

**Forensic Criminology and Psychophysiology:
Truth Verification tools, with a special study of Truster Pro**

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1 Background

In 1997 Prof. A. Padayachee, requested the development of a module for Forensic Criminology for the University of Durban Westville, one particular chapter being "Investigative tools", meaning all Truth Verification techniques. As a long practising polygraph operator, qualified in forensic psychophysiology in 1982, I was asked by Trustech Israel, to analyse their latest product, the Truster Pro.

It soon became clear that this knowledge should not be restricted to the academic world but be made available to the real practitioners in the field. To share my knowledge of Truth Verification tools and the Truster Pro in particular we composed this article. I hope you enjoy it.

This paper is directed at people involved, or merely interested, in the fight of crime. The purpose is to provide or to improve the basic knowledge of "Truth Verification" needed by any investigator.

Certain techniques and different methods of Investigative tools will be discussed enlarging on the newest tool, the Truster Pro without the intent of neglecting or degrading the other excellent tools, such as the well known and proven polygraph.

2 Investigative Tools, Truth Verification Techniques

2.1 Introduction

Mankind, throughout history, has sought and found ways and means of separating truth from deception. The science of truth verification however, based mainly upon psycho-physiological analogues, is barely one hundred years old. Many stories of inventive procedures have been carried over from the past. One ancient legend mentions a method employing the tail of a donkey. The donkey was placed in a darkened tent and its tail was then generously coated with lampblack. All possible suspects were then asked, one after the other, to enter the tent and pull the donkey's tail. They were told that the donkey would only bray if a liar pulled his tail.

The honourable men obviously having nothing to fear did indeed pull the donkey's tail and came out of the tent with their hand blackened with lampblack. The liar however, afraid of the fact that the donkey would indeed bray, did not pull the tail and reappeared from the tent with clean hands.

An interesting technique stemming from ancient China is the following: When subjects were interrogated, they were given a small amount of dry rice, with the instruction to keep the rice under the tongue. After the interrogation, he had to spit out the rice in his hand. The fortunate people whose rice was wet by saliva could keep their head. The person whose rice was still dry lost it. The theory comes down to a well-known phenomenon: the mouth goes dry when under stressful conditions.

The middle ages in western Europe, followed by the dark times of the Inquisition, used methods not to be proud of: hot irons, iron maiden, the wheel, burning at the stake, dunking etc. Ironically, they have proven to be the least effective.

From these ancient records until today, many techniques and methods have been invented and tried to ascertain truth and lie, deception or non-deception, right or wrong. Sometimes based upon pure psychological methods, sometimes purely mechanical, sometimes a combination of both, they all come down to the basic need of knowing the real facts.

The great breakthrough came at the end of the 19th century (1893) when the well known "father of criminology" Cesare Lombroso started experimenting with pulse and blood pressure changes in order to establish verification of truth in answers given to questions by actual criminal suspects. The idea of using the pulse as a truth verification technique was older than that, but Lombroso and his student Angelo Mosso were the first to actually use a physical device to demonstrate the changes in pulse and blood volume and to scientifically document the findings. Already in the middle ages it was related that the pulse was used as an investigative tool. A nobleman suspected his wife of infidelity and informed his advisor of this. The advisor arranged a test during a dinner party at which he was seated next to the nobleman's wife. While conversing he casually laid his hand on the wrist of the lady and mentioned the name of the person suspected by the nobleman. The lady's pulse suddenly quickened while it had not when mentioning her husband's name. A confession was later obtained. (Gesta Romanorum 1906).

In 1730, just before he died, Daniel Defoe wrote an essay called "An effectual Scheme for the Immediate Preventing of Street Robberies and Suppressing all Other Disorders of the Night". Defoe claimed that taking the pulse rate of a suspect is a practical, effective and more human method of determination of deception. "Guilt always carries fear around with it, there is a tremor in the blood of a thief, that, if attended to, would effectually discover him, and if charged as a suspicious fellow, on that suspicion only I would always feel his pulse, and I would recommend it to practice. The innocent man which knows himself clear and has no surprise upon him; when they cry "stop thief" he doesn't start; or strive to get out of the way; much less does he tremble

and shake, change countenance or look pale, and less still does he run for it and endeavour to escape."

Defoe went on: "It is true some are so hardened in crime that they will boldly hold their faces, carry it off with an air of contempt, and outface even a pursuer; but take hold of his wrist and feel his pulse, then you shall find his guilt; confess he is the man, in spite of bold countenance or a false tongue...a conscious heart will discover itself by faltering pulse..."

It may be true, that this discovery by the pulsation of the blood cannot be brought to a certainty, and therefore it is not to be brought into evidence; but I insist if it be duly and skilfully observed, it may be brought to be allowed for a just addition to other circumstances, especially if concurring with other grounds of suspicion (Scott-Kilvert 1965; Ansley 1989).

