

Experimental

A COMPUTERIZED INSTRUMENT FOR FORENSIC CREDIBILITY ASSESSMENT: *Initial Standardization and Test-Retest Findings*

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ABSTRACT

A fully automated computerized instrument for forensic credibility assessment was field tested with one hundred and three experimental trials utilizing an experimental population of ninety-four. One of the group participants thereafter participated in further test-retest experiments. A core digital brainwave signature enabling the affirmation of truth and falsehood was found to be held in common across the entire experimental population. While the aforementioned core brainwave signature was found to be extant and common across the test population, the test-retest data found that an individual's core brainwave signature included additional idiosyncratic relational brainwave indices which served as robust indicators in the thirty-six test-retest experimental trials. The implications of these findings relative to credibility forensic assessments free of technician/examiner bias are discussed.

KEYWORDS: Computerized EEG, TruthScan, veracity

INTRODUCTION

Computer-based assessment in areas of forensic science evaluations are notably powerful insofar as providing automated scoring systems enabling accurate, unbiased, diagnostic decisions where large amounts of data need to be organized and interpreted. The author has developed a new computer software program that now extends that same capability into the arena of forensic credibility assessment; specifically, in the area of the verification of veracity (VOV). This new software program is called TruthScan. As such, TruthScan is a radical departure from the traditional physiological detection of deception (PDD) technology based on the polygraph. The polygraph relies on the premise that for everyone, anxiety is directly related to lying/deception. Generating anxiety and catching people lying is the foundation of PDD. TruthScan's foundation is the validating of truth and affirming one's innocence—in short exculpating the innocent.

TruthScan selects out and differentiates affirmations of truth by direct inquiry of one's brain which is enabling the affirming of said truth. One's mind is constantly informed by one's flow of consciousness and relational thought. Cognitive aspects of this informational cascade are/have been shown to be trackable by computer.¹⁻⁴ Since 1982, increasingly specific and digitally exact measures of brainwave signature patterns, as accurate functional assessments of cognitive, somatosensory, and/or higher order mental function, have followed on the heels of the rapid advances in the power of computers.²⁻¹⁶ This study illustrates how the new science of digital brainwave analysis can be used in forensic credibility assessment so as to exculpate the innocent.

METHOD

SUBJECTS

The experimental sample comprises ninety-four individuals closely representative for both sexes from ages eleven through seventy-three. Females are singularly representative for ages seventy-three through eighty-eight.

ELECTROENCEPHALOGRAPHIC (EEG) RECORDING

Three saline sensors are used (impedance in saline of 1K ohm). The active sensor is placed so that its 6.5 cm X 1.3 cm contact surface lay lengthwise along the midline of the top of the skull (overlying the cerebral longitudinal fissure) centering about Cz (10/20 system). Based on Goldberg's work on the brain substrate of intentionality, Cz was chosen as the site from which to attempt to quantify and chart the affirmation of truth and falsehood.¹ The active sensor is held in place with two elasticized headbands with velcro on the ends. One band is placed about the head, parallel to the eyebrows, across the middle of the forehead. A second band goes across the top of the head and the active sensor, attaching at either end on the other headband, near each ear. In this position, the active sensor is kept in place over the Rolandic cortex (pre- and post-central gyri) of both the right and left cerebral hemispheres; extending anteriorly over the upper portions of the bilateral Supplementary Motor Area.¹ The reference and ground sensors are randomly placed on opposite ears via comfortable ear clips. The raw EEG is amplified with an optically isolated, battery powered pre-amplifier, sampled at a rate of approximately 8,000 times per second, then digitized and processed by computer via spectral analysis. The resultant digitized indices of brainwave activity are subsequently processed by the TruthScan software.

PROCEDURE

Prior to sensor attachment, each participant read and signed a detailed information and informed consent form. On that form they read the following description of their actions during the upcoming procedure:

On the next sheet, you will see five animals. You will choose one before sensor attachment. After sensor attachment, the computer will make several statements including: "You chose the Gopher. You chose the Bird" and so on through the list of five animals. Thus, you will be saying "yes" to one correct statement and "yes" to several incorrect statements. The completed computerized delivery of all five statements takes 20 seconds in total.

