest in detecting deception is more accurate (Ekman, O'Sullivan, & Frank, 1999; Lankowski, 2003; Vrij, 1994). However, researchers have not really discussed how to identify individuals who may be naturally good at detecting deception. Generally, researchers either rely on organizations to identify employees who have a consistent track record of successfully detecting deceivers, or give simple one-time detection tests. This latter method has been criticized as subsequent tests may show that the individual does not consistently perform well, but only at the one type of test (Bond, 2008).

Whether or not training improves deception detection is currently being debated in the literature. Individuals that have never received training tend to rely on false beliefs and heuristics (rules of thumb) in order to detect deception (Fiedler & Walka, 1993). It is thought that being informed and trained in the use of the different behavioural and verbal cues will provide individuals the information they need to not be reliant on false beliefs and to notice more accurate indicators of deception (de Turck & Miller, 1990; Fiedler & Walka, 1993; Vrij, 1994; Zuckerman, Koestner, & Alton, 1984).

Research has shown that trained individuals can detect behavioural and verbal cues associated with deception in real time (Vrij, et al., 2004). Deception training is usually fairly simple. It starts with a presentation of what behavioural and verbal cues should be looked for during examinations. Individuals are then presented with a series of targets and asked to determine whether or not the target is being deceptive. After answering, the individual is then told whether or not the answer is accurate. This feedback is thought to allow individuals to form associations between the taught behavioural and verbal cues and deception as well as learn which cues they are personally better at recognizing (de Turck & Miller, 1990).

Training has been shown to be most successful with the inclusion of other elements. Specifically, individuals generally do better if the targets that they are being trained with also include base-line conditions for comparison (deTurck & Miller, 1990; Horvath, Jayne, & Buckley, 1993). Additionally, other researchers have shown that the use of a planned interview style improves detection (Vrij, 1994). Finally, there is some evidence that concentrating on the hands and ignoring other indicators can improve detection (Vrij, 1994).

Recently training programs to detect deception, developed specifically for the exposing of suspects for law enforcement, have been receiving some attention. Both the Behavioural Assessment Screening System (BASS) and the Screening Passengers Observations Techniques (SPOT) train officers to use behavioural and verbal cues to detect deception and stress in others. The BASS program is currently being evaluated by the Centre for the Protection of National Infrastructure.

The strategic use of evidence technique can only be used during examination where details of the case are known. During examination, the examining officers due not offer any evidence to

the suspect until the conclusion of questioning (Hartwig, Granhag, Strömwall, & Kronkvist, 2006). When officers strategically use evidence in their examinations, this increases the chances that deceivers will contradict known evidence, or display more cues as they attempt to hide evidence.

Weaknesses

- The research community seems to be fairly divided on the issue of deception training. There has been some evidence that deception training may not actually improve accuracy, but instead make individuals more suspicious (Masip, et al., in press). Specifically, individuals may seem to be more accurate in detecting deception, but are also making more false accusations. However, some researchers have speculated that this may not necessarily be a problem as having a suspicious nature is necessary for the detection of deception (DePaulo, 1992).
- . Most research on deception training has involved very specific aspects of training and trains individuals with only a few behavioural and/or verbal cues. Whilst this makes for very strong and valid research, it is problematic when attempting to translate it into fieldwork. Specifically, as has already been discussed, no one cue is used by all deceivers all the time, but individuals use a catalogue of both behavioural and verbal cues (Vrij, Edward, & Bull, 2001). Similarly, in order to be accurate at detecting deception, an individual must be trained in the catalogue of cues that have been shown to be the most reliable, and also taught in what contexts to expect these cues (Masip, Alonso, Garrido, & Herrero, in press). In order to be effective, deception training may also need to include a combination of techniques (e.g., planned interview styles, strategic use of evidence, base-line conditions) in order to account for the variety of individual differences in behaviour.

- The belief that some people are naturally good at detecting deception is also being debated in the literature. Ekman has been the most vocal at finding evidence that natural ability occurs. However, there have been some legitimate arguments that his methodology has been flawed (Bond, 2008). To date, no one has created a validated and reliable test for identifying individuals who are naturally gifted at identifying deception.

Feasibility to use Deception Training by Kent Police Authority.

Before the use of Deception Training by the Kent Police Authority would be feasible some questions would first need to be examined.

- What catalogue of cues should officers be trained in, and does combining the different training techniques improve accuracy?
 - First, a list of valid and reliable behavioural and verbal indicators would need to be established. Examples of how this could be conducted have been provided previously. Once this list is established, a series of experiments using these cues could be conducted comparing the different training techniques (e.g., planned interview styles, strategic use of evidence, base-line conditions). Experimental conditions would need to include individuals only using one of the techniques, and then additional conditions where individuals are trained to use different combinations of the techniques.
- Is there a reliable way to test for a natural ability of accurately detecting deception?
 - This question is difficult to answer as some research has shown that the detection of deception may be contextually dependent (Bond, 2008). Specifically, whilst some individuals may perform well in one test of deception detection, they may not be able to do as well in later or other types

of tests. This suggests that the only way to establish natural ability is to test individuals over a significant period of time in a variety of different ways. However, it would be difficult to get most experimental participants to agree to this type of commitment to a study.

Therefore, security personnel would need to be presented with a variety of deception detection tests throughout the course of their training to become officers. If an officer can consistently detect deceivers above chance regardless of the test, this would suggest natural ability. However, as this has not been examined before, there would be no guarantee that officers with natural abilities to detect deception could be or would be identified with these series of tests.

However, once these conditions are met it should be simple, though perhaps costly to implement the use of Deception Training as a way to identify and examine potential suspects by the Kent Police Authority.

- A workshop could be given as part of the regular officer training program. As this would be a regular workshop, the main cost would come from training and employing professionals capable of delivering the course.
- The training could then be utilized during both identification and examination of suspects.

II.) Profiling

Summary & Recommendations for Profiling

Criminal profiling (i.e., the use of crime scene evidence in order to infer characteristics about the criminal) and geographic profiling (i.e., the use of area information to determine offender activity based on location) could be valuable tools for identifying individuals who are engaging in criminal activity and areas that are more susceptible to criminal activity. However, these tools need to first be created by the careful collection, collation and analysis of information at checkpoints. It is possible that some of the necessary databases may already exist and will only need to be incorporated into the larger database.

The use of profiling for identification has been controversial, especially the use of racial profiling. Research has suggested that racial profiling is not an effective screening technique unless the race of the suspect is already known (Ickes, 1984; Vrij & Winkel, 1991).

Specifically, research has shown that the racial profiling of individuals for certain criminal activity results in more false arrests than is justified in accurate arrests (Engel & Johnson, 2006).

However, with appropriate training other forms of profiling have been found to be an important tool for suspect identification (Connors & Nugent, 1990; Foster, 1992; Harman, 1993; Remsberg, 1997). Profiling has been most often used to understand the personality characteristics and behavioural patterns of serial killers in an attempt to identify and locate them (e.g., Kocsis, 2008). Personality profiling is most useful when examining a particular case study of behaviour, and is difficult to generalize to a broader category of criminal activity, especially terrorist activity (Grimland, Apter, Kerkhof, 2006; Stevens, 2005).

Therefore, it may not be of practical use to port security. Of greater interest to port security, are other types of profiling that have been used as a tool for identifying individuals engaged

in criminal activity (criminal profiling; e.g., Engel & Johnson, 2006), and to determine offender activity based on location (geographic profiling; e.g., Rossmo, 2000).

Criminal profiling is the use of crime scene evidence in order to infer characteristics about the criminal (Goodwill & Alison, 2007). Generally, this information is gathered from content analyzing case reports for criteria that may be associated with a particular type of crime (Goodwill & Alison, 2007). With appropriate training, criminal profiling has been found to be an important tool for suspect identification (Connors & Nugent, 1990; Foster, 1992; Harman, 1993; Kocsis, 2003; Remsberg, 1997). Criminal profiling has been used to create sketches for everything from sexual offenders (e.g., Beauregard, Rossmo, & Proulx, 2007) and serial killers (e.g., Kocsis, 2008) to cyber criminals (e.g., Casey, 2008) and drink-drivers (e.g., White & Gasperin, 2007).

To date, there has not been a comprehensive profile conducted on the specific criminal activities that would be of interest to port security (i.e., terrorism). However, other criminal activities that are known to be used by terrorists (e.g., drug trafficking) have been profiled, and so may be of interest. Additionally, it is possible that the methodologies that have been used to develop these profiles may also be beneficial for the creation of a profile for port relevant crimes.

In the drug interdiction studies, researchers identify indicators that can be used to detect individuals engaged in illegal activity (see Table 6). These indicators are based on the analysis of traffic stop dispositions and include information about the vehicle, the occupants and the stories of the occupants (Engel & Johnson, 2006). No one of these variables is enough to establish probable cause, however when a number of them occur simultaneously

this suggests suspicious activity (Connors & Nugent, 1990; Foster, 1992; Grimming & Burwitz, 1988; Harman, 1993; Remsberg, 1997; Robin, 1993).

Table 5. Possible indicators of illegal activity.

| The Vehicle | The Occupants | The Stories ⁴ |
|---|---|---|
| Unusual items in the interior (e.g., spare tyre, luggage, excessive amount of fast food trash, dog biscuits but no dog) | Nervous behaviour (see I.A. Behavioural Cues) | Lies (e.g., occupants tell conflicting stories) |
| Vehicle modifications (e.g., fresh body work, heavy duty shocks, windows that won't roll down, extra fuel tank) | Accessories (e.g., walky-talky style radios, multiple pagers or cell phones) | Inconsistencies (e.g., not enough luggage for trip plans) |
| Vehicle type (e.g., large sedan or sport utility vehicle, rented or borrowed vehicle, inconsistent with occupants social economic status) | Appearance (e.g., unshaven stubble, body odour wrinkled clothes from sleeping in vehicle) | Unknown vehicle owner (e.g., occupants do not know the owner's name, only know the first name) |
| Unusual odours (e.g., a lot of air fresheners, carpet deodorizer, perfume) | Dress (e.g., inconsistent with socioeconomic status, gang colours, drug themes) | Nonsensical situations (e.g., taking trip by car when it would have been more economical to fly). |
| Drug related items (e.g., syringes, compact mirrors) | Record (e.g., past offences, driving record) | Other (e.g., occupants do not have key to open trunk) |

