**Report**

# TRUTHSCAN—A COMPUTERIZED INSTRUMENT FOR CREDIBILITY ASSESSMENT:

## Initial Field Testing Data For New Exculpatory Verification of Veracity Technology

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## ABSTRACT

In Tansey,[1] the results of an initial field study as to the efficacy of TruthScan, a fully automated computerized instrument for credibility assessment, implemented on a NeXT computer running under Unix, were published. TruthScan's code has been rewritten and expanded under MSDOS enabling it to run on a portable computer. In this, it again utilizes standardized, computer delivered auditory stimuli, and the identical computer-scoring algorithm for picking "truth" as found in TruthScan's initial field-testing running under Unix. In the current MSDOS implementation, TruthScan then computed four separate numeric verification indexes in the same manner as Tansey.[1] Two numeric verification indexes were computed for males. A numeric verification index was computed based on a commonly held "truthful" brainwave signature as well as a numeric verification index based on a commonly held "falsehood" brainwave signature ($n = 10$). Two numeric verification indexes were computed for females. A numeric verification index was computed based on a commonly held "truthful" brainwave signature as well as a numeric verification index based on a commonly held "falsehood" brainwave signature ($n = 10$).

# INTRODUCTION

**D**igital analysis of the electrical properties of human brainwave activity (cycle-per-second waveforms) provides great specificity as to the functional correlates of the brain's cognitive, somatosensory, and higher order mental function—the electrophysiological substrate of one's flow of consciousness. Cognitive and somatosensory aspects of this brainwave cascade have been shown to be trackable, and remediable if anomalous, via digital representation.[1-18] As such, TruthScan is a radical departure from traditional physiological detection of deception (PDD) technologies.

In 2003, the author published initial standardization and test-retest data for a Verification of Veracity (VOV) software program named TruthScan. Therein, across one-hundred and three experimental trials, for a sample of ninety-four individuals, ages eleven through eighty-eight, a core brainwave signature enabling the affirmation of truth was found to be held in common for all ninety-four participants. TruthScan's VOV software correctly separated out and picked one hundred and three verbal declarations of truth from amongst four hundred and twelve verbal declarations of falsehood. Additionally, test-retest data were reported. For a teenage participant, across a time separation of two years, four months, and twelve days, across thirty-six identical experimental trials, thirty-six verbal declarations of truth were separated out and picked from amongst one hundred and fourth-four declarations of falsehood.

The Tansey study utilized the now discontinued NeXT Computer running under Unix.[1] This study presents the results of TruthScan's initial field-testing, of its updated end-user protocol, utilizing a portable computer running MSDOS. The current TruthScan protocol attempts to maximize unequivocal knowledge of all stimuli and responses in a TruthScan session while eliminating any bias in presentation and scoring. In this, it again utilizes standardized, computer delivered, auditory stimuli and the same computer algorithm (Truth Verification Index) for the scoring of "truth" as found in TruthScan's initial field testing running under Unix.[1] In the current MSDOS version, TruthScan also uses the same algorithm (Falsehood Verification Index) to produce a computer scoring of "falsehood." Whereas the previous field-study only computed a numeric verification index for "truth as a discriminative entity, the

MSDOS based TruthScan computes the verification index for "truth" and a separate numeric verification index "falsehood."

In the current study, computerized instructions and monitoring are structured so as to require the participant to attentively focus on the standardized auditory stimuli during the TruthScan session. The current monitoring of a TruthScan session now includes video, audio, and EEG recordings throughout the session. All questions are answered prior to the TruthScan session. An informed consent form is signed and witnessed. All stimuli presented to each participant during the session come from the computer, while all verbalizations come solely from the participant. As such, the totality of the test record is saved.

# METHOD

## SUBJECTS

The experimental sample consisted of ten participants; ten males and ten females. The males range in age from age 22 to age 75 (22, 26, 27, 35, 36, 41, 59, 63, 63, 75). The females range from age 7 to age 89 (7, 24, 26, 29, 35, 36, 59, 59, 70, 89).

## ELECTROENCEPHALOGRAPHIC (EEG) RECORDING

Tansey used three saline sensors.[1] The current implementation utilizes three Grass 10mm cup electrodes. Electrode placement is exactly the same as in Tansey.[1] There are two active electrodes and one ground electrode. The ground electrode is mounted in an ear clip and placed on the right earlobe. One active electrode is also mounted in an ear clip and placed on the left earlobe. The remaining active electrode is mounted in a one-half inch square of rubber and placed along the midline of the top of the head (overlying the cerebral longitudinal fissure) centering about CZ (10/20 system). The active electrode at the top of the head is held in place with two elasticized headbands having Velcro at their sides and ends. One band is placed about the head, parallel to the eyebrows, across the middle of the forehead.