Thus, the ground truth/special knowledge possessed by each participant for each experimental trial was accurately ascertained. Each participant would now

be subject to a fully automated, computerized interrogation and analysis as to a definite, distinct, action on their part.

After sensor attachment each participant closed their eyes while seated in a chair and said “yes” immediately to each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” The raw EEG was recorded simultaneously and saved for processing by TruthScan. TruthScan automatically computes the numeric verification index of each voiced affirmation and picks the truthful one.

RESULTS FOR THE INITIAL STANDARDIZATION SAMPLE

One hundred and three experimental trials were conducted to test the hypotheses as to this sample sharing a core brainwave signature enabling the affirmation of truth. In twelve of the experimental trials Bird was chosen as the ground truth. In twenty-nine of the experimental trials Dog was chosen as the ground truth. In twelve of the experimental trials Gopher was chosen as the ground truth. In thirty-four of the experimental trials Bear was chosen as the ground truth. In sixteen of the experimental trials Cat was chosen as the ground truth. The actual choice as to the animal was not a factor. TruthScan correctly picked all of the one hundred and three truthful affirmations from amongst the four hundred and twelve false affirmations. The main hypothesis that there is a core digital brainwave signature enabling the affirmation of truth held in common for the sample population was empirically proven correct.

LONGITUDINAL TEST-RETEST RESULTS

A then sixteen year old male member of the experimental sample volunteered to participate in additional future experimental trials. These trials continued across a two year and four month time period. In all, thirty-six experimental trials were conducted. The exact same procedure and methodology that this participant underwent as part of the initial group one hundred and three experimental trials were used in the subsequent thirty six longitudinal test-retest experimental trials.

Copies of the actual TruthScan computation of the numeric verification index for each of the five voiced affirmations and resultant picks of the single truthful one, for each of the thirty-six experimental trials are included in the presentation of these test-retest results. In eight of the experimental trials Bird was chosen as the ground truth, in six of the experimental trials Dog was chosen as the ground truth, in six of the experimental trials Gopher was chosen as the ground truth, in six of the experimental trials Bear was chosen as the ground truth, and in ten of the experimental trials Cat was chosen as the ground truth. TruthScan correctly picked all of the thirty-six truthful affirmations from amongst the one hundred and forty-four false affirmations—wherein there existed a separation in time of two years, four months and twelve days between the first experimental trial and the thirty-sixth one. The secondary hypothesis as to the test-retest robustness of one’s idiosyncratic core brainwave signature was empirically proven correct.

To give a truly meaningful sense of how significant this test of reliability is, the following descriptive account of each experimental session is provided.

On 6-14-98, the then sixteen year old boy chose “Dog” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” He chose “Dog,” so did TruthScan. See Figure 1.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	57	84	67	62	65	61	51	64	41	70	51	70	66	53	79	48	63	58	61	65
Gate		1	1		1								1						1	
Percent	0.51	0.75	0.69	0.55	0.58	0.54	0.46	0.52	0.32	0.63	0.46	0.63	0.59	0.47	0.71	0.43	0.56	0.52	0.54	0.58
Filter	0.51	0.75			0.58								0.59						0.54	

Figure 1. Correspondence between human target stimulus choice (Dog) and computer assessment of participant’s credibility on 6/14/98.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	82	75	69	56	64	79	64	65	58	70	74	62	62	62	64	60	55	64	61	56
Gate	1			1	1	1												1		
Percent	0.73	0.67	0.62	0.50	0.57	0.71	0.57	0.52	0.52	0.63	0.66	0.55	0.55	0.55	0.57	0.54	0.49	0.57	0.54	0.50
Filter	0.73			0.50	0.57	0.57													0.57	

Figure 2. Correspondence between human target stimulus choice (Bird) and computer assessment of participant's credibility on 6/17/98.