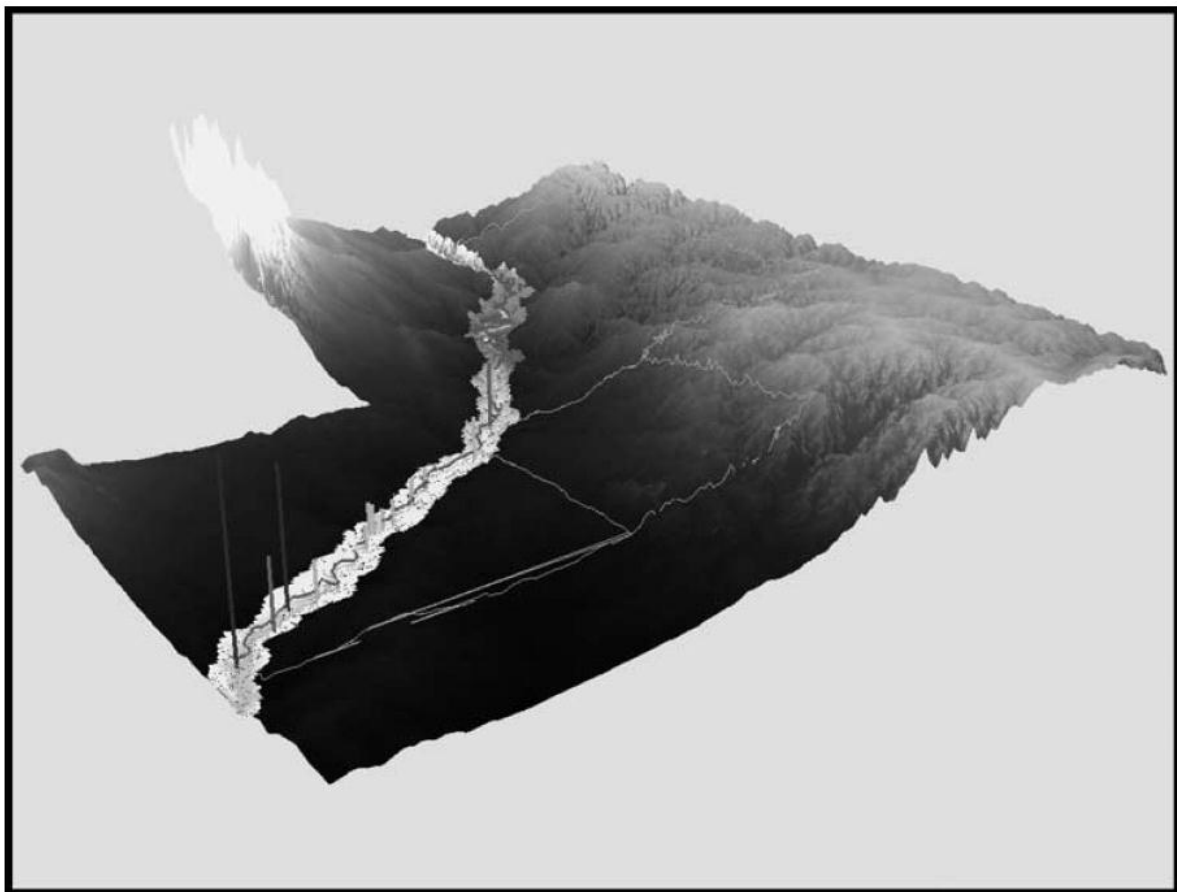
Modified from Engel and Johnson (2006)

Importantly, unlike with behavioural and verbal cues, the creation of a criminal profile will provide information about how many and which indicators need to be present to be sufficiently confident of suspicious behaviour. This makes criminal profiling a stronger identification tool, not the least because behavioural and verbal cues could be included in the profile. However, this does not mean that it will not be possible for officers to identify an innocent individual as appearing suspicious. As discussed below in the weaknesses section, whilst some groupings of indicators may be indicative of criminal behaviour, these same indicator groups may be highly associated with other non-criminal groups as well.

⁴ See section I.B.4. General Content Analysis for other examples of how the story could be analyzed.

Geographic profiling summarizes area information to create a three-dimensional topographical map (see Figure 1 for an example) to determine offender activity based on location (Rossmo, 2000). Geographic profiling was first used to predict the location of expected serial crimes (Brantingham & Brantingham, 1984). However, it has since been expanded to encompass issues of illegal immigration (Rossmo, Thurman, Jamieson, Egan, 2008).

Figure 1. Geographic profiling of criminal activity by illegal immigrants (seen as bars) across the Del Rio Sector, TX, USA.



From Rossmo et al. (2008)

For immigration issues, geographic profiling takes entry data and border region information to look for possible relationships (Pick, Viswanathan, & Hettrick, 2001). For example, a particular port (landing point) may be a target for criminal activity (event role) when vehicle traffic is high and time spent for identification is low (entry demographics) but only when certain conditions are met at the staging area as well (see Table 7 for more specific details of information that could be used for profiling).

Table 6. Examples of information that could be used to analyse the associations between geographic information and criminal behaviour in a geographic profile.

| <i>Geographic Information</i> | <i>Entrant Demographics</i> | <i>Entry Demographics</i> |
|--------------------------------------|--------------------------------------|----------------------------------|
| Waiting location | Age | Number officers on duty |
| Staging area | Gender | Amount of business traffic |
| Crossing | Marital status | Amount of foot traffic |
| Landing point | Citizenship | Amount of vehicle traffic |
| Proximity foreign urban area | Date of entry | Number of checkpoint stops |
| Proximity local urban area | Intermittent destination | Number held for questioning |
| Population density | Final destination | Time spent for identification |
| | Number of passengers | |
| <i>Event Role</i> | Passenger demographics | <i>Reason for Entry</i> |
| Legal entrant (no crime) | | Travel |
| Illegal Entrant | | Employment |
| Suspected of crime | <i>Proximity to Transport</i> | Construction |
| Charged with crime | <i>Network</i> | Institutional |
| | Railroads | Agriculture |
| <i>Weather Conditions</i> | Highways | Services |
| Precipitation | Public transportation | Industry |
| Temperature | Walking paths | Welfare |

Adapted from Rosmo et al. (2008)

Although the previous example may seem simplistic, what geographical profiling provides is detailed information about which conditions throughout the crossing are associated with particular criminal activity, which ports may be more susceptible to these conditions, and which criminal activities are more closely associated with which ports. This type of

information could allow the police authority to more effectively allocate their resources (e.g., manpower, equipment, specialized officers) to specific ports.

Geographic profiling equipment is sold in a variety of packages, with some suppliers providing the materials for free and others selling software packages based on the needs of the consumer. Most of the software programs require the separate use of a geographic information system programs (i.e., MapInfo, Atlas*GIS, Surfer for Windows, and ArcView Spatial Analyst) for the data imaging. Some suppliers of geographic profiling software are:

- CrimeStat
 - Software, datasets, and manual downloadable free from website
 - No official training programs available
 - <http://www.icpsr.umich.edu/CRIMESTAT/about.html>
- Environmental Criminology Research Inc – Rigel
 - Standard software package ~\$7000 (~£4700)
 - Required 2 week training from \$500-3000 per week (~£340-2000)
 - <http://www.ecricanada.com/index.html>

However, it may be possible to avoid these costs by using resources already available in the U.K. The National Policing Improvement Agency (NPIA) already employs trained geographic profilers who may be willing to lend their expertise in this area.⁵

Weaknesses

- There has been no research that has specifically studied how profiling could address the needs of port security. Although the profiling on drug trafficking shares similar characteristics (i.e., the use of a vehicle by the suspect as an accessory, the need of the

⁵ Liaison for the NPIA is Neil Trainor, Professional Lead & Senior Geographic Profiler, Specialist Operational Support, Operations Directorate, National Policing Improvement Agency.

suspect to cross borders expediently, the limited amount of time for police officers to determine whether or not to detain the suspect) there are also some very important differences (i.e., the permanence and physical limitations of the checkpoints, the volume of traffic, the diversity of the passengers, the checking across national borders). These differences are serious and it would not be recommended to simply use the drug interdiction training at the port checkpoints.

In order to utilize both criminal and geographic profiling, it would first be necessary to create an accurate profile of the criminal activity at the ports. This would require the collating of the available reports from previous stops and seizures. Identifying suspect information would not need to be included. However, it would require all other available information (e.g., number of officers on duty, time of stop, contents of vehicle, demographics of suspect, etc.).

Additionally, depending on what information is normally included in the reports, it may be necessary for officers to systematically collect new data (e.g., cleanliness of car, unusual items in interior, occupant accessories) at checkpoints for a set period of time. As part of this process, it would also be useful for transporters (e.g., ferry operators) to collect basic demographic information of passengers (e.g., number of passengers per vehicle, license plate number, purpose of trip).

Most ferry operators already provide some or all of this information for HM Revenue and Customs, but in order to create an accurate profile the collection of this information would need to be more systematic across all ferry operators. If the ferry operators could provide this basic information, then that would simplify the collection

task of the checkpoint officers, as well as provide more accurate and detailed information on passengers who were not selected for further examination at the checkpoints

- Research has shown that some of the possible profile indicators can show specific racial and cultural associations. For example, the makers of large sedans and luxury cars that are often associated with drug trafficking have been actively and successfully targeting young Black professionals as consumers (Brown & Washton, 2002). In fact, most of the indicators that are associated with socio-economic status and consumer habits (e.g., dress, phones and beepers, car make and model) have been found to be highly associated with Black youth culture independent of any criminal behaviour (Brown & Washton, 2002).

Additionally, researchers have shown that whilst certain geographic locations may be associated with different crimes, these areas may also be associated with individuals of specific cultural or racial characteristics (Brown & Washton, 2002). For example, according to the UK 2001 census, ethnic minority groups are highly concentrated in urban areas with 45% of the total population living in London (Office for National Statistics, 2001). Since most drug distribution centres are located in urban areas, ethnic minorities may be unfairly targeted when asked about their final destination (Engel & Johnson, 2006).

These racial and cultural differences could make it difficult to create a criminal profile that would be accurate for all port visitors. However, it is important to remember that not any one indicator would be grounds for suspicion. Moreover, it would be possible to take these differences into consideration when creating the profile.

Feasibility to use Profiling by Kent Police Authority.

Before the use of Profiling by the Kent Police Authority would be feasible a question would first need to be examined.

- Which criminal activities is the port authority interested in profiling?
 - The port authority would need to identify which criminal activities they are specifically interested in targeting. In the case of terrorism, it would be very difficult to create a profile of these individuals as they may not be engaging in any crime at the time of border crossing. In order to create a meaningful profile it would be necessary to engage in a concerted effort across agencies to collect the case studies of identified terrorists across the UK. However, what may be of more practical use would be the creation of profiles of criminal activities that are generally associated with the support of terrorist activity (e.g., drug trafficking, weapons smuggling, money laundering).
- What is the profile of individuals engaging in these criminal activities of interest, and what geographic indicators affect these individual profiles?
 - This question could be answered through the systematic analysis of current databases of checkpoint reports, and the collection of additional information at checkpoints and by ferry operators. The amount of time needed for the compiling of the already existent databases would be dependent on the number of staff members that could be employed, the size of the already existent databases, and the compatibility of the existing databases with each other.

The collection of new material for the database would need to be completed over the course of the year. For the ferry operators this would mean the

implementation of a data collection procedure of basic information that could become a permanent part of their loading processes. For the checkpoint officers this would require a randomized collection of more detailed, and systematic information throughout the course of a year.

However, once these conditions are met it should be simple, though perhaps time consuming to implement the use of Profiling as a way to identify and examine potential suspects by the Kent Police Authority.

- Once a profile database is created, officers would need to continue to catalogue indicators of interest during stops at checkpoints. This is important in order to keep an up-to-date catalogue of what indicators are still accurately predicting criminal activities. It is possible that individuals engaged in criminal activity could become aware of which indicators are being used to target them and change their behaviour accordingly. By keeping the database up-to-date these changes in behaviour should be observable.
- When specific conditions identified from the geographic profiling are met (e.g., weather patterns, time of year) officers and equipment could be allocated to the identified port(s).
- Officers would need to attend a workshop explaining the criminal profiles and giving examples of the different indicators.
- Officers could then use a basic sub-sample of indicators for the purpose of real-time, initial identification
- Checklists could then be provided of more detailed inventories of indicators for use at the checkpoints after a suspect is pulled aside for further examination.

III.) Facial Recognition

Summary & Recommendations for Facial Recognition

The confirmation of identity with official documents (e.g., detecting a false passport photograph) is very difficult, especially when identifying someone of another race or ethnicity. However, research has shown that there are certain cues that can improve identification. Specifically, the use of bright lighting, shone from an above source, and having the suspect maintain similarity in head position and expression have been found to help. Additionally, there may be a feature-based training program which can reduce problems with identifying other-race faces, and may improve facial recognition overall.

Before these recommendations can be implemented, three questions should first be answered: Can lighting and facial cues improve facial recognition in port environments? Can the other-race bias be reduced in other groups besides Whites, and will training reduce the bias towards other racial groups besides Blacks? How long do the effects of other-race bias training last and how often would individuals have to go through the training experience in order for it to show real improvements?