Mosso, with strong encouragement by his mentor Lombroso, used for his research on emotion and fear during questioning and their influence on cardio activity and respiration, a "plethysmograph". This instrument, developed by Francis Franke measures blood pressure and volume. The use of it revealed periodic undulations in blood pressure caused by the respiration cycle. Mosso was the first scientist to report that the breathing pattern changes under certain stimuli. He also reported that variations in blood pressure and the circulation of blood during fear are greater than those resulting from mere noise and sound. Mosso's mentor, Cesare Lombroso actually applied Mosso's experimental blood pressure and pulse tests to actual criminal suspects on several occasions.

In his second edition of *L'Homme Criminel* (published 1895) Lombroso describes his experimental use of the plethysmograph and sphygmograph during interrogations. Scientific research towards truth verification thus started as an academic discipline.

The military forces (with greater budgets than police forces) quickly became aware of the importance of reliable truth verification techniques (or better, *procuring information from unwilling subjects*) and engaged in their own research. Dr. Charles E. Cady, a U.S. military surgeon, observed Rebel officers divulge important information whilst under the influence of chloroform. Although not involving himself in the practical application, he strongly recommended that skilled anaesthetists should administer pure chloroform to subjects in a well-ventilated room and, whilst the subject is semiconscious, interrogate him bluntly and pointedly (Eisenschiml, 1940).

Further developments in scientific truth verification at the end of the previous century came from F. Galton, who developed the word association test and Wilhelm Wundt, the founder of the first psychological laboratory in Leipzig, Germany. Wundt modified Galton's association method to a standardised form, still in use. Adamkiewicz's experimental proof that the secretion of sweat is closely linked to psychological processes, lead Sticker to experiment with the galvanic skin phenomenon and the development of the first

psychogalvanometer.

The three essential components of the modern polygraph had now been developed, together with the knowledge of word association and hypnotics (truth serum). Arthur MacDonald can be described as the first person to propose the development and the creation of an apparatus combining the three systems: pneumograph, psychogalvanometer and cardiospasmograph. The polygraph was born. Hundreds of scientists from then on worked on the development of polygraph, word association and so called truth serums.

In 1964, Charles R. McQuiston made a new step in the truth verification research. The U.S. Army desired an alternative instrument to the polygraph with no need for direct connection to the subjects body, one of the main disadvantages of the polygraph. He coined the name "voice stress analysis" and together with two retired friends, Wilson Ford and Alan Bell, he developed the first prototype of his "Psychological Stress Evaluator". The PSE relied on measuring stress-induced changes to the "muscle micro-tremor" as displayed in involuntary changes in the voice. In less than one century the science of truth verification developed four main techniques and instruments, the polygraph, the voice stress analysis, psychological profiling and truth serum.

2.2 Polygraph

2.2.1 Scope.

The scope of this document is to give you the essential facts about polygraph testing, in order to give you the basic understanding of what happens if you consult a polygraph examiner, what he can and cannot do and to make a right choice to consult him or one of his colleagues using a different truth verification technique.

2.2.2 Underlying principles.

The term "POLY-GRAPH" means literally "Multiple Writing" (from the Greek Language). The name is now often connected to the term "Lie Detector" or as "an instrument for recording of several different pulsations (as of physiological variables) simultaneously" (Encyclopaedia Britannica). The name was derived from the fact that the polygraph, as opposed to, for example, the GSR or VSA which only record one reading, looks at various selected physiological activities. Human beings (as well as any other mammals and most other living beings) are endowed with a very sophisticated survival mechanism. Their whole well being depends on the maintenance of an inner balance, fluids and chemicals, throughout every organ in the body. This balance is called homeostasis. In the centre of the brain is a gland called the Hypothalamus: our internal regulator. All our unconscious activities such as sleep, breathing, digestion, pulse, blood volume, respiration etc. are regulated by the autonomic nervous system, controlled by the hypothalamus.

When our well being is threatened, physically or psychologically, one of our sensors, hearing, seeing, feeling or even instinct, will send alarm signals to the autonomic nervous system which will activate its sympathetic department and take action. When the ear of the subject receives a potentially threatening message from the examiner, this stimulus is transferred via sensory neurones to the temporal lobe of the cerebrum. Regarding treating the nature of the stimulus the signal is sent to the frontal lobe (the centre for judgement and reasoning) where the question is perceived and a judgement made. If the question is perceived as threatening, the alarm is sent from the frontal lobe through the hypothalamus to the sympathetic system which will then take appropriate action in a sympathetic response. (Note that this whole process cannot even be calculated in microseconds, it is semi instantaneous). The body is now programmed for "fight or flight" mode. The adrenal medulla glands will extract adrenaline (hormones known as epinephrine and norepinephrine) so that certain bodily functions will alter in order to stand the best chance to survive the emergency. For example, the blood will be instantly distributed to the most important areas like the brain and the larger muscles, and in other parts the arterioles will constrict, preventing blood going to where it is not needed.