Two days later, on 6-17-98, the then sixteen year old boy chose "Bird" as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said "yes" immediately after hearing each of the five computer delivered statements: "You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat." He chose "Bird," so did TruthScan. See Figure 2.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	68	67	81	54	63	48	50	63	63	51	112	55	43	45	66	67	61	51	52	58
Gate	1				1				1		1								1	
Percent	0.61	0.60	0.72	0.48	0.56	0.43	0.45	0.56	0.56	0.46	1.00	0.49	0.38	0.40	0.59	0.60	0.54	0.46	0.46	0.52
Filter			0.60		0.56				0.56		1.00								0.46	

Figure 3. Correspondence between human target stimulus choice (Bird) and computer assessment of participant's credibility on 6/19/98.

Two days later, 6-19-98, the then sixteen year old boy again chose "Bird" as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said "yes" immediately after hearing each of the five computer delivered statements: "You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat." He chose "Bird," so did TruthScan. See Figure 3.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	61	61	85	53	59	54	51	53	59	62	59	56	61	71	63	53	49	59	77	55
Gate		1	1	1						1	1									
Percent	0.54	0.54	0.76	0.47	0.53	0.46	0.46	0.47	0.53	0.55	0.53	0.50	0.54	0.63	0.56	0.47	0.44	0.53	0.69	0.49
Filter		0.54	0.76	0.47						0.55	0.53									

Figure 4. Correspondence between human target stimulus choice (Gopher) and computer assessment of participant's credibility on 7/06/98.

Twenty days later, on 7-6-98, the then sixteen year old boy chose "Gopher" as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said "yes" immediately after hearing each of the five computer delivered statements: "You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat." He chose "Gopher," so did TruthScan. See Figure 4.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	55	57	57	47	53	93	51	55	60	58	58	54	65	57	49	51	46	61	58	54
Gate			1	1	1	1						1								
Percent	0.49	0.51	0.51	0.42	0.47	0.83	0.46	0.49	0.54	0.53	0.52	0.48	0.58	0.51	0.44	0.46	0.41	0.54	0.52	0.48
Filter			0.51	0.42	0.47	0.83					0.48									

Figure 5. Correspondence between human target stimulus choice (Bird) and computer assessment of participant's credibility on 7/27/98.

Twenty one days later, on 7-27-98, the then sixteen year old boy chose "Bird" as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said "yes" immediately after hearing each of the five computer delivered statements: "You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat." He chose "Bird," so did TruthScan. See Figure 5.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	80	58	59	63	57	61	70	61	56	49	67	77	63	62	51	79	55	53	63	55
Gate		1	1						1						1				1	
Percent	0.71	0.52	0.53	0.56	0.51	0.54	0.63	0.54	0.59	0.44	0.60	0.69	0.56	0.55	0.46	0.71	0.49	0.47	0.56	0.49
Filter	0.71	0.52						0.50						0.46				0.47		
Total	55	70	54	61	57	43	65	62	57	57	59	64	60	63	59	104	61	31	64	46
Gate				1			1		1							1		1		
Percent	0.49	0.63	0.48	0.54	0.51	0.38	0.58	0.55	0.51	0.51	0.53	0.52	0.54	0.56	0.53	0.93	0.54	0.28	0.57	0.41
Filter				0.51		0.58		0.51								0.95		0.28		
Total	78	54	55	61	59	63	64	63	78	55	55	61	63	76	63	59	62	67	63	61
Gate		1		1	1													1		
Percent	0.70	0.48	0.49	0.54	0.53	0.56	0.57	0.56	0.70	0.49	0.49	0.54	0.56	0.68	0.56	0.53	0.55	0.60	0.56	0.54
Filter	0.70		0.49	0.54	0.53													0.55		
Total	82	53	64	53	48	67	51	58	66	43	66	60	48	56	56	55	49	59	55	50
Gate		1	1		1								1							
Percent	0.73	0.47	0.57	0.47	0.43	0.60	0.46	0.52	0.59	0.38	0.59	0.54	0.43	0.50	0.50	0.49	0.44	0.53	0.49	0.45
Filter	0.73	0.47		0.47	0.43								0.43							
Total	71	57	54	55	66	67	60	83	49	47	52	56	58	65	55	58	60	70	48	60
Gate		1	1						1				1							
Percent	0.63	0.51	0.48	0.49	0.59	0.60	0.54	0.74	0.44	0.42	0.46	0.50	0.52	0.58	0.49	0.52	0.54	0.63	0.43	0.54
Filter	0.63		0.48					0.44				0.58		0.49						

Figure 6.1-6.5. Comparison of computerized assessment of truth-telling with actual target (Bird) determined by participant over 5 corresponding trials on 6/21/99.