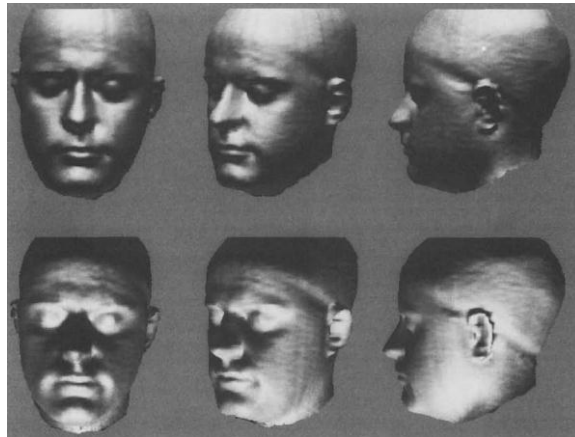
The confirmation of identity with official documents and the identification of known suspects from images (e.g., passport photographs, security video, etc.) have been shown to be difficult tasks for most individuals, including law enforcement officers (Bruce, 1982; Hancock, Bruce, & Burton, 2000; Morgan, Hazlett, Doran, Garrett, Hoyt, Thomas, Baranoski, & Southwick, 2004; Stone & Valentine, 2004). This difficulty in face recognition occurs both when an individual is trying to remember a face (e.g., as in eye-witness testimony), and when an individual is trying to match images of a face (e.g., a passport photograph to a mugshot) or match an image to a person (e.g., driver's license photograph with the driver) (Bruce, Valentine, & Baddeley, 1987; Burton, Wilson, Cowan, & Bruce, 1999; Hill & Bruce, 1996; Kemp, Towell, & Pike, 1997). It is these problems of recognition that are of particular concern for suspect identification.

Different cues in the environment and on the face can make face recognition less difficult (Bruce, 1982; Burton, Wilson, Cowan, & Bruce, 1999; Hancock, Bruce, & Burton, 2000; Hill

& Bruce, 1996; Wogalter, Jarrard, & Cayard, 1991). The main cues that have been identified are lighting, face angle and changes in expression. Specifically, judgments of face recognition are improved when all three cues are kept constant between the image (e.g., photograph) and the other image or the individual (Bruce, 1982; Hancock, Bruce, & Burton, 2000; Hill & Bruce, 1996). For example, if the lighting in the photograph is bright and from the top, the face is shown fully from the front, and the person is smiling then an accurate match will most likely be made if suspect is viewed in a space with bright ceiling lighting, looking fully into the face of the officer, and smiling.

In addition to maintaining similarity in the environment, certain lighting and face angles improve the chances of accurate identification (see Figure 1 for examples). When lighting is from above facial recognition is improved, but when lighting comes from below facial recognition is impeded (Hancock, Bruce, & Burton, 2000; Hill & Bruce, 1996). Face recognition also improves when viewed under bright illumination (DiNardo & Rainey, 1989). Furthermore, individuals are more accurate at matching faces presented in a $\frac{3}{4}$ view, and are very bad at matching faces presented in a profile view (Bruce, 1982; Bruce, Valentine, & Baddeley, 1987; Hancock, Bruce, & Burton, 2000). Full-face views fall somewhere in the middle and similarity of the images increases this accuracy, whilst similarity of the images does not improve the poor matching that occurs with profile views (Bruce, Valentine, & Baddeley, 1987).

Figure 2. Example of differences in lighting (from top or bottom) and face angle (full, ¾, and profile).



From Hill and Bruce (1996).

Of particular note in understanding the difficulties with facial recognition is the other-race effect (i.e., the phenomena that it is very difficult for individuals to accurately identify and recognize the faces of people from other racial or ethnic groups; Hills & Lewis, 2006; MacLin & Malpass, 2001; Malpass & Kravitz, 1969; Meissner & Brigham, 2001). However, some evidence has shown that not all racial groups perform equally poorly on cross-race facial identification tasks (i.e., Blacks tend to perform better than Whites; Cross, Cross, & Daly, 1971; Malpass & Kravitz, 1969), and that this improvement in identification may be due to the different ways the face is examined (Ellis, H., Deregowski, & Shepherd, 1975).

For example, Black individuals examine the face outline, eye size, eyebrows, chin, ears, mouth and nose when trying to remember a face. However, White individuals examine hair colour, hair texture and eye colour (Ellis, H., Deregowski, & Shepherd, 1975). These differences make sense when examining members of one's own race as hair features have been found to explain 85% of the variance between White faces, and lower facial features (i.e., nose, mouth, and chin) have been found to explain 75% of the variance between Black

faces (Shepherd & Deregowski, 1981). However, hair features only explain 35% of the variance for Black faces, and lower facial features only explain 35% of the variance for White faces (Shepherd & Deregowski, 1981).

In order to reduce the other-race effect, researchers have designed training taking these different ways to examine faces into account. In a laboratory experiment, White participants were asked to determine whether or not faces were similar (Hills & Lewis, 2006). These faces differed on feature-critical aspects that have been found to explain the most variance of Black faces (i.e., nose, chin, mouth and cheeks; see Figure 2 for example). Participants engaged in this matching task examining 40 different faces for an hour, and the task became progressively more difficult as faces became more similar. After the task was over, the other-race effect was eliminated, as participants performed equally well at identifying Black and White faces.

Figure 3. Example of feature-critical faces that differ in nose, chin, mouth and cheeks.



From Hills & Lewis (2006).

Weaknesses

- Most face recognition work has been conducted exclusively in controlled laboratory settings. Although there have been some exceptions that have studied realistic images (e.g., ID cards, security footage) or used relevant samples (e.g., Burton, Wilson, Cowan, & Bruce, 1999; Kemp, Towell, & Pike, 1997), there has not been an examination of whether or not these different lighting and facial cues improve facial recognition in a real-world environment, like a port security setting. However, these cues are very straightforward and it would be expected that they would improve facial recognition in a port security setting.
- Although promising, the training to reduce the other-race bias in facial examination has a number of issues that need to be examined. First, this study only examined the reduction of the other-race bias in White participants. Second, this training only examined the reduction of bias with Black faces. Third, this training was conducted in a controlled laboratory setting where the reduction of the other-race bias was tested very soon after training.

To date, there is no evidence to suggest whether or not this training would also work to eliminate the other-race bias in other non-White populations. Though, Black individuals tend to do better than Whites at identifying other-race faces, Blacks still exhibit a bias. It would not be expected that this current training program would significantly improve Black individuals' identification of White faces as the features that were used (i.e., nose, mouth, chin and cheeks) have only been found to explain 35% of the variance with White faces. This suggests that in order to improve Black individuals' identification of White faces they would need to have a training program that used differences in hair and eyes as these features have been shown to explain

most of the differences with White faces. Additionally, very little is known to what extent other racial or ethnic groups that are not White or Black exhibit the other-race bias, and nothing is known about how this training could benefit them, nor which features best describe them.

Finally, there is no information about whether or not the effects of this training are permanent or not. If they are not permanent, how long do the effects last, and how often would individuals have to go through the training experience in order for it to show real improvements? It is possible that the regular use of the techniques by officers may be enough to keep the original training effect active. Applying other-race bias training to a port security setting could be very beneficial as it is possible that the training in the use of other facial indicators may make an individual better at face recognition in general.

Feasibility to improve Facial Recognition by Kent Police Authority.

Before the Kent Police Authority could feasibly implement Facial Recognition improvements three questions would first need to be examined.

- Can lighting and facial cues improve facial recognition in port environments?
 - This question could be answered by a very simple study. At a few selected ports four different conditions could be tested in-between periods of high traffic. During these periods confederates could drive through the checkpoints with either real or fake forms of identification. In the first condition, changes in lighting could be made to increase the brightness (e.g., use stronger light bulbs) and direction (e.g., ask drivers to turn on the overhead lights in their cars, provide officers with flashlights) of lighting. In the second condition,

officers could be taught to make judgments by asking the driver to change the direction he/she is facing and to modify his/her expression to more closely resemble the identification image. In the third condition, both lighting changes and providing officers with facial cue information would be used. In the fourth officers would screen drivers normally, with no special instructions or changes to environment. It would be expected that the most improvement would occur in the third condition, when all possible cues are being utilized. However, it is possible that due to inherent problems in the checkpoint environment (e.g., poor natural lighting, elevated angle of officer from the driver in the car) that the cue changes may make identification more difficult.

- Can the other-race bias be reduced in other groups besides Whites, and will training reduce the bias towards other racial groups besides Blacks?
 - The Police Authority would first need to determine which racial/ethnic groups besides Blacks and Whites warrant further examination. It is suggested that groups be chosen either because they (1) make up a large proportion of the minority population currently in the U.K., or (2) make up a large proportion of individuals that pass through the port as passengers. Physiognomic differences (e.g., the amount of variance explained by features) between these races would then need to be identified.

Once the physiognomic differences are identified, composites would need to be created that differed only on these various features. A representative sample of individuals from various racial and ethnic groups would then be presented with different conditions of the training procedure described earlier.

Specifically, they would either be trained to use (1) features that represented

one of the identified physiognomic differences (e.g., just lower features), (2) all of the different physiognomic differences (e.g., lower and upper features, as well as internal (eyes) and external features (ears)), or (3) not provided any training in physiognomic differences. This would provide information on whether or not the training for reducing Black other-race bias can be generalized to other races, and whether or not other racial or ethnic groups can also benefit from this training.

- How long do the effects of other-race bias training last and how often would individuals have to go through the training experience in order for it to show real improvements?
 - In order to answer this question, individuals would need to go through varied lengths of other-race bias training (e.g., an hour, an hour once a week, an hour once a month). They would then need to be tested for the other-race bias after the passage of set periods of time (e.g., 1 hour, 1 day, 1 week, etc.). This is a potentially a very complicated design and would probably need to be divided into different parts in order to best establish how much training is needed and how long the training effects last. Additionally, it would be important for the Police Authority to establish a limit when the need to retrain to maintain the benefits is too costly (e.g., if retraining needs to occur every week).

However, once these conditions are met it should be simple, though perhaps time consuming to implement the use of Facial Recognition as a way to identify and examine potential suspects by the Kent Police Authority.

- The training program could be loaded onto easily accessible computers. After a first training session, where officers are taught how to use the program correctly, officers

could then sit down for a set period of time on a regular basis (e.g., once a month for an hour) to be ‘retrained’ if that is found to be needed.

- If lighting cues are found to be effective then it is possible that identification areas may need to be refitted with better and directional lighting sources. However, it is also possible that officers could simply carry flashlights with them, or ask drivers to turn on their overhead lights when entering the checkpoint.
- If facial cues are found to be effective, officers would need to attend a brief seminar on which cues are effective, and how to request suspects to improve similarity to ID (e.g., ask the suspect to please face the officer fully as most IDs are full-face images).

IV.) Implicit Attitudes

Summary & Recommendation for the Implicit Attitudes

Implicit attitudes can provide information about what an individual feels about a target without having to directly ask the individual, or, in some cases, without the individual being aware of the information under scrutiny.

The implicit association test measures how much an individual believes two concepts are related (e.g., terrorist activities and heroism). This test could be used during examination to determine whether or not a suspect supports a given target. However, the Kent Police Authority would need to first identify which targets and concepts are useful.

Research has shown that an individual's skin conductance response changes when presented with a familiar face. Additionally, this change occurs whether or not the individual is aware of seeing the face or not. This tool could be used during examination when some suspects are already known to the police. However, little is known about whether or not this effect can be used in a setting where base-rate responses are already high due to stress.