Other very obvious effects will take place, known by all of us:

- * The mouth gets dry, due to the salivary glands producing much thicker saliva.
- * The heart pumps harder and faster, thereby increasing blood volume and pulse.
- * Stimulation of the respiratory muscles leads to breathing changes.
- * The sweat glands are stimulated and forced to release perspiration.
- * The iris of the eye dilates permitting more light into the eye.
- * The anal and urinary sphincters contract and the bladder relaxes.
- * Involuntary muscles contract.

While the sympathetic system organises this whole defence system in next to no time, the parasympathetic system, functionally antagonistic towards his partner, follows up in order to re-establish the chemical balance of the body. Without these two antagonistic partners, the defence system of the body would go into a high build up and cause damage to the body (E.g.. burst artery in brain). The two of them are essential to maintain a perfect homeostasis. All of the above mentioned physiological activity can be measured.

As Dr. James A. Matte puts it:

"The forensic psychophysiological (the polygraph examiner) measures and records breathing patterns, heart beat, pulse rate and strength, changes in mean blood pressure, and electrodermal responses in order to obtain physiological evidence of hypothalamic activity including the sympathetic and the parasympathetic subdivisions of the autonomic nervous system during the psychophysiological veracity examination (polygraph examination) on the test." (Matte 1996, Forensic Psychophysiology using the Polygraph).

The " Introduction" briefly outlined the various stages of history of the polygraph and explained that three basic scientific techniques had to be developed before the first real polygraph was created. The polygraph collects physiological data from at least three systems of the human body:

- * The respiratory system: the examiner will record " thoracic breathing" and " abdominal breathing". Convoluted rubber tubes are placed over the chest and the abdomen.

- * Galvanic skin response (electrodermal).

Two small metal plates are connected to the fingers (normally the middle section of the index and ring finger of the left hand). These plates record the filling up of sweat glands (empty during homeostatic condition) and the nearly immediate reabsorption of the moisture.

- * The Cardiac system: the examiner will record Blood volume and Pulse rate.

A medical blood pressure cuff containing a rubber bladder is wrapped around the upper right arm, against the brachial artery. The cuff is connected via the instrument (cardiosphygmograph) to a hand pump with a pressure indicating gauge.

- * Certain systems (e.g. Lafayette) offer an option where the examiner can measure minor movements induced by the contraction of involuntary muscles.

These five (thoracic and abdominal breathing, blood volume, pulse rate and galvanic skin response) or six (movement) readings will be recorded on "Chart" (see later). Normally the examiner will do three to four charts.

From these charts, the examiner will do his calculations (manually or with computerised systems via his software), make his decision and file a report, which goes to the client.

2.2.3 The Polygraph examination.

2.2.3.1 General.

The typical polygraph examination consist of three distinctive parts:

- * the pre test interview

- * the actual examination or chart collection phase

- * the test date analysis phase

2.2.3.2 The pre test interview

Most people do not really realise that in fact, the most important and often the longest phase in a polygraph examination is the pre test interview. While the average test will take approximately 90 minutes, the pre test interview can easily absorb 45 minutes in general.

During the pre test interview the examiner will:

- * Talk nicely with the subject and do his best to put him / her at ease.
- * Will give the subject a detailed explanation of what is going to happen during the actual testing phase and confirm his understanding.
- * Will define the subject's legal rights.
- * Explain to the subject what the polygraph is all about and how it works (briefly)
- * Write down all the subject's details in order to make the identification sheet attached to the report.
- * Ask certain questions about the subject's health, if he has eaten over the last 5 - 6 hours, if he had a good nights rest and is not too tired.
- * Talk about the "incident" or "issue".
- * Discuss all the questions which will be asked and make sure the subject answers them all confidently and understandingly.
- * Ask the subject one last time if he is prepared to undergo the test and then invite him to take a seat in the interviewing chair.

The examiner will then connect the different components to the subject whilst asking him to sit absolutely still during the whole time of each chart recording (approximately 4 to 5 minutes).

2.2.3.3 The actual polygraph examination.

Before the pre test interview, the examiner had a briefing with the client, which will typically be the investigator but, in certain cases, can be the subject himself.

During this briefing, the examiner has to make up his mind as to which type of questionnaire he will be using (see later). Depending on the type of test he will draw up a specific questionnaire, discuss the relevant questions (see later) with the client and, on his approval, go to the interview room (see later) to start his pre test interview.