The second headband goes across the top of the head securing the active electrode there from movement, attaching on other side of the head on the first headband near the ear. In this manner, the active electrode at the top of the head is kept in place over the Rolandic (pre- and post-central gyri) of both the right and left cerebral hemispheres, and the upper portion of the bilateral Supplementary Motor Area.[2]

The raw EEG is processed by a medical grade differential pre-amplifier, digitized via an analog-to-digital converter card, and subsequently processed by the TruthScan software.

## PROCEDURE

Prior to electrode placement, each participant reads with the TruthScan examiner the informed consent form. Any last minute questions are answered at this time. All further instructions are delivered via the computer as follows:

It is very important that you listen to these instructions carefully. The examiner can no longer speak to you or you to him. For the next several minutes, you must only look at and speak to the video camera. This way no one can say later that you were not cooperative and straightforward. The computer will present you with a series of true or false statements. Each statement will be clearly true or clearly false. You will know the answer right away. If a statement is true, it will be so obvious that you will know it right away. You must say "true" right away, as soon as you know it—which means as soon as you hear the last word. The answer will be that clear. If a statement is false, it will be so obvious that you will know it right away. You must say "false" right away, as soon as you know it—which means as soon as you hear the last word. The answer will be that clear.

I will now present you with an example. Remember, as soon as you hear the last word, it's being true or false will be obvious right away, and you must say it is true or false right away. Remember, that you are being video recorded and a pause before you respond may be considered as an attempt at deception. Here's an example: "The sweet round fruit of the peach tree is always called a peach." This statement is clearly true. If you did it correctly, you should

have said "true" right away; as soon as you heard the word peach. Even if you got it right the first time, let's do it again to make sure that you understand that you only say true right away, or that you only say false right way, immediately at the end of each statement. Here's another example: "I want you to add in you mind, three plus one. The answer is ten." This statement is clearly false. If you did it correctly, you should have said false right away, as soon as you heard the word ten. The regular test questions will begin now. Each one will follow the other after a two second pause, so you need to pay very good attention so that you can accurately tell if they are true or false. Remember, you must only look at and speak to the video camera. This way, no one can say later on that you were not cooperative and straightforward. The rest of this test will only take a few minutes to finish. We will start now.

The computer then delivers the first set of twenty-four T/F statements. After this first set of twenty-four statements, the following instructions are given by the computer:

The first half of the test is now over. For the second half, we will be doing something slightly different. For the rest of the statements, you will lie on each and every one of them. If the honest answer is true, you will, as quick as you can, lie and say false. If the honest answer is false, you will lie and say true, as quick as you can. Like before, each statement is clearly true or clearly false. Like before, you will know the answer right away. If you do not lie right away, you may be seen as trying to cheat. Again, the answer will be clear. Your lie must be immediate, unless you are trying to cheat. If so, you will be caught. Remember, you are being video recorded, and that you must only speak to and only look at the video camera during the statements.

Here is an example: "The round sweet fruit of the peach tree is always called a peach." This statement is clearly true. If you did it correctly, you should have said false right away, as soon as you heard the word peach. Even if you got it right the first time, let's do it again, to make sure that you understand that you only say true right away, or that you only say false right away, immediately at the end of each statement. Here's another example: "I want you to add in your mind, three plus one. The answer is ten." This statement is clearly false. If you did it correctly, you should have said true, right away, as soon as you heard the word ten. Here is your first statement, listen carefully.

Following the second set of twenty-four statements, the computer delivers these final instructions:

> Now, we will do a quick and easy experiment. On the desk are ten playing cards (Ace through 10 of the same suit. The same suit is used in all experimental trials). Take one and show it to the video camera and then place it face up on the desk. Leave the rest of the cards face down. Now, I will make some statements about the card that you took just now. You will answer "true" to all of the ten card statements. Thus, you will be telling one truth and nine lies. Here's an example: "The card that you have just picked and placed face up is the Ace." If you did it correctly, your answer is "true." Here's another example: "The card that you have just picked and placed face up is the two." If you did it correctly, our answer is "true." For all of the ten card statements, you will only answer with "true." This will take only two minutes. Remember, you are not to pause. As soon as you hear the end of the statement, you will say true. Any hesitation on your part may be seen as deception on you part. The statements will begin now.

TruthScan automatically computes the numeric verification index for each of the participant's ten identical verbal declarations.