Research has shown that people very rarely provide accurate information to a question, either because they are being intentionally dishonest or, more often, because they are unaware that the answer they are providing is not accurate. In order to deal with this issue a large amount of research has examined how to measure implicit (e.g., automatic) attitudes and knowledge (Beauchemin, Beaumont, Vannasing, Turcotte, Arcand, Belin, & Lassonde, 2006; Eimer, 2000; Ellis, H., & Quayle, 1999; Greenwald, McGhee, & Schwartz, 1998). Implicit attitudes can provide information about whether or not an individual is familiar with or feels positively towards a target without having to directly ask the individual, or, in some cases, without the individual being aware of the information under scrutiny. Two areas of implicit attitude research have been identified of possible use to the Kent Police Authority, the implicit association test, and facial familiarity.

A.) Implicit Association Test

The Implicit Association Test (IAT) was originally designed to study concepts that participants may find difficult to discuss honestly (e.g., prejudicial attitudes, political

sympathies, psychopathology) because the concepts are stigmatizing or socially inappropriate (Gray, MacCulloch, Smith, Morriss, Snowden, 2003; Greenwald, McGhee, & Schwartz, 1998; Jost, Nosek, & Gosling, 2008). The first use of this methodology explored prejudicial attitudes of White towards Blacks (Greenwald, McGhee, & Schwartz, 1998). Individuals were tested to see how strongly they associated Black/White names with pleasant/unpleasant words. White people who were prejudiced more strongly associated Black names with unpleasant words.

During the procedure of the IAT, individuals sit in front of a computer and are asked to make a response with their right finger (using 'L' key) and their left finger (using 'A' key) depending on what word they see on screen (see Table 8 for example of the procedure)⁶. In the first trial, the individual see words about the target of interest (e.g., names of flowers or weapons) and is asked to push 'L' if they see a flower and 'A' if they see a weapon. Next, they see words that are associated with pleasantness and are asked to push 'L' if the word is unpleasant and 'A' if the word is pleasant. In order to strengthen the association, the two sets of targets are then paired using the same finger (i.e., unpleasant words and flower names push letter 'L', and pleasant words and weapon names push letter 'A'). In Trial 4, they reverse the fingers used to indicate the target of interest (i.e., if the right finger pressed 'L' when a flower name appeared, they now use the left finger to press 'A'). Finally, the two sets of targets are paired again, but this time the pleasant words and the pleasant target (i.e., flowers) are paired with the same finger (i.e., 'A'), and the unpleasant words and the unpleasant target (i.e., weapons) are paired with the same finger (i.e., 'L'). Throughout the task, the amount of time it takes for the individual to press the appropriate button is recorded by the computer.

⁶ Visit <https://implicit.harvard.edu/implicit/> for examples of the IAT procedure.

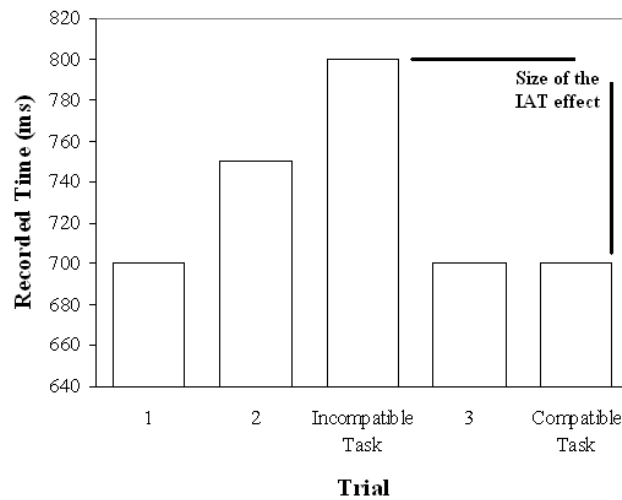
Table 7. Example of target trials in the IAT (A = left finger, L = right finger).

| Sequence | 1 | 2 | 3 | 4 | 5 |
|-------------------|---|---|--|---|--|
| Trial Description | TARGET OF INTEREST | ASSOCIATED CONCEPT | INCOMPATIBLE COMBINED TASK | REVERESED TARGET | COMPATIBLE COMBINED TASK |
| Trial Instruction | FLOWER ^(L) (A)WEAPON | (A)Pleasant Unpleasant ^(L) | FLOWER ^(L) Unpleasant ^(L) (A)WEAPON (A)Pleasant | (A)FLOWER WEAPON ^(L) | (A)FLOWER Unpleasant ^(L) WEAPON ^(L) (A)Pleasant |
| Sample Stimuli | POPPY ^(L) (A)ARROW (A)RIFLE IRIS ^(L) LILY ^(L) (A)DAGGER TULIP ^(L) (A)MISSILE | (A)Lucky (A)Honour Poison ^(L) Grief ^(L) (A)Gift Disaster ^(L) (A)Happy Hatred ^(L) | (A)Pleasure ASTER ^(L) Evil ^(L) (A)BOMB (A)Miracle CLOVER ^(L) Filth ^(L) (A)KNIFE | GUN ^(L) (A)MARIGOLD (A)CROCUS AXE ^(L) (A)ORCHID MACE ^(L) (A)ROSE SPEAR ^(L) | (A)BLUEBELL (A)Peace PISTOL ^(L) (A)Rainbow (A)PANSY BLADE ^(L) Accident ^(L) Ugly ^(L) |

Adapted from Greenwald, McGhee, and Schwartz (1998).

The IAT is scored by the difference in time between button pushes in the incompatible combined task and the compatible combined task. When the target and the concept are compatible (i.e., flower and pleasant) the amount of time it takes to push the correct button should go more quickly. When the target and concept are incompatible (i.e., weapon and pleasant) the amount of time it takes to push the correct button should take longer. The more strongly an individual believes that the pleasant concept and target are associated and the unpleasant target and concept are associated the greater the difference between the incompatible and compatible response times (see Figure 3 for an example).

Figure 4. Example of the recorded differences that make the IAT effect (adapted from Greenwald, McGhee, and Schwartz, 1998).



Recently the IAT has been used in forensic settings to explore various associations in order to identify certain types of criminals (Gray, Brown, MacCulloch, Smith, & Snowden, 2005; Gray et al., 2003). For example, one study examined the relationship between psychopathology and violence (Gray et al., 2003). The research showed that psychopathic murders had lower IAT effects for the incongruent pairing of pleasant concepts with the unpleasant target (i.e., words related to murder) compared to nonpsychopathic murders, psychopathic other crime offenders, and nonpsychopathic other crime offenders. Specifically, psychopathic murders do not think pleasant words and violent words are incongruent.

One of the reasons that IAT has been incorporated into forensic research is that it is very difficult to fake the IAT effect (Asendorpf, Banse, & Mucke, 2002; Kim, 2003; Tulbure, 2006). In order to fake the IAT effect, an individual must be aware of the association of interest, which trials are the compatible and incompatible trials, and that the shorter reaction times should be made when the associations are compatible and longer reaction time should be made when the associations are incompatible (Fiedler & Bluemke, 2005). Additionally,

even with all of this information it can still be very difficult to fake an IAT effect (Steffens, 2004; Tulbure, 2006).

Weaknesses

- The use of the IAT in forensic fields is relatively new. To date, the IAT has only been used in forensic settings to identify murderous psychopathology and paedophilic attraction to children (Gray, Brown, MacCulloch, Smith, & Snowden, 2005; Gray et al., 2003), and has not been used to identify the associations held by criminals of interest to Kent Police Authority. However, other researchers have developed IATs on topics that have forensic application (Nosek, Banaji, & Greenwald, 2006):
 - Asian/White faces American/foreign landmarks – This IAT examines an individual's knowledge of local and foreign stereotypical landmarks. The IAT could be adapted to look at a group of criminals (i.e., known terrorists) from a known area (i.e., Afghanistan). Performing well on the task would suggest familiarity with both the individuals and locality. This would be suspicious if the suspect denies familiarity with the individuals or locality.
 - Nationalism task stimuli sets – This IAT can be adapted to look at a suspect's favouritism towards a specific nationalist group. Could be adapted to test belonging to other groups and associations.
 - IATs could be designed to look at the favouritism, liking or association of any group, individual or concept.
- The IAT is very limited and specific in the type of information that can be exposed. For an example, an IAT designed to examine a suspect's response to terrorist activities could only verify whether or not the individual believes that terrorist activities are not negative events. By itself, an IAT can not verify whether or not a

suspect is a terrorist, promotes terrorism, would or has engaged in terrorist activities, or is being deceptive. However, if during an examination a suspect very clearly states that he is strongly against any acts of terrorism but then scores low on an terrorism response IAT (i.e., does not think terrorism and positive concepts are incongruent), this could suggest that the suspect is being dishonest. Additionally, if a suspect scores low on a terrorism response IAT, scores low on an IAT designed to examine associations with murder, and scores low on an IAT designed to examine associations with terrorist organizations, this could suggest that this individual should be examined in greater depth.

Feasibility to use the IAT by Kent Police Authority.

Before the Kent Police Authority could feasibly implement the IAT, concepts and targets would need to be identified as being of interest. These concepts and targets would then need to be evaluated and tested to assure that association of interest is being represented by the IAT procedure. This would involve comparing IAT responses for a given target to other measures that have also been designed to evaluate that target. If the IAT is valid, it would be expected to correlate to other measures designed to evaluate that target.

However, once this condition is met it should be simple to implement the use of the IAT as a way to examine potential suspects by the Kent Police Authority.

- A computer with the IAT program would need to be made available in areas where examinations take place.
- Suspects would then be asked to complete the IAT(s) that is relevant to the reason he/she is under suspicion. For example, if the suspect is believed to be part of a terrorist activity he/she could complete a terrorist behaviour, terrorist organization,

and murderous intent IATs. However, if the suspect is believed to be a paedophile illegally transporting a minor he could complete a paedophile IAT. An IAT session generally takes 10-15 minutes to complete, and the program delivers a response immediately.

- Officers could then continue the examination with some knowledge about the suspect's attitudes about specific topics.

B.) Facial Familiarity

Being able to establish that a suspect is familiar with other known criminals without relying on the suspect honestly providing this information is potentially useful information for law enforcement. Research has shown that being familiar with a target face produces automatic responses that are difficult to control (Ellis, A., Flude, Young, & Burton, 1996). These types of responses do not occur with other target information, like names or descriptions (Ellis, A., et al., 1996; Ellis, A., Young, Flude, & Hay, 1987; Ellis, H., Jones, & Mosdell, 1997; Ellis, H., & Quayle, 1999), and can be detected with physiological measures (Eimer, 2000; Ellis, Young, & Koenken, 1993; Ellis & Quayle, 1999).

In the area of facial familiarity, two physiological measures have been identified. The first, event-related brain potentials, is expensive, unwieldy, and requires a great deal of training with an fMRI scanner (Eimer, 2000). However, the second physiological measure, skin conductance, has a greater potential to be applicable in an examination setting.

Research has shown that an individual's skin conductance response changes when presented with a familiar face (Ellis, Young, & Koenken, 1993; Ellis & Quayle, 1999; Stone, Valentine, & Davis, 2001). Additionally, this change occurs if the individual is aware of seeing the face

or not (Ellis, Young, & Koenken, 1993). Specifically, in these studies, faces of familiar people (e.g., celebrities) are presented on a computer screen either for only a very few milliseconds (too quickly to be consciously observed) or for a few seconds. Regardless of how long they were able to see the image, a familiar face produced an increased galvanic skin response (GSR; Ellis, Young, & Koenken, 1993).

Equipment to measure GSR varies in usability and price (from £400-£2000). Many devices need to be attached to a computer, however equipment has been recently created that can be used in conjunction with a Bluetooth device for greater mobility (Strauss, Reynolds, Hughes, Park, McDarby, & Picard, 2005). Training to use equipment for familiarity task is very straightforward and simple.