2.2.3.3.1 The interview room.

The ideal interview room is not too small, not too big (3,5m X 3m). It should be guaranteed have privacy with

no possibility of interference (no telephone). The furniture has to be sober but adequate: desk and chair for the examiner, normal chair for the subject and a chair for the test itself. This last chair has to be really comfortable, has to have large and long enough armrests in order to give the subject the easiest means to sit still during the chart recording. Psychological research has indicated that the most relaxing colour for the walls is with a very light hint of purple mix. This colour seems to subdue the subject and leads easier to confessions.

2.2.3.3.2. Question types.

In the different types of test questionnaires which will be discussed later, three different types of questions will be used.

* Irrelevant questions.

Irrelevant questions are essentially questions, which will give the examiner a truthful answer. It is generally a "Yes" answer.

Examples:

Is today _____?

Is your name _____?

Are you sitting in a chair?

Were you born in _____?

The irrelevant question gives the examiner a good idea how the subject reacts when being truthful. It also allows the parasympathetic system to bring back homeostasis.

* Control questions.

The control questions are questions on which all subjects will be potentially untruthful. They are used to absorb any anxiety of a truthful subject and draw the attention away from the relevant questions. The control questions are so designed that they will draw a possible lie from the subject to items broadly similar to the issue on hand.

The reaction to the control questions will be compared to the relevant questions in order to give a result.

Examples of control questions:

Before this year, did you ever steal anything in your life?

Before this year, did you ever lie to someone who trusted you?
Do you remember if you ever stole anything from a place where you worked?
Do you remember ever seriously lying to any of your colleagues?

The question is typically a "No" question. When the subject says yes to a question, which asks if he ever stole anything, the examiner will quietly ask what he stole. Most subjects will then say, "small things" or mention a few neglectable items. The examiner will then rephrase: Apart from what you told me, did you ever steal anything else in your life?, which will then result in the desired "No" answer.

* Relevant questions

The relevant questions are the questions of which the examiner wants a result. These are the questions which only the subjects knows the truth about and is the reason for undergoing the test. The question must be phrased to engage the subject to say "No". If for example we want to solve a dispute between X and Y where X says she gave Y a cheque and Y says she never got it we will ask X :

Did you give Y the cheque we discussed? He will say obviously say "Yes" while we want "No".

The examiner will retract a "No" answer by formulating the question as follows:

Did you lie when you told me you gave Y the cheque we discussed? Now we get a "No" answer.

The relevant questions are split up in 4 categories (e.g. theft of car):

Primary Involvement: Did you steal that car?

Secondary Involvement: Did you help anybody to steal that car?

Guilty Knowledge: Do you know who stole that car?

Evidence Connecting : Did you get any reward coming from the theft of that car? or : Do you know where that car is at present time?

These four different questions are called " the four legs of the crime: " Did you do it, did you help, do you know who did it, did you get anything out of it".

2.2.3.3 Type of tests.

Various and different types of test questionnaires have been developed during the history of the polygraph. We can not go through all different techniques but will only discuss the three most used tests as today. Excellent documentation of all possible test questionnaires can be found in the recommended reading list, especially S. Abrams and J. Matte.

* MGQT.

The Modified General Question Technique (MGQT) is a modified version of the Reid technique developed by the famous John E. Reid in 1953. The difference is in the strict structuring of the test. No changes on the order of Irrelevants, controls and relevants are allowed. It is a test adapted in most computerised scoring algorithms.

The test involves the four legs of a crime as mentioned above.

The structure of the test is as follows:

1. Irrelevant
2. Irrelevant
3. Relevant: Secondary involvement
4. Irrelevant
5. Relevant: Primary involvement
6. Control
7. Irrelevant
8. Relevant: Guilty knowledge
9. Relevant: Evidence connecting
10. Control

* ZCT

The Zone Comparison Technique stems from Baxter, one of the great researchers in polygraph techniques. Although originally designed as a S.K.Y technique (Suspicion, Knowledge, You (did you)) he later used it as a technique using three relevant questions, three controls and four irrelevants concentrating with the relevants on only one leg of the four legs of the crime.

The structure of the test is as follows:

1. Irrelevant
2. Irrelevant
3. Irrelevant
4. Control
5. Relevant
6. Control
7. Relevant

8. Irrelevant
9. Control
10. Relevant

* RANKING

In a ranking test all questions are relevant. It is typically used to identify other people's involvement in a particular case or to locate where the missing goods are.

It will go as follows:

Is Mr. X involved in this incident?

Is Mr. Y involved in this incident?

Is Mr. Z involved in this incident?