# RESULTS

After verbally declaring twenty-four truths and twenty-four falsehoods, each of the twenty participants chose one of ten playing cards (Ace through 10 of the same suit), placed their choice face up; with the others remaining face down. Each participant then made an additional ten identical declarations as to the identity of the card that they had chosen. TruthScan then computed four separate numeric verification indexes in the same manner as Tansey.[1] Two numeric verification indexes were computed for males. A numeric verification index was computed based on a commonly held "truthful" brainwave signature as well as a numeric verification index based on a commonly held "falsehood" brainwave signature ($n = 10$). Two numeric verification indexes were computed for females. A numeric verification index was computed based on a commonly held "truthful" brainwave signature as well as a numeric verification index based on a commonly held "falsehood" brainwave signature ($n = 10$).
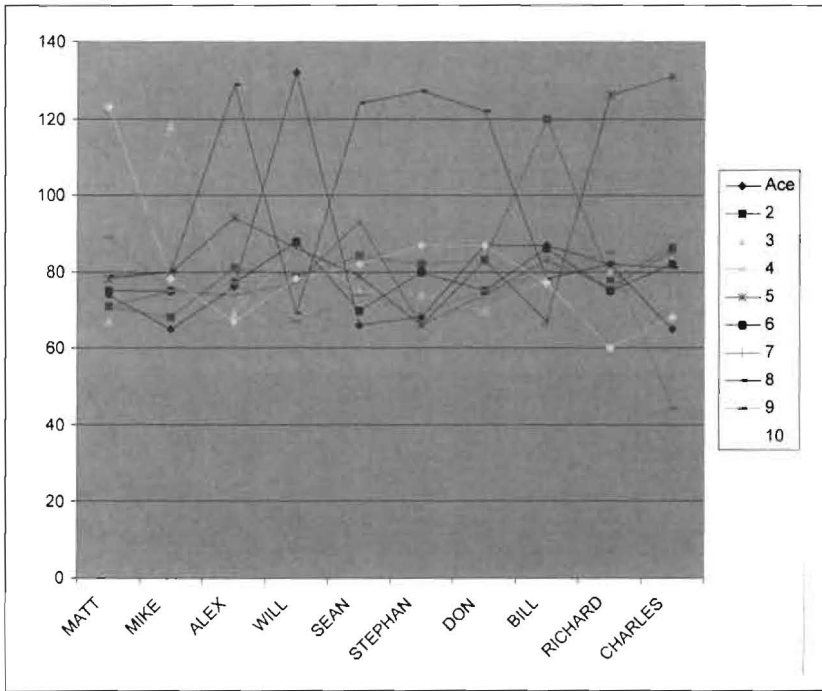
**Figure 1.** *TruthScan's Numeric Verification Index—Picking Truth For Males (n = 10).*

For all males and females in this study, truthful and false declarations were found to have distinct group numeric identification characteristics and to be clearly identifiable through same. For each of the two distinct sub-populations, male and female, the highest numeric Truth Verification Index number was indeed the singular truthful declaration; and clearly significantly higher than all of the rest of the other nine numeric Truthful Verification Index outcomes reflecting falsehood (Figure 1 and Figure 3).