Weaknesses

- The use of GSR to indicate suspect familiarity with a target face has only occurred in a laboratory setting. There is no evidence that this tool would be useful in less controlled settings where other aspects of the environment could affect changes in the skin response.

Feasibility to use Physiological Measures of Facial Familiarity by Kent Police Authority.

Before the Kent Police Authority could feasibly implement Physiological Measures of Facial Familiarity, a question would first need to be examined.

- Can GSR indicate familiarity with a target face in an examination setting?
 - In order to answer this question, individuals would need to be shown target faces during an examination whilst connected to GSR equipment. In order to

make appropriate comparisons, a GSR base rate would be recorded, as well as the individual's responses to the faces of familiar and unfamiliar targets.

However, once this condition is met it should be simple to implement the use of the Physiological Measures of Facial Familiarity as a way to examine potential suspects by the Kent Police Authority.

- Officers would need to be trained in the use of the galvanic skin response equipment.
- During examinations where accomplices have been identified, images of the accomplices could be shown to the suspect and the galvanic skin response would be recorded. A base-line response would need to be recorded previous to the showing of the image for comparison purposes.

V.) Contextual Cues

Summary & Recommendation for Contextual Cues

Research has shown that the exposure of different contextual cues can influence later behavioural responses. However, this type of cue has never been used in an applied setting like a port, nor have contextual cues been developed that are directly related to behaviours of interest to the port authority.

One possible exception is self-awareness cues (e.g., mirrors, video cameras), which have been shown to increase self-monitoring and anxiety relevant behaviours in individuals that are nervous. These self-awareness cues could be installed in a port setting and used to cause suspects experiencing anxiety to behave more nervously. If this was paired with deception detection training, then trained officers could then identify these overly anxious individuals. However, before this could be implemented, research would need to be conducted to examine if these cues will work in an applied setting.

Research has shown that people's behaviours can be changed by the presence or absence of cues in the environment (Bargh, Lombardi, & Higgins, 1988; Beaman, Klentz, Diener, & Svanum, 1979). For example, the presence of mirrors and video cameras make people more self-aware of what they are doing, and will result in a reduction of transgressive behaviours (Beaman, Klentz, Diener, & Svanum, 1979). The purposeful exposure to contextual cues for the purpose of influencing behaviour is known as priming. Priming as it can relate to the identification of suspects is discussed in further detail below. Additionally, a prime that has been identified in the literature search as having specific relevance to suspect identification (i.e., self-monitoring) is described in more detail

Priming. Researchers often use priming (i.e., the exposure to a stimulus influences a later response) in order to elicit observable responses without making participants aware that their behaviour is being influenced. This is done by making some change in the environment that leads to a related response. For example, individuals who have read a list of words about elderly people (e.g., old, bingo) will, for a short period of time, walk more slowly than people not shown those words (Bargh, Chen, & Burrows, 1996).

More importantly, researchers have shown that differences in a person's attitudes, beliefs, or feelings will effect whether or not a prime will influence the desired behaviour (Bargh, Lombardi, & Higgins, 1988; Cesario, Plaks, & Higgins, 2006; Custers & Aarts, 2007; Dijksterhuis, Preston, Wegner, & Aarts, 2008; Thompson & Musket, 2005). For example, in the earlier elderly illustration, research has shown that individuals walk slowly if they had a positive attitude towards the elderly, whereas if individuals have a negative attitude towards the elderly then they walk more quickly (Cesario, Plaks, & Higgins, 2006).

In regards to a port setting, this technique has some very interesting implications. Contextual cues (e.g., images of known criminals, signs warning of terrorist checks) that have been developed to have priming effects for individuals engaging in criminal activity (e.g., feeling guilty, being knowingly deceptive, having strong positive attitudes towards terrorist activities) could be displayed throughout areas in the port. Officers could then be trained to observe the primed behaviours (e.g., ostensibly ignoring information, or entering one queue over another). A specific contextual cue (i.e., items that promote self-monitoring,) have known effects on behaviours that may be applicable in a port setting and are provided as a further example of priming.

Self-monitoring. One powerful prime in the literature is the presence of cues (e.g., mirrors, video cameras) that increase individuals' levels of self-checking and self-awareness (Hofmann & Heinrichs, 2002; Wicklund & Duval, 1971). When forced to be self-aware by the presence of these cues, individuals focus on how their current behaviour are (in)consistent with the standards of the situation (Wicklund & Duval, 1971). For example, trick-or-treating children were more likely to follow the written directions to take only one sweet from an

unmonitored basket when a mirror was present than if no mirror was present (Beaman, Klentz, Diener, & Svanum, 1979).

One area that self-monitoring research has been applied is social phobias and anxiety.⁷ Research has shown that when individuals who are experiencing anxiety about a task are asked to perform the task in the presence of a self-awareness cue (e.g., mirrors or video cameras), the individuals show increased signs of anxiety and nervousness (Carver, Blaney, & Scheier, 1979; Woody, 1996). This occurs because the forced self-awareness makes the individuals more aware of the task and their level of performance in the task (Spurr & Stopa, 2002).

Additionally, when people are asked to complete new or complex tasks they are likely to require more time or make more errors. These effects are increased if a person is made self-aware (Abrams, 1985). By implication, someone who is trying to conceal something is likely to show far more slowness/error proneness when faced with a competing task. This may make it more difficult for them to conceal deceptive behaviour.

The use of self-awareness cues would be most effective with other techniques that have already been described in this report. Specifically, the most benefit would occur by placing self-awareness cues throughout the port setting, whilst officers trained in the detection of deceptive behavioural and verbal cues observed. According to the literature, the placement of these cues should cause individuals that are already anxious about their criminal behaviour to become more nervous and present more deception cues.

⁷ A related area of research has shown that, with psychiatric patients, the presence of mirrors leads to more accurate and honest reporting of hospitalization history (Gibbons, Smith, Ingram, Pearce, Brehm, & Schroeder, 1985). This could suggest that the presence of mirrors in the examination room may increase accurate and honest reporting. However, it is possible that this finding is specific to individuals that have an invested interest in being accurate and honest, like clinical patients trying to get healthier.

Weaknesses

- Although contextual cues should be able to serve as primes to elicit observable behaviour in criminals, to date these cues have never been studied. It is currently unknown what type of cues (e.g., images of known criminals, signs warning of terrorist checks) and what type of behaviours (e.g., ostensibly ignoring the information, choosing a route to avoid checks) will be associated with criminal activity. The one exception to this is self-awareness cues (e.g., mirrors, video cameras) which have been shown to elicit nervous behaviour in anxious individuals.
- To date, none of the contextual cues described above have been used systematically in an port security setting. It is unknown if these cues would cause individuals engaged in criminal activity to behave in a observable manner.

Feasibility to use Contextual Cues by Kent Police Authority.

Before the Kent Police Authority could feasibly implement Contextual Cues, two questions would first need to be examined.

- Are there contextual cues that can prime criminal populations?
 - In order to answer this question, the priming literature would have to be thoroughly investigated to identify any possible contextual cues that could be utilized in a port setting or that are related to behaviours of interest to the Kent Police Authority. Identified contextual cues would then need to be tested in the port setting to establish whether or not they will elicit an observable response (see next point).
- Can contextual cues be used to elicit observable behaviour in a port setting?

- To answer this question, the self-awareness cue of mirrors will be used as an example. Mirrors would need to be installed in targeted areas around the port. Officers would then need to be trained to detect noticeable differences in anxiety behaviour. Over a set period of time, officers would need to record if the anxiety behaviour was a primary factor for a suspect to be stopped and searched. In a separate condition, officers would note if anxiety behaviour was a primary factor for stop and search, but without the installation of the mirrors. If mirrors work in eliciting noticeable nervous behaviour in criminal suspects, then officers should site anxiety behaviours as a primary reason for stop and search more often when mirrors are present. Additionally, nervous behaviour should be related to correct identification of criminal suspects more often when mirrors are present than when mirrors are absent.

However, once this condition is met it may be simple to implement the use of the Contextual Cues as a way to identify potential suspects by the Kent Police Authority. How easy this process would be would depend on the cue itself (e.g., the installation of mirrors around the port would be relatively easy and inexpensive, compared to changing traffic patterns to allow cars to make different choices).

- Contextual Cues would need to be installed at points throughout the port where behavioural responses can easily be observed.
- Officers would need to be informed of the purpose of the contextual cues, and taught which behaviours to observe.

VI.) Other Areas of Possible Interest

During the course of the literature search, other areas of research were flagged as being of interest to the Kent Police Authority, although they did not fit within the scope of Project Sphinx (i.e., procedures that could be used to identify and examine suspects). Therefore, brief summaries focused specifically on usable recommendations are provided below. More detailed examination of these literatures could be the subject of a later report if there is interest.

A. Work environment

Quite a few studies have examined how to increase efficiency and alertness with employees and sentries (Åkerstedt, & Landström, 1998; Juslén, & Tenner, 2005; McBride, Johnson, Merullo, & Bartow, 2004; Partonen & Lonnqvist, 2000; Penn & Bootzin, 1990). Most research has examined how to increase alertness during extended periods of time during duty as individuals can only maintain effective vigilance for a period of two hours (Johnson & Merullo, 1999). These studies include the examination of the optimal amount of caffeine (Penatar & Thorne, 1990; Walsh, Muehlbach, Humm, Stokes Dickins, Sugerman, & Schweitzer, 1990), the use of environmental stimuli (e.g., light, sound, social interaction, vibration; Deguchi & Sato, 1992; Landström, Englund, Nordström, & Åström, 1994; Lowden & Åkerstedt, 1993; McBride, et al., 2004), the effective use of breaks and naps (Bonnet, 1991; Horne & Reyner, 1995).

Caffeine should be used in moderate doses. Ideally, individuals should ingest 2-4 mg/kg of caffeine which is equivalent to about one large mug of coffee or three coca colas (Walsh, et al., 1990). The caffeine should be absorbed within 30 minutes and then beneficial effects should last for 5-6 hours (Bonnet & Arand, 1990; Walsh, et al., 1990). However, caffeine

should not be used as a stimulant for longer shifts, or be used more often than recommended as it can lead to side effects such as jitteriness, trembling and problems concentrating (Åkerstedt, & Landström, 1998; Bonnet & Arand, 1990).

All of the research agrees that the use of bright lighting increases wellbeing (Mills, Tomkins, & Schlangen, 2007), decreases distress (Partonen & Lonnqvist, 2000), and increases alertness (Cajochen, Zeitzer, Czeisler, & Dijk, 1999; Deguchi & Sato, 1992; Phipps-Nelson, Redman, Dijk, & Rajaratnam, 2003). Maintaining a healthy balance in well-being, distress and alertness have been found to be important for reducing accidents and improving performance in high stress work, like security (Friedl; Johnson & Merullo, 1999; Mills, Tomkins, & Schlangen, 2007). Ideally, colour temperature should be maintained at 6500-1700K (Deguchi & Sato, 1992; Mills, Tomkins, & Schlangen, 2007) and illumination brightness between 1000-2500lux (Cajochen, et al., 1999; Partonen & Lonnqvist, 2000; Phipps-Nelson, et al., 2003) for maximum effect.

Monotonous duties and low frequency and monotonous sounds, like car traffic, can reduce alertness (Åkerstedt, & Landström, 1998; Landström & Lindblom Häggqvist, 1988).