Ranking is extremely useful in investigations where one subject has been directly linked to the crime and to find out who his/hers accomplices can be.

Example:

An armed robbery took place at a wage pay out office of a certain company. Thirteen staff members were present. The robbers (three) got away with R138.000,00. All thirteen staff members had to come for polygraph testing regarding the involvement in the robbery (handing out information to the robbers as to when, where, how etc.) A ZCT test was done on all staff members. A lady cashier was found deceptive regarding her involvement in the armed robbery. It was then decided to do a ranking regarding which robber she had spoken to.

The questions were all: " Was your "brother, sister, mother, father, boyfriend, etc." involved in the robbery we discussed. The result pointed to her brother. The next ranking's objective was to determine where the money was being kept at that time. The questions were: " Is the money at your " mother's, brother's, boyfriend's, etc" house? It again pointed to the brother's house. The last ranking went through the brother's house: Is the money in the " garden, garage, bathroom, ceiling, etc." of your brother's house? The test indicated the bathroom. After having given this information to the police, they reported 40 minutes later that they had indeed found the money under the bath in the bathroom of her brother's house. Case was closed two days after the robbery took place.

* Other tests.

Stimtest: A ranking where the person picks a card or number and will be asked to lie when asked if he picked that certain number. Used as a relaxation technique in pre test interviews or as a demonstration.

* Pre employment interviews

Often used for important or high-risk employment. The technique used is Relevant/ Irrelevant whereas the irrelevant questions, when scored as ranking, should score higher than the relevant ones.

2.2.3.4 Scoring.

The actual scoring of the test is a profession. We will not go into any detail since the investigator has to rely on the skills of the examiner. The computerised polygraphs use scoring algorithms. The most renowned software is called "Polyscore" and was designed by the "Applied Physics Laboratory" of the "Johns Hopkins University".

2.2.4 Who uses the polygraph?

The polygraph daily becomes more and more popular in RSA. At present the USA, Israel, Russia and Japan are probably the biggest users, although 77 other countries are also known as being frequent users of the polygraph for various applications. The polygraph is obviously mostly used in investigations: Crime investigators (private or official) Fraud investigators, Insurance companies etc. Another popular use is involved in pre employment screening and honesty maintenance checks. Attorneys often use it in civil litigation. The private sector often requires it for matters not involving the legal or criminal justice system. In certain countries the polygraph is generally used as a tool to control and check people on parole.

2.2.5 Is the polygraph admissible in court?

In certain countries and certain states of the USA, yes. In South Africa, no real status has been given to the validity of a polygraph test as evidence in court. One Magistrate's court (Booyens) once accepted (1996) two polygraph tests as evidence, but since then no other case has been reported, as far as the author is aware. The CCMA at certain times ruled in favour of the employer due to a polygraph test done on one of their employees, but rejected the test just as often. The polygraph test remains an investigative tool mainly and has to be viewed purely as that. It is our opinion that any evidence delivered in court has to be foolproof and not one investigative tool such as truth verification test can claim to be 100%.

2.2.6 Training available for polygraph operators.

In the RSA, training was available through a pilot school in Midrand, but our correspondent stated that too much problems arose about accreditations. The University of Durban Westville is in the process of developing a BA Honours module, which will enable BA Criminologists or Psychologists to fully qualify as Truth Verification Experts. In the USA several Universities offer training courses on an academic level comparable to BA Honours. Private institutions can be found through the APA (American Polygraph Association) which offer Certificates at non-academic level. Matte (Forensic Psychophysiology using the polygraph; 1996: 671) however states that the training of polygraph should be restricted to persons who have already obtained a degree at a minimum level of a BA. Israel, Japan, Russia, Belgium, the Netherlands, France, Germany and Italy all have Universities offering Polygraph qualification at Honours or Masters level (no private colleges known to the author).

2.3 Voice Stress Analyser (VSA)

2.3.1 Underlying principles

In 1964, Charles R. McQuiston made a new step in the truth verification research. The US Army desired to obtain an alternative instrument to the polygraph with no need for direct connection to the subject's body, one of the main disadvantages of the polygraph. The instrument was to be "a remote lie detector" with a concept based on recognition that emotional stress induces measurable change into the human voice. All VSA's rely on measuring stress-induced changes to the "muscle micro-tremor" as displayed in involuntary changes in the voice. These changes can be found in a tremor associated with contraction of muscles, effecting minute oscillations at a frequency of about ten to twelve Hertz (cycles per second). The amplitude of these oscillations is a fiftieth or less of that of the total contraction. Although all muscles do exhibit this tremor, the voice stress analyser will only take into regard those associated with the human voice.