Conversely, for each of the two distinct sub-populations, male and female, the lowest numeric Falsehood Verification Index number was indeed the truthful declaration; and clearly significantly lower than all of the rest of the other nine numeric Falsehood Verification Index outcomes reflecting falsehood (Figure 2 and Figure 4).
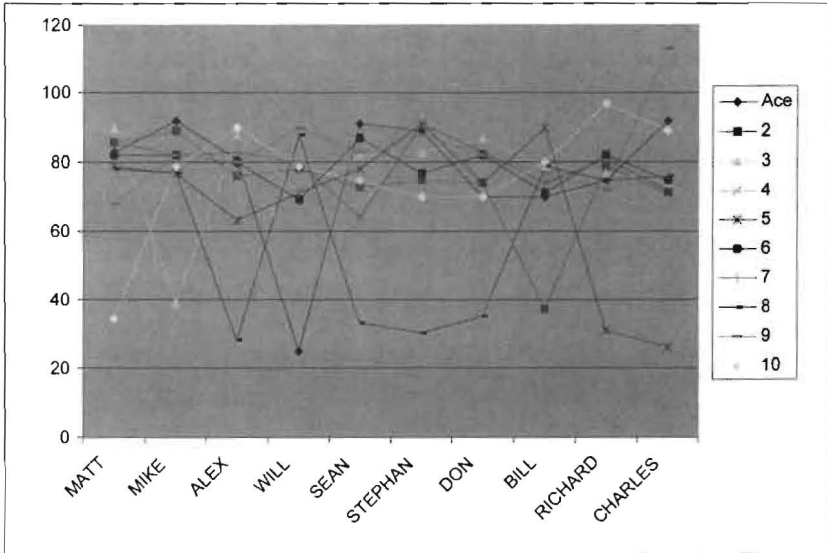
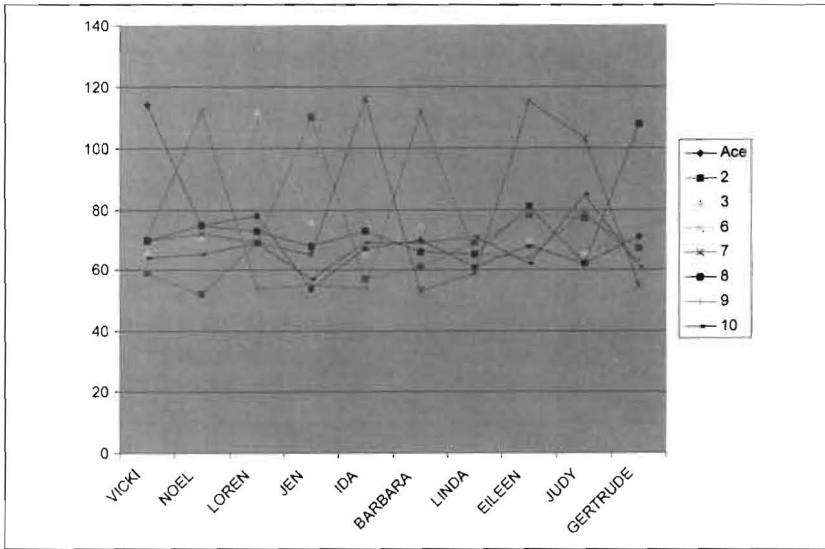**Figure 2.** *TruthScan's Numeric Verification Index—Picking Falsehood For Males (n = 10).*
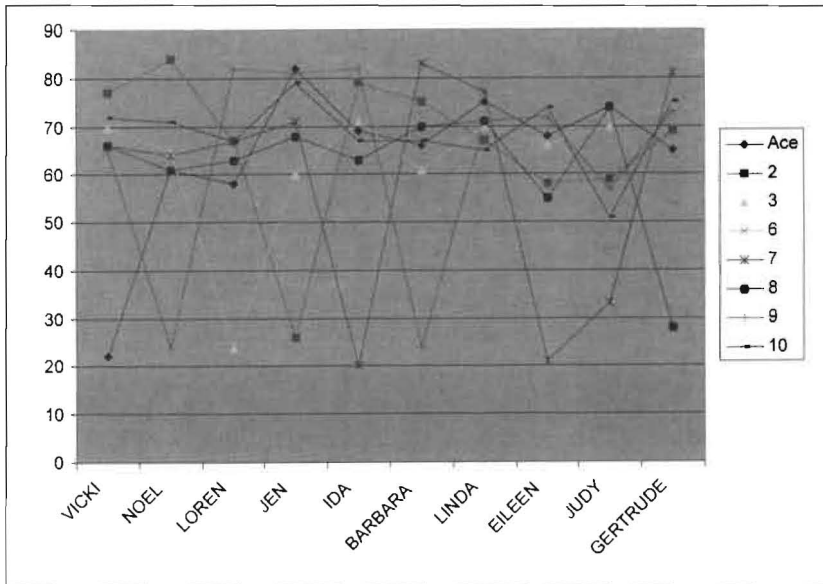


**Figure 3.** *TruthScan's Numeric Verification Index—Picking Truth For Females (n = 10).*

*Figure 4.* *TruthScan's Numeric Verification Index—Picking Falsehood For Females*
*(n = 10).*

# DISCUSSION

Clearly, the importance of being able to separate out and identify both truthful and false declarations as numerically identifiable and mutually exclusive entities in exculpating the innocent cannot be overstated. To be able to objectively and definitively exculpate the innocent whose circumstances place them under misplaced suspicion is the mission of TruthScan.

As presented in Tansey, the "scientific" statistical criteria for outcome significance most often used is what is termed the five percent level of significance; i.e. bottom line outcomes are to be judged statistically significant if the odds of their occurring by chance alone would be less than five in one hundred.[1] For the TruthScan algorithm to correctly pick the truthful card declaration, from amongst the other nine identical but false declarations for one participant, the odds of having the result be the product of pure chance is one in ten. For the TruthScan algorithm to correctly pick the truthful card declara-

tion, from amongst the other nine identical but false declarations for a second participant in a row, the odds of having the result are the product of pure chance is one in one hundred. If this experiment was performed using only two participants, the results would exceed the five in one hundred cut-off for proving statistical significance. After correctly picking the ten truthful declarations, ten times in a row, for ten participants, from amongst their ninety false declarations, the odds of having that result being the product of pure chance is one in ten billion. Testing of TruthScan's MSDOS implementation on a population of twenty is just a beginning. Further findings applying TruthScan's updated protocol to larger populations will be forthcoming.

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