However, things that break up the monotony like high frequency sound (Landström, et al., 1994), tactile stimuli (McBride, et al., 2004) and social interactions (Lowden & Åkerstedt, 1993) can have an alerting effect. In regards to sound, alertness is maintained if 4 different ones (3050, 3700, 5800, 10750 Hz at 45 dB) are presented in a random sequence for short, randomized bursts (3-7 s) throughout a period of time. For tactile stimuli, some researchers have shown that a vibrator on a phone or pager set to go off randomly can increase alertness and improve friend-foe discrimination during sentry duty (McBride, et al., 2004). Less is known about the effects of social interaction, however the fact that it could be used to break

up monotony and increase vigilance may suggest that it would be beneficial for officers to question passengers fairly regularly throughout the screening process (Lowden & Åkerstedt, 1993).

During long periods of work activity, breaks and naps can be important to separate long periods of monotony and restore energy (Bonnet, 1991; Horne & Reyner, 1995; Rosekind, Graeber, Dinges, Connel, Rountree, & Gillen, 1995; Schweitzer, Muehlbach, & Walsh, 1992). Research has shown that a 30 minute to hour nap whilst work is slow provides the equivalent of a large cup of coffee (Rosekind, et al., 1995; Schweitzer, Muehlbach, & Walsh, 1992). However, alertness will not fully increase until 10-15 minutes after the nap (Dinges, 1989). Additionally, straight breaks without the consumption of food, napping, or the performance of other activities only shows very short term effects in increasing alertness (Horne & Reyner, 1995).

B. Stress & adaptability training

There is a lot of research examining how to maximise efficiency and improve decision making in stressful military and police situations (Hancock, & Szalma, 2008; Meichenbaum, 2003; van der Hek & Plomp, 1997). Related to this line of research, others have examined how to increase the ability of the military and police forces to adapt in a variety of different situations (White, Mueller-Hanson, Dorsey, Pulakos, Wisecarver, Deagle, & Mendini, 2005). Two existing and relevant training programs have been identified (i.e., Stress Inoculation Training, and the Officer Adaptive Thinking and Leadership course) and will be briefly discussed below.

Stress Inoculation Training (SIT) was designed to help individuals cope with situations that provoked a stressful response (Meichenbaum, 1985) and has been shown to help reduce stress for police officers (Digliani, 1995). Training consists of three stages: learning to understand the nature of stress, the development of skills to make effective responses to stress, and the use of skills in environments that are increasingly similar to the stressful situation (Saunders, Driskell, Johnston, & Salas, 1996). A meta-analytic examination of SIT showed that even one training session can improve performance, that behaviour-based training is more effective than imagery-based training for performance, and training is most effective in groups of about 7-8 (Saunders et al., 1996; Van der Klink, Blonk, Schene, & Van Dijk, 2001).

Similar to SIT, research has shown that receiving preparatory information before engaging in a task can reduce stress and improve performance (Inzana, Driskell, Salas, & Johnston, 1996). Specifically, providing sensory information (e.g., describing typical stress responses like increased heart rate, and tension), procedural information (e.g., they may get distracted, feel rushed, be confronted by someone being rude), and given instructions on how to deal with these reactions and situations (e.g., feeling this way is normal, focus on the task) reduced anxiety, and increased confidence and performance.

Adaptability is the capacity to change based on an alteration in the environment, and is very important skill for military and police officers (Mueller-Hanson, White, Dorsey, & Pulakos, 2005; Shadrick, Lussier, & Fulz, 2007; White, et al., 2005). In order to teach individuals to be adaptable it is important that training consists of exposure to a variety of experiences and situations, and consistent rounds of exposure, practice and feedback (Mueller-Hanson, et al., 2005; Shadrick, Lussier, & Fulz, 2007). The US military has designed the Officer Adaptive Thinking and Leadership course to address these points in a classroom setting (see Appendix

B; White, et al., 2005). However, in order to properly train adaptableness it is important to continue providing feedback in the field (Jacobs & Sanders, 2004; Klein, 2003; Mueller-Hanson, et al., 2005; Shadrick, Lussier, & Fulz, 2007).

With fieldwork, it is important that the process of encouraging adaptability starts before officers enter the field. During the initial planning stages, it is important for officers to imagine that everything that could go wrong did go wrong (Klein, 2003). The use of this ‘pre-mortem’ allows an honest evaluation of possible mistakes without having to face punishment for their own errors, or censure for criticizing a commanding officer (Mueller-Hanson, et al., 2005). Additionally, it can allow the team to make crucial changes to the initial plan to avoid the mistakes whilst in the field.

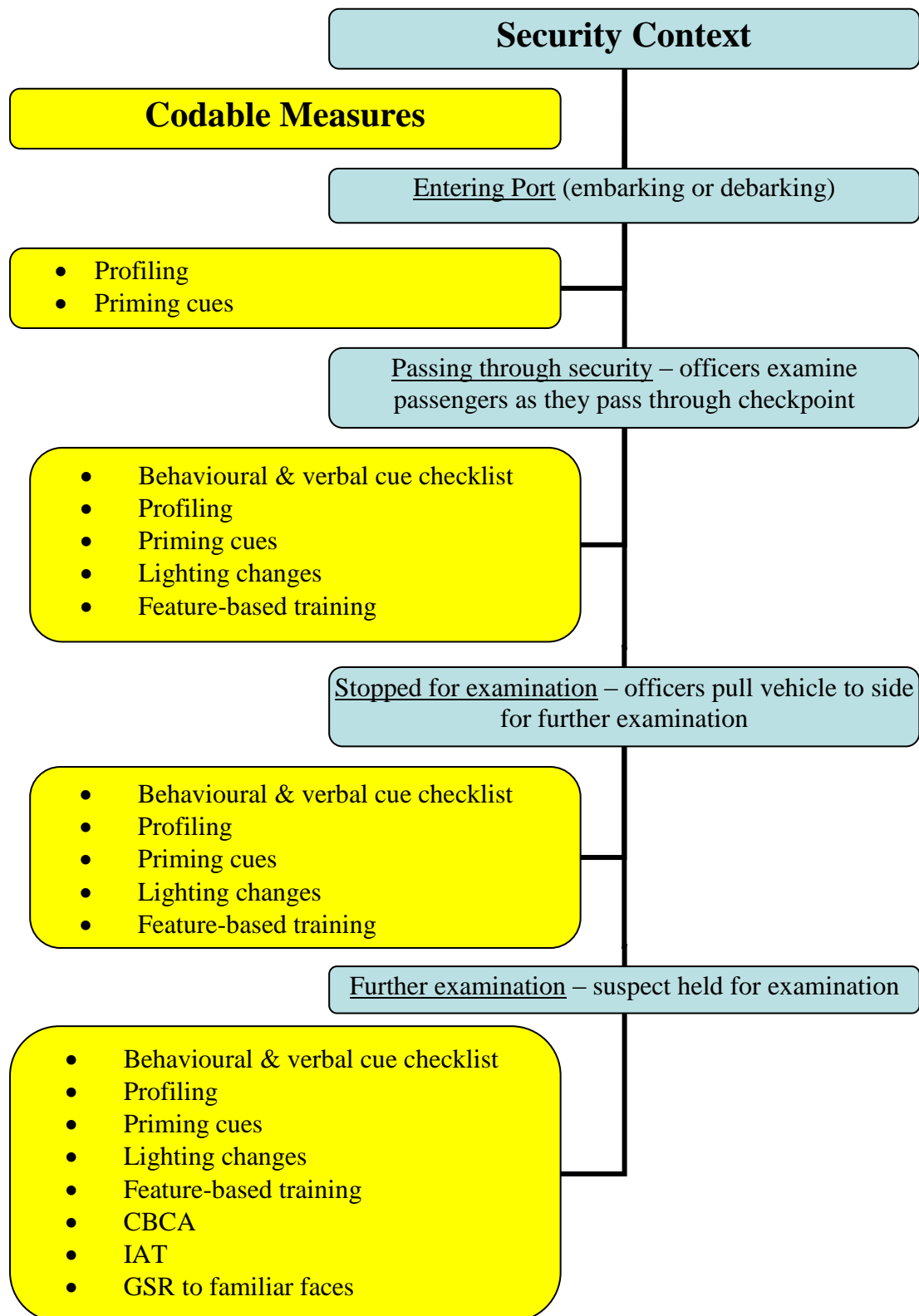
After fieldwork, training opportunities can come in many different forms. The team can be brought together to perform an After Action Review; a critical analysis of what was successful, what did not work, and how to improve in the future (Mueller-Hanson, et al., 2005). Similarly, the use of 360 degree evaluations after the fieldwork is concluded provides critical analysis through a combination of self-report, peer-reports, supervisor-report, and subordinate-reports (Walker & Smither, 1999). With both of these techniques, it is important have help in interpreting feedback in a constructive and focused manner (Walker & Smith, 1999).

VII.) Conclusion

The purpose of this report is to identify areas of research that have yielded observable and codable measures that potentially can be utilized to identify and examine potential suspects in a security setting. Five topic areas of possible interest were examined (i.e., detecting deception, profiling, facial recognition, implicit attitudes, and contextual triggers). This report has identified nine observable and codable measures that could be utilized by the Kent Police Authority (i.e., behavioural and verbal cues to deception, CBCA, criminal profiling, geographic profiling, lighting changes, feature-based recognition training, IAT, GSR to familiar faces, and priming cues). Figure 5 illustrates when these codable measures are most likely to be useful in the port setting. A summary of the recommendations for these codable measures is made below.

In order to detect deception accurately, it would be useful to develop a checklist of behavioural and verbal cues for the identification of suspects. Accuracy of detecting deception will increase as the number of the behavioural and verbal cues being evaluated increases. Implementation requires an understanding of the optimal range of behavioural and verbal cues to be observed to be confident that the target is being deceptive. It is also important to be aware of how much cultural, religious, racial, or ethnic differences affect deception detection. Additionally, criteria-based content analysis examines the discrepancies in the content of statements given after a structured interview. With extensive training, it can be employed in examinations where it is possible to transcribe or record the interview and conduct an immediate analysis.

Figure 5. Summary of codable measures and their usability in a port security setting.



Criminal and geographic profiling are potentially valuable tools for identifying individuals who are engaging in criminal activity and ports that are more susceptible to criminal activity. These tools need to be created by the careful collection, collation and analysis of information at checkpoints. Some of the necessary databases may already exist, in which case they will only need to be incorporated into the larger database.

The ability to match a suspect to an image improves with the use of bright lighting, shone from an overhead source, and having the suspect maintain similarity in head position and expression to the image. There may also be a feature-based training program that officers could take, which may reduce problems with identifying other-race faces, and may improve facial recognition overall. It would be necessary to conduct an evaluation of how improving lighting will work in a port setting, and whether or not the training is practically effective.

The IAT could be used during examination to determine whether or not a suspect supports a given target. The Kent Police Authority would need to first identify which targets and concepts are useful to adapt the test appropriately. Additionally, an individual's skin conductance response changes when presented with a familiar face, and this change occurs whether or not the individual is aware of seeing the face. This tool could be used during examination when potential associates of suspects are already known to the police. More research is required to discover whether or not this effect can be used in a setting where base-rate responses are already high due to stress.

Self-awareness cues (e.g., mirrors, video cameras) could be installed in a port setting and used to cause suspects experiencing anxiety to behave more nervously. If this was paired with

deception detection training, then trained officers could identify these overly anxious individuals. Research is needed to test the effectiveness of these cues in a security setting.