Since our voice transmits these tremors at the same time as the occurrence of stress, the PSE can be used to analyse a narrative conversation, a serious advantage over the traditional polygraph, where only carefully timed (25 sec. interval) questions, with only strict yes or no answers, can be used. The basis of the PSE comes down to McQuiston's discovery that, under stress, these tremors disappear. When a person speaks, air is pushed from the lungs upward to the vocal cords. As a result, the vocal cords vibrate in the frequency mentioned above (the speaker's main leading frequency). The air keeps flowing upward to the mouth and goes through the tongue, teeth and lips, thereby creating the speech flow. When a person lies, the amount of blood in the vocal cords drops as a result of stress, so, no tremor. In short, the VSA searches for the disappearance of the normal tremor in a voice due to stress. This lack of tremor indicates a lie.

2.3.2 Development of the VSA

McQuiston coined the name "voice stress analysis" and together with two retired friends, Wilson Ford and Alan Bell, he developed the first prototype of his "Psychological Stress Evaluator" (PSE). In 1970, the three of them founded "Dektor Counterintelligence and Security, Inc." This company brought the first PSE's on the market and is still one of the biggest manufacturers and suppliers of the instrument. This instrument, applying voice stress analysis, represented the first major advance since the introduction of the kymograph in 1920 by Keeler (" = a device that physically records motion or pressure", i.e. the predecessor of the polygraph). It applied a single-pen-heated wire Electrocardiogram chart recorder to describe the changes to the micro-tremor. For approximately 12 years, the PSE was dominant in stress analysis, until the Verimetrics system, another invention of McQuiston, appeared. The Verimetrics allowed the analytical process to take advantage of the newly developed personal computers to more conveniently and effectively produce charts. Shortly afterwards Charles Humble brought the " Computer Voice Stress Analyser" (CVSA) system on the market.

The major advantage this system brought was the ability of "real-time" analysis. The interview could now be committed directly to the instrument, without the need of an intermediate recording on magnetic tape. Various adaptations, modernisations and more flexible systems have since then been introduced such as:

*Diogenes Voice Stress Analysis System (Diogenes Group 1996)

*Truster (1997): a program on CD-ROM using a highly sophisticated algorithm which enables the system not only to detect a state of stress and measure its degree, but also to pinpoint the cause of the stress: from lying, exaggeration or emotional conflict.

* Truster Pro (end of 1998): Truster Pro cannot really be called a CVSA, but entails more. This new product will be discussed later.

2.3.3 Advantages of VSA over the Polygraph.

* The VSA can be used as a remote truth verification tool.

* No direct connection to the subject's body, nor any testing equipment (respiratory tubes, arm cuff, electro dermal finger cups).

* Possibility to interview the subject over the telephone.

* Previously recorded conversations can be analysed later.

* Normal conversation using full phrases and answers can be used, no need for yes and no answers only, no timing of questions necessary (in short, one can do an interview as well as an interrogation).

* The subject can be held ignorant of the fact that he is interviewed and that his answers will be analysed (in this case the recording nor the analysis can be used against him).

2.3.4 Disadvantages

The VSA is a relatively young instrument using a technique, which has not been as thoroughly evaluated as the psychophysiological data recorded by the polygraph. The polygraph has been used for many decades and has been a study object of many universities and government agencies all over the world. There is no doubt that the future will still bring dramatic improvements and that faults will be documented (computer bugs). The VSA analyses only one single item, namely the tremor in the voice while the polygraph, as its name says, reads multiple items, thoracic breathing, abdominal breathing, blood pulse, blood volume, galvanic skin response and movement. However, the frequency and amplitude modulations in the voice cover a broad spectrum.

2.3.5 Reliability / accuracy

As said already, not one truth verification technique can claim to be 100% accurate. In the past, it was commonly agreed that the polygraph had a higher reliability in correctly indicating deception or truthfulness. Clifton Coetzee, a well known polygraphist and voice stress analyst states in his latest work (Truth extraction; 2000: 74) that a skilled and well trained operator will obtain the same results with polygraph as well as with CVSA. Several sources indicate reliability of the CVSA as higher than 91,1%. The effectiveness of a VSA test is based on the total system consisting of the hardware, the software and, most importantly, the analyst him or herself. Trustech Ltd (Israel) has recently developed a product called TrusterPro which was analysed world wide and got an accuracy level similar to the polygraph.

2.3.6 Conclusion

It is the investigator's duty to analyse his needs and weigh the advantages and disadvantages of the 2 systems. The VSA is quicker, more versatile, can be easily hidden and can perform an interview as well as an interrogation. The polygraph is considered in general more researched and field tested.