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Appendix A:
List of Cues for Detecting Deception Adapted from DePaulo, et al. (2003)⁸

| Behavioural Responses | |
|---|---|
| 001 Presses lips..... | (AU 23, 24) Lips are pressed together |
| 002 Facial expressiveness..... | Face appears animated or expressive |
| 003 Illustrators..... | Hand movements accompany speech and illustrate it |
| 004 Eye contact..... | Looks toward other person's eyes, uses direct gaze |
| 005 Gaze aversion..... | Look away or avert their gaze |
| 006 Eye shifts..... | Eye movements or shifts in the direction of focus of the speaker's eyes |
| 007 Chin raise..... | (AU 17) Chin raised; chin & lower lip are pushed up |
| 008 Shrugs..... | Up and down movement of shoulders; or, palms of hand are open and hands are moving up and down |
| 009 Body animation, activity..... | Movements of the head, arms, legs, feet, and/or postural shifts or leans |
| 010 Postural shifts..... | Postural adjustments, trunk movements, or repositioning of the body |
| 011 Head movements (undifferentiated) | |
| 012 Hand movements (undifferentiated) | |
| 013 Arm movements | |
| 014 Foot or leg movements | |
| 015 Involved, expressive (overall)..... | Seems involved, expressive, interested |
| 016 Friendly, pleasant (overall)..... | Seems friendly, pleasant, likable (Negative affect were also included after being reversed.) |
| 017 Cooperative..... | Seems cooperative, helpful, positive, and secure |
| 018 Attractive..... | Seems physically attractive |
| 019 Facial pleasantness..... | Shows more positive facial expressions (smiles) than negative expressions (frowns or sneers) |
| 020 Head nods..... | Affirmative head nods; vertical head movements |
| 021 Brow lowering..... | (AU 4) |
| 022 Sneers..... | (AU 9, 10) Upper lip is raised |
| 023 Smiling (undifferentiated) | |
| 024 Lip corner pull..... | (AU 12) Corners of the lips are pulled up and back |
| 025 Eye muscles..... | (AU 6) Movement of the orbicularis oculi, muscles around the eye, during emotions that are not positive |
| 026 Nervous, tense (overall)..... | Seems nervous, tense; Makes body movements that seem nervous |
| 027 Relaxed posture..... | Posture seems comfortable, relaxed; Leaning forward or sideways |
| 028 Pupil dilation..... | Pupil size, usually measured by a pupillometer |
| 029 Blinking..... | (AU 45) Eyes open and close quickly |
| 030 Object fidgeting..... | Touching or manipulating objects |
| 031 Self-fidgeting..... | Touching, rubbing, or scratching their body or face |
| 032 Facial fidgeting..... | Touching, rubbing their faces, playing with their hair |
| 033 Fidgeting (undifferentiated)..... | Object and/or self-fidgeting and/or facial fidgeting |
| 034 Number of segments..... | Perceived number of behavioural units |

⁸ Note. RM – reality monitoring; AU – facial action unit (as categorized by Ekman & Friesen, 1978); CBCA – Criteria-Based Content Analysis.

| | |
|---|--|
| 035 Facial shielding..... | Speakers appear to be shielding their face |
| 036 Intensity of facial expression..... | Speaker's facial expression appears to be intense; rated intensity of AUs |
| 037 Face changes..... | Changes in facial expressions; onset, offset, and apex phases; face seems mobile |
| 038 Indifferent, unconcerned..... | Seems indifferent, unconcerned |
| 039 Seems planned, not spontaneous | |
| 040 Cognitively busy..... | Seems to be making mental calculations |
| 041 Serious..... | Seems serious, formal |
| 042 Facial immediacy..... | (Eye contact, head orientation) Facing other person and gazing at that person; face direct and intense |
| 043 Direct orientation..... | Degree to which the body and head were directly oriented to the other person |
| 044 Proximity..... | In close physical proximity to other person |
| 045 Specific hand and arm movements... | Hand movements that do not include the arm and finger movements that do not include the hand |
| 046 Competent..... | Performance successful; Manages the conversation smoothly; Makes a good impression |
| 047 Ingratiation..... | Use of tactics of ingratiation, such as agreeing with others' opinions or values, expressing approval of others, or revealing their own values that are relevant to the conversational context |
| 048 Genuine smile..... | (AU 6) Movement of the muscles around the eye, orbicularis oculi, as well as the zygomatic major, during positive emotions |
| 049 Feigned smile..... | Masking smiles involving the action of the zygomatic major and muscle movements associated with emotions that are not positive ones; incomplete smiling that appears masked or unnatural |
| 050 Head shakes..... | Negative head shakes; side-to-side head movements |
| 051 Mouth asymmetry..... | Mouth is asymmetrical |
| 052 Relaxed face..... | Show nervous facial movements (reversed) |
| 053 Hand, arm, and leg relaxation..... | Hands or legs are asymmetrical; hands are relaxed |
| 054 Brow raise..... | (Inner-AU 1, Outer -2) corner of the brow is raised |
| 055 Lip stretch..... | (AU 20) Lips are stretched sideways |
| 056 Eyes closed..... | (AU 43) |
| 057 Lips apart..... | (AU 25) Lips relaxed, parted slightly, jaw closed |
| 058 Jaw drop..... | (AU 26) Jaw is dropped open |
| 059 Eye blink latency..... | Time until the first eye blink |
| 060 Eye flutters..... | Barely discernible jiggling of the eyes without fully breaking eye contact (Hocking & Leathers, 1980) |
| 061 Eyelids tight..... | (AU 7) |
| 062 Eyelids droop..... | (AU 41) |
| 063 Lip pucker..... | (AU 18) Mouth is pushed forward so that lips pucker |
| 064 Tongue out..... | (AU 19) Speaker's tongue is out |
| 065 Duration of facial expression..... | Total duration of a facial expression |
| 066 Hands together..... | Hands clasped, folded, or else touching/resting in lap |
| 067 Hands apart..... | Each hand rests separately on different part of body |
| 068 Emblems..... | Hand movements with direct verbal translations |

| | |
|--|---|
| 069 Changes in foot movements..... | Changes in number of foot/leg movements over time (absolute value) |
| 070 Pupillary changes..... | Changes in pupil size |
| 071 Biting lips | |
| 072 Facial reaction time..... | Time until the first facial movement |
| 073 Neck muscles tightened..... | Typically the platysma muscle is tightened |
| CBCA ⁹ | |
| 074 Logical structure..... | “Consistency and coherence of statements; collection of different and independent details that form a coherent account of a sequence of events” |
| 075 Frequency, pitch..... | Voice pitch high; fundamental frequency of voice |
| 076 Unstructured production..... | Narratives presented in unstructured way |
| 077 Spontaneous corrections..... | Spontaneous correction of own statement |
| 078 Admitting lack of memory..... | Admission of lack of memory |
| 079 Self-doubt..... | Raise doubt/objection about own testimony |
| 080 Self-deprecation..... | Use unfavourable, self-incriminating details |
| 081 Contextual embedding..... | “Statements that place the event within its spatial and temporal context” |
| 082 Reproduction of conversation..... | Verbatim reproduction of dialogue |
| 083 Description of interactions..... | Descriptions of interrelated actions and reactions |
| 084 Unexpected complications..... | Report an unforeseen interruption, difficulty, or spontaneous termination of the event |
| 085 Unusual details..... | “Inclusion of detail that is not unrealistic, but has a low probability of occurrence” |
| 086 Superfluous details..... | “Vivid and concrete descriptions of superfluous details” |
| 087 Related external associations..... | “Reference to events or relationships that are external to the event” |
| 088 Another’s mental state..... | “Statements inferring the cognitive and emotional state of others involved in the event” |
| 089 Subjective mental state..... | Report of own cognitive and emotional during the event |
| 090 Details misunderstood..... | “Inclusion of actions and details that are not understood by the witness but may be understood by the interviewer” |
| 091 Pardoning others..... | “Providing explanations or rationalizations for the offender’s actions” |
| Reality Monitoring Scale ¹⁰ | |
| 092 Sensory information..... | Describe sensory attributes e.g. sounds and colours |
| 093 Idiosyncratic information..... | Speakers mention idiosyncratic information |
| 094 Realism..... | The story is realistic and makes sense |
| 095 Clarity..... | “Clarity and vividness of the statement” |
| 096 Reconstructability..... | Event can be reconstructed with the information given |

⁹ The CBCA information comes from Zaparniuk, Yuille, & Taylor (1995), p. 344

¹⁰ The RM information comes from Vrij, 2000, p. 160

097 Cognitive processes..... “Descriptions of inferences made by the participant at the time of the event”

Voice Stress Analysis

098 Vocal tension..... Voice sounds tense, not relaxed; or, vocal stress as assessed by the Psychological Stress Evaluator (PSE), which measures vocal micro-tremors, or by the Mark II voice analyzer

General Content Analysis

Changes in Speech Patterns

- 099 Response length..... Length or duration of the speaker’s message
- 100 Talking time..... Proportion of the total time of the interaction that the speaker spends talking or seems talkative
- 101 Length of interaction..... Total duration of the interaction between the speaker and the other person
- 102 Response latency..... Time between the end of a question and the beginning of the speaker’s answer
- 103 Rate of speaking..... Number of words or syllables per unit of time
- 104 Amplitude, loudness..... Intensity, amplitude, or loudness of the voice
- 105 Non-ah speech disturbances..... Speech disturbances other than “ums,” “ers,” and “ahs,” as described by Kasl and Mahl (1965); categories include grammatical errors, stuttering, false starts, incomplete sentences, slips of the tongue, and incoherent sounds
- 106 Word and phrase repetitions..... Subcategory of non-ah speech disturbances in which words or phrases are repeated with no intervening pauses or speech errors
- 107 Silent pauses..... Unfilled pauses; periods of silence
- 108 Filled pauses..... Pauses filled with utterances such as “ah,” “um,” “er,” “uh,” and “hmmm”
- 109 Mixed pauses..... Silent and filled pauses (undifferentiated)
- 110 Mixed disturbances (ah + non-ah)..... Non-ah speech disturbances and filled pauses
- 111 Miscellaneous dysfluencies..... Miscellaneous speech disturbances
- 112 Vocal pleasantness..... Voice positive, friendly, likable
- 113 Pitch variety..... Variation in fundamental frequency
- 114 Pitch changes..... Frequency of changes in the pitch of the voice
- 115 Rate change..... Rate of speaking in the second half of the message minus rate of speaking in the first half
- 116 Loudness variety..... Standard deviation of amplitude
- 117 Stutters..... Subcategory of non-ah speech disturbances in which the speaker stutters
- 118 Intruding sounds..... Subcategory of non-ah speech disturbances in which the speaker makes intruding sounds that are totally incoherent and are not stutters
- 119 Subset of non-ah..... Subset of non-ah speech disturbances (interrupted words and repeated words)
- 120 Interruptions..... Simultaneous talk results in a change in turns
- 121 Filled pause length..... Duration of filled pauses
- 122 Unfilled pause length..... Duration of unfilled pauses

| | Statement Content |
|---------------------------------------|--|
| 123 Details..... | Degree to which the message includes details e.g., descriptions of people, places, actions, objects, events, and timing of events; degree to which message is complete, concrete, striking, or detailed |
| 124 Cognitive complexity..... | Use of longer sentences (mean length of the sentences), more syntactically complex sentences (those with more subordinate clauses, prepositional phrases, etc.), or sentences that includes more words that precede the verb (mean pre-verb length); use of the words <i>but</i> or <i>yet</i> ; use of descriptions of people that are differentiating and dispositional |
| 125 Type–token ratio | Total number of different or unique words |
| 126 Blocks access to information..... | Attempts by the communicator to block access to information, including, for example, refusals to discuss certain topics or the use of unnecessary connectors (<i>then, next, etc.</i>) to pass over information (Volunteering of information beyond what was requested was also included, after being reversed.) |
| 127 Plausibility..... | The message seems plausible, likely, or believable |
| 128 Discrepant, ambivalent..... | Communications seem internally inconsistent or discrepant; information from different sources (e.g., face vs. voice) contradict; seems to be ambivalent |
| 129 Verbal and vocal involvement..... | Describe personal experience, or events in personal, revealing way; vocally expressive, involved |
| 130 Verbal immediacy..... | Linguistic variations called <i>verbal nonimmediacy devices</i> , described by Wiener and Mehrabian (1968) as indicative of efforts to distance from the listener, the content of the communications, or the act of conveying those communications. 19 categories and subcategories, such as spatial nonimmediacy (e.g., “There’s Johnny” is more nonimmediate than “Here’s Johnny”), temporal nonimmediacy (present tense is more immediate), and passivity (passive voice is more nonimmediate than active voice). |
| 131 Verbal immediacy, temporal..... | A subcategory of verbal immediacy uses the present tense instead of past or future tenses |
| 132 Generalizing terms..... | Generalizing terms (e.g., <i>levellers, everyone, no one, all, none, every</i>); statements implying that unspecified others agree with the speaker |
| 133 Self-references..... | References to themselves or experiences, indexed by use of personal pronouns (<i>I, me, mine, myself</i>) |
| 134 Mutual and group references..... | References to themselves and others, indexed by the use of second-person pronouns (<i>we, us, and ours</i>) |
| 135 Other references..... | References to others or their experiences, indexed by use of third-person pronouns (<i>he, she, they, or them</i>) |
| 136 Verbal and vocal immediacy..... | Respond in ways that seem direct, relevant, clear, and personal rather than indirect, distancing, evasive, irrelevant, unclear, or impersonal |

- 137 Nonverbal immediacy..... Nonimmediate when they maintain a greater distance from the other person, lean away, face away, or gaze away
- 138 Tentative constructions..... Verbal hedges such as “may,” “might,” “could,” “I think,” “I guess,” and “it seems to me” (Absolute verbs, e.g. *to be*, included after being reversed.)
- 139 Verbal and vocal uncertainty.....Uncertain, insecure, or not dominant, assertive, or emphatic; Difficulty answering question
- 140 Ritualized speech..... Vague terms and clichés such as “you know,” “well,” “really,” and “I mean”
- 141 Negative statements & complaints....Degree to which the message seems negative or includes negative comments or complaints (Positive comments were included after being reversed.)
- 142 Modifiers..... A subcategory of verbal nonimmediacy in which speakers qualify their responses (e.g., “sometimes”) or objectify them (e.g., “it is obvious”)
- 143 Verbally distal versus proximal..... Ratio of distal (nonimmediacy) indices to proximal (immediacy) indices
- 144 Pronoun and tense deletion..... Deviations from use of first person and past tense
- 145 Sentence changes..... Subcategory of non-ah speech disturbances in which the flow of the sentence is interrupted by a correction in the form or content (e.g., “Well she’s . . . already she’s lonesome”; “That was . . . it will be 2 years ago in the fall”; Mahl, 1987, p. 167)
- 146 Admitted uncertainties..... Qualifying descriptions by expressions of uncertainty such as “I’m not sure but” or “at least I believe it was like that”
- 147 Self-interest statements..... References to benefits to themselves (Benefits to others were also included, after being reversed.)
- 148 Issue-related reporting style..... Description stays on topic
- 149 Reasons for lack of memory..... Describe reasons for inability to provide a complete description
- 150 Mentions responsibility..... All mentions of responsibility for behaviour (e.g., accepting responsibility, blaming others, offering excuses/justifications, denying participation)
- 151 Qualifications and truthfulness..... Explicit claims that they have the necessary qualifications or that they are telling the truth
- 152 Extreme descriptions..... Extreme descriptions of others (e.g., “the most aggressive person I know,” “extremely intelligent”)
- 153 Neutral descriptions..... Use of evaluatively neutral descriptions
- 154 Hypothetical statements..... References to conditions that did not currently exist but might exist in the future
- 155 Nonsensory-based words..... Words referring to concepts not verifiable by senses, e.g. *love*, *accidentally*, *interesting*, *dishonesty*
- 156 Provides standard description..... Provides description in standard way (as instructed)
- 157 Ratio of conclusion to introduction.. Ratio of the number of words in the conclusion of a story to the number of words in the introduction
- 158 Repetition of story elements..... Aspects of story that were previously described are repeated without elaboration
- 159 Comments and interpretations..... Comment on others in event, interprets event

Appendix B:

Outline of the Officer Adaptive Thinking and Leadership, taken from White et al. (2005)

Introduction to Adaptability

The introductory section of the O-ATL is intended to (1) emphasize the importance of adaptability in SF, (2) introduce the basic concepts of adaptability, and (3) provide students with information and guidance for continued self-development in the area of adaptability. Elements of this section include:

- *Importance of Adaptability.* The course begins with exercises and examples designed to emphasize to the students the numerous ways in which they will be required to adapt to their surroundings.
- *Basic Adaptability Concepts.* The course reviews some basic concepts associated with adaptability so that the students will have a clear understanding of what is meant by adaptability and what will be covered in the remainder of the course. Additionally, students are presented with a set of “Adaptability Rating Scales,” and they are encouraged to use the scales to periodically measure their own adaptability skills.
- *TAIS Workshop.* The TAIS (Test of Attentional and Interpersonal Style) Workshop is delivered by Winning Minds. During the workshop, students receive feedback on their TAIS scores. Students also receive guidance on how to interpret their scores and how their individual attentional and interpersonal style may relate to their performance.
- *Guided Self-Development.* Students are presented with a planning guide to help them develop and record goals for improving their adaptive performance. The students complete the guide on their own, and they are also encouraged to engage in developmental activities upon leaving the course to meet their personal adaptability goals.

Mental Adaptability

The second module of the O-ATL focuses on mental adaptability, or the ways in which people must adjust their thinking to handle situations effectively. This module of the course focuses on (1) being willing and able to recognize and adjust to changes, switching mindsets as necessary, (2) thinking critically and solving problems, and (3) making decisions/choosing courses of action. In essence, this section is concerned with how problem solving and decision making skills can be applied to achieve adaptive performance, and how the students can improve their skills in those areas. Elements of this section include:

- *Switching Mindsets.* Mindsets are ways that people mentally frame or represent situations so that they can understand them and approach them appropriately. These concepts are illustrated with an exercise.
- *Tools and Strategies for Critical Thinking.* Since mental adaptability is concerned with the ways in which people cognitively approach changing situations, the O-ATL provides information on thinking critically about dynamic situations and solving the problems that emerge from them. First, the course reviews common errors that people make in their thinking (e.g., identifying the wrong problem; jumping to conclusions; not evaluating the information received for consistency; taking information on faith;

ignoring information in favor of personal feelings). To illustrate this concept, students read a case study of a historical situation. Next, the course reviews active problem solving strategies that the students might use to solve a difficult problem (e.g., breaking a problem into parts; restating a problem in different terms; using prompting questions to guide analysis of the problem; taking different perspectives toward the problem). The students then engage in an exercise in which they watch a video of four colleagues solving a problem. As the Soldiers discuss the problem, the students identify critical thinking errors and the use of problem solving strategies. An instructor-facilitated discussion of the video highlights the effective and ineffective examples of critical thinking and problem solving.

- *Decision Making.* The course reviews the standard Military Decision Making Process (MDMP) and emphasizes that it is an appropriate approach when time pressure and stress are low enough to allow someone to develop and evaluate alternative courses of action (COA). However, many environments are characterized by time pressure, stress, poor information, ill-defined and/or shifting goals, and changing circumstances. For these types of situations, the students are encouraged to consider a naturalistic approach, in which someone chooses a likely course of action, “wargames” it in his mind, and implements it if it seems like it will work. The students then watch a video of experienced officers describing how they assessed different situations and the COAs that they chose in carrying out actual SF missions. Students compare their own approach to that of the officer on the video and an instructor facilitates a discussion.

Interpersonal Adaptability

The third module of the O-ATL focuses on interpersonal adaptability, or the ways in which people adjust their behaviors depending on the social demands of a situation. This module of the course focuses on (1) understanding social settings, including an awareness of oneself, others, and the larger social system, and (2) strategies for more effectively negotiating with others to obtain desired outcomes. An important concept in this module is that adjusting one’s own behaviors to accommodate others will enable them to accomplish their tasks more effectively. That is, interpersonal adaptability is not about being nice and getting along with others – it is ultimately about interacting with others effectively in order to be productive. Elements of this section include:

- *Understanding Social Settings.* Interacting effectively with others often requires adjusting one’s approach to a situation based on the perspectives, beliefs, personalities, etc. of the other parties involved.
 - *Understanding Oneself:* The O-ATL provides the students with feedback on how they are viewed by others. The students interact in small groups to solve a problem then rate their teammates on a variety of attributes and behaviors. The ratings are exchanged so that each student can see how he is viewed by his teammates in these areas.
 - *Understanding Others:* The key to interpersonal adaptability is to be able to see the world through someone else’s eyes, and the students are provided with strategies for finding out about the perspectives of others. To practice these strategies, the students engage in a role-playing exercise.

– *Understanding the Social System*: Another piece of understanding social settings is seeing how they fit in with the larger environment. For example, most social settings are characterized by rules, norms, regulations, an historical context, etc. These characteristics constrain what sorts of behaviors might be appropriate, and they must be understood to achieve effective interactions with others. The instructor leads the students through a discussion of how elements of social systems are likely to influence their interactions with others.

- *Negotiation Strategies*: Different approaches to negotiations are presented and specific strategies for conducting effective negotiations are provided. The students practice these skills by negotiating in pairs and in a larger group setting (simulating an ODA's interaction with another group).

Leading an Adaptable Team

The last major training module of the O-ATL is dedicated to providing information to the students about leading an adaptable team. The module emphasizes (1) communication and leadership styles that have been effective in the SF ODA environment, and (2) the importance of effective feedback for improving individual and team skills. Elements of this section include:

- *Communication/Leadership Styles*. Students are led through a discussion of effective leadership strategies. Following this discussion, students read descriptions provided by officers that describe effective and ineffective characteristics of their previous team leaders. All of this information is intended to guide the students in adopting a leadership style that is conducive to an effective and adaptive team.
- *Effective Feedback*. Feedback can be a powerful tool both for improving individual performance and team performance. A frank examination and discussion of a team's past performance, coupled with concrete suggestions for improvement, can be instrumental in developing a high performance team. In this section, the students are presented with guidance on delivering effective feedback in a team setting. The students practice delivering team feedback by engaging in a scenario-based exercise.

Summary

The O-ATL concludes with a brief summary of the major points of the course. The students are encouraged to continually evaluate their own adaptive performance and seek continual improvement. The final activity is a course evaluation.

Appendix C:
Index of Tables and Figures

Tables:

| | |
|--|----|
| Table 1. Behavioural cues to deception. | 9 |
| Table 2. Contextual modifiers of behavioural cues. | 10 |
| Table 3. Dimensions of the CBCA (Criterion marked with an * were used often by deceivers in DePaulo et al.'s (2003) meta-analysis). | 15 |
| Table 4. Verbal cues to deception (Only occurred during a transgression if marked with an *). | 24 |
| Table 5. Possible indicators of illegal activity. | 34 |
| Table 6. Examples of information that could be used to analyse the associations between geographic information and criminal behaviour in a geographic profile. | 36 |
| Table 7. Example of target trials in the IAT (A = left finger, L = right finger). | 53 |

Figures:

| | |
|--|----|
| Figure 1. Geographic profiling of criminal activity by illegal immigrants (seen as bars) across the Del Rio Sector, TX, USA. | 35 |
| Figure 2. Example of differences in lighting (from top or bottom) and face angle (full, ¾, and profile). | 44 |
| Figure 3. Example of feature-critical faces that differ in nose, chin, mouth and cheeks. | 45 |
| Figure 4. Example of the recorded differences that make the IAT effect (adapted from Greenwald, McGhee, and Schwartz, 1998). | 54 |
| Figure 5. Summary of codable measures and their usability in a port security setting. | 71 |