2.4 Scan and View

2.4.1 SCAN (SCIENTIFIC CONTENT ANALYSIS)

The SCAN technique is a scientific analysing technique of written statements and is used worldwide. Avinoam Sapir, an Israeli psychologist and criminologist developed the technique. Sapir started as a polygraphist with the Police Department in Jerusalem. He conducted extensive research into verbal communication, looking into the linguistic behavior used by people in communication. Sapir is now the head of the L.S.I Laboratory for Scientific Interrogation, Phoenix Arizona. Although SCAN is a method of obtaining information and

detecting deception, it is neither interviewing nor interrogation. The SCAN technique, to detect truth or deception, requires from the subject only his written version of what happened. The examiner will then interpret this statement from beginning to end. Every word in the subject's written explanation of the facts - the pronouns and connotations, the subjective time and the changes in language are analysed will give the examiner his answers. SCAN has proved to be a scientifically based consistent formula with consistent results. The examiner needs only the subject's own words and doesn't need to bother with personal interviews. The catch comes in the training of the examiner. The discipline requires not only the in depth knowledge of the various SCAN techniques but also a perfect understanding of the subject's language. The training facilities were until 1992 only available in the USA, Canada and Israel.

In 1997, a Johannesburg based company undertook to invite two instructors from L.S.I. to South Africa to teach and qualify a select number of examiners. This course will be offered twice yearly, as far as the author is aware

(Truth Verification Testing Centre : C. Coetzee +27 11 463 7080). In any investigation, where written statements from the different subjects can be obtained, the use of a qualified SCAN expert can be extremely valuable.

2.4.2 View Questionnaire

View stands for Verbal Inquiry - Effective Witness. The questionnaire is typically a multiple questions document. The subject has to answer each question in as much detail as possible. Certain questions are very subtle duplications which the non-trained subject will be not aware of. The theory behind the questionnaire is that a person cannot lie twice. The human psyche makes it difficult to lie, and a person, when asked the same question, but formulated totally differently, will answer differently. The method has shown results of reliability of up to 80% and is mainly used to speed up investigations. It is also a very fast technique and is especially useful when dealing with large number of subjects. A further advantage of this technique is the fact that a written statement creates the lowest level of resistance from the subject and that people are more truthful on paper than when confronted eye to eye. The questionnaire can obviously also be used as a remote way of interviewing.

3 Characteristics of Truster Pro

TrusterPro is an innovative, highly advanced computerised system that is specially designed to provide you with easy access to truth verification in a highly professional and discreet manner. Conversations can be analysed in real-time or offline (from recorded files), to provide timely and reliable data for making the right decisions. It is based on the technology of vocal stress analysis calculated from a series of complex, sophisticated algorithms that detect states of stress, and then measure and grade them accordingly. TrusterPro technology pinpoints the cause of stress, and reports back with a determination as to whether a

speaker's stress is caused by a lie, excitement, an exaggeration or cognitive conflict.

Law enforcement agents and managers around the world speak different languages, have different customs and methods of operation, not to mention the different values and laws they uphold. Yet, they are all united in their need to verify facts and information that are presented to them on a daily basis. The quicker they get this verification, the more efficient their work becomes and the faster they can react and make crucial decisions.

To understand the benefits of TrusterPro, it is important to understand the psychological structure of a deceptive comment, and the ease with which these deceptions can normally creep into free conversation. People all over the world usually refer to a lie as any untruth, but many times this is not the case, but simply an inaccuracy or exaggeration. Those interested in truth verification and lie detection use a more specific definition. In this case, a lie is something said that is not only not truth, but was said for the purpose of DECEIVING, meaning, that the person who said it really wants you to believe in what he said. TrusterPro is able to differentiate between different types of lies, which include jokes, white lies, defensive lies, and offensive lies. A lie detector is a tool designed for the purpose of determining one's level of truthfulness. The basic idea in all of the existing machines today is to monitor involuntary body reactions, to determine and analyse the subject's state of fear, stress and arousal. A polygraph, for example, uses a system of multiple sensors, recording the heart pulse rate, blood pressure, sweat, Galvanic Skin Response (GSR) and so on. The assumption is that the higher the stress is when the subject is asked the relevant questions, the higher the probability for deception.

Other types of lie detectors use vocal sensors (microphones, tapes, etc.) to determine the level of honesty by measuring the stress in the voice. These lie detectors use a technology known as "Micro tremors" stress detection, and analyse the stress indicative to deception. TrusterPro introduces yet another type of technology, although it still uses an edited analysis of the Micro tremors as well. When a person talks, air is pushed from the lungs upwards, through the vocal cords that in time vibrate in a certain frequency. From there, the lips, tongue and teeth create the speech flow. The vocal cord's vibrations generate a leading frequency. This frequency range differs according to gender and is very sensitive to stress. The human brain also plays a very big part in the generation of speech flow, and monitors the whole process of thought and speech very closely. In fact, any event that occurs in the brain (such as feeling, confusion, pain, etc.) is automatically reflected in the voice. The feelings detected in the voice analysis reveal a psychological pattern that can indicate various situations in the subject's mind, including, stress, confusion, hesitation, and deception. Because there are many types of lies, there is no set voice pattern or frequency for deceptive speech. However, there is a uniform appearance for truthful situations, where the mainstream thought process is fluent and uninterrupted.

This pattern of truth is unique to each person, at any given time, and might change if the circumstances

change. For example, if someone were sitting in front of you and waiting for the beginning of the test, he may not feel he is being tested and so is more relaxed. Once the actual testing begins, the speaker's brain will register a whole new set of values. He might be more alert, more excited, more confused and so on. TrusterPro analyses any deviation from that truthful pattern and will present it graphically and textually. Therefore, it is the deviations of this pattern, more than the regular and fluent brain pattern that indicates the person is responding to his stress, confusion, excitement, etc.

The TrusterPro system is a combination of three different vocal lie detectors, which include:

1. The Online Mode:

This allows you to conduct interrogations where analysis is required in realtime and allows you to focus better on suspected portions and ask additional questions, if necessary. A telephone conversation or normal discussion can be analysed in this mode.

2. The Interrogation Mode:

This is equivalent to the traditional polygraph system, providing quick and computerised summaries and reports using all familiar Polygraph techniques of interrogation.

3. The Offline Mode:

This can be used to analyse pre-recorded material to produce an in-depth psychological structure view.

TrusterPro provides a new technique of analysis in all these modes of operations: the Rich Psychological Analysis (RPA), which is automatically generated in any of the modes. In addition, for cases in which you require a specialist to analyse its results, TrusterPro provides two series of graph displays for easy and convenient manual analysis. TrusterPro technology uses these psychological patterns to distinguish between stress resulting from excitement or any other emotional stress, confusion or any other cognitive stress, global stress resulting from the circumstances, and deceptive stress. TrusterPro also detects levels of tension/rejection, fear, attempts to outsmart or answer cynically, and even detects the subject's level of thinking. Using Deception Patterns TrusterPro can get one of the highest ever accuracy rate in detecting deceptions.

The sole Truster Pro distributor for continental Africa and the Indian Ocean Islands is Scenematic (Pty) Ltd, based in Pretoria (+27 82 698 1369).

4 Example of one of the performed Researches

Here follows the results of our evaluation of the Truster Pro program. Due to time restrictions and the holiday period, most examinations were laboratory cases, which are more strenuous on the program and bring your accuracy levels down. However, the Truster Pro proved to be an excellent truth verification tool.

4.1 Scope of research

The evaluation process was performed with as primary goal the testing of the efficiency of the Truster Pro as a Truth Verification Instrument, the major principle of truth verification being indication of probabilities of deception and stress levels.

4.2 Tests executed

The three different modes of the program were analysed.

On Line mode: 164 interviews - 93 by telephone, 51 using microphone. Interrogation mode: 142 tests. MGQT (as per your CQT): 56 ZCT (as per your peak of tension): 32 Ranking (stimtests): 54 Off line mode: 14 recordings were analysed.

4.3 Results

4.3.1 On Line mode: 164 interviews

93 by telephone:

Laboratory cases: 82 71 (correct) 86,5% (validity)

Real cases: 11 10 90,9%

51 using microphone:

Laboratory cases: 45 35 77,7%

Real cases: 6 6 100%

4.3.2 Interrogation mode: 142 tests (all by microphone)

4.3.2.1 MGQT: 56

Laboratory cases: 45 37 (correct) 82,2% (validity)

Real cases: 11 10 90,9%

4.3.2.2 ZCT: 32

Laboratory cases: 9 6 (correct) 66,6% (validity)

Real cases: 23 21 91,3%

4.3.2.3 Ranking: 54

Laboratory cases: 54 39 (correct) 72,2% (validity)

4.3.3 Off line mode: 14 recordings were analysed.

Criminal cases: 14 14 100,0%

4.4 Conclusion

The Truster Pro is a user friendly, versatile and feasible truth verification instrument. The accuracy, established during our research, is considered high and more than satisfactory (even excellent) for a CVSA (94% to 98%).

4.5 Caution

The Truster Pro is effective to a high degree, which makes it a useful tool for qualified operators, but which also makes it dangerous for abusive persons. Advanced users should be instructed in the reading of the graphs (we encountered one test in which the graphs showed a correct result where the computerised result was wrong). We would like to conclude with the final message of congratulating Trustech Ltd with their achievement and wishing them all the best, but the Truster Pro's danger is that the program really works.

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