Eleven months later, on 6-21-99, the then seventeen year old boy chose “Bird” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” *He did this five times in a row for five consecutive back-to-back experimental trials.* He chose “Bird” five times in a row, so did TruthScan. See Figure 6.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	63	58	60	56	73	68	93	61	70	69	56	50	66	58	56	49	51	69	57	50
Gate	1		1	1	1		1													
Percent	0.56	0.52	0.54	0.50	0.65	0.61	0.83	0.54	0.63	0.62	0.50	0.45	0.59	0.52	0.50	0.44	0.46	0.62	0.51	0.45
Filter	0.56		0.54	0.50	0.65		0.83													
Total	59	62	59	58	57	59	100	60	45	54	73	63	53	52	67	48	66	51	57	55
Gate			1	1			1				1							1		
Percent	0.53	0.55	0.53	0.53	0.51	0.53	0.89	0.54	0.40	0.48	0.65	0.56	0.53	0.46	0.60	0.43	0.59	0.46	0.51	0.49
Filter			0.53	0.51			0.89				0.65							0.46		
Total	64	66	72	67	68	45	42	45	61	47	67	53	56	53	58	59	62	63	56	62
Gate		1					1					1		1					1	
Percent	0.57	0.59	0.64	0.60	0.61	0.40	0.38	0.40	0.54	0.42	0.60	0.47	0.50	0.47	0.52	0.53	0.55	0.56	0.50	0.55
Filter		0.59				0.40						0.50		0.52					0.50	
Total	79	85	57	55	64	66	79	61	58	70	56	75	57	57	63	60	70	69	61	64
Gate		1	1	1	1											1				
Percent	0.21	0.26	0.51	0.49	0.57	0.59	0.71	0.54	0.52	0.63	0.50	0.67	0.51	0.51	0.56	0.54	0.63	0.62	0.54	0.57
Filter		0.76	0.51	0.49	0.57											0.54				
Total	50	80	70	58	55	37	45	72	57	78	51	56	65	58	65	52	64	61	54	64
Gate	1	1		1	1								1							
Percent	0.45	0.71	0.63	0.52	0.49	0.33	0.40	0.64	0.51	0.70	0.46	0.50	0.58	0.52	0.58	0.46	0.57	0.54	0.48	0.57
Filter	0.45	0.71		0.52	0.49								0.58							

Figure 7.1-7.5. Comparison of computerized assessment of truth-telling with actual target (Dog) determined by participant over 5 corresponding trials on 6/22/99.

The next day, on 6-22-99, the then seventeen year old boy chose “Dog” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” *He did this five times in a row for five consecutive back-to-back experimental trials.* He chose “Dog” five times in a row, so did TruthScan. See Figure 7.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	62	52	80	57	57	64	41	69	60	49	73	69	65	70	57	74	63	64	68	58
Gate	1	1	1							1				1						
Percent	0.55	0.46	0.21	0.51	0.51	0.57	0.37	0.62	0.54	0.44	0.65	0.62	0.58	0.63	0.51	0.66	0.56	0.57	0.61	0.52
Filter	0.55	0.46	0.21							0.44				0.63						

Total	57	64	80	62	56	54	61	62	69	55	70	76	70	64	66	55	61	72	62	64
Gate		1	1	1	1	1														
Percent	0.51	0.57	0.21	0.55	0.50	0.48	0.54	0.55	0.62	0.49	0.63	0.68	0.63	0.57	0.59	0.49	0.54	0.64	0.55	0.57
Filter		0.57	0.21	0.55	0.50	0.48														

Total	62	66	88	65	75	62	52	37	88	38	70	65	68	68	69	58	56	61	70	59
Gate	1		1	1			1								1					
Percent	0.55	0.59	0.24	0.58	0.67	0.55	0.46	0.33	0.34	0.34	0.63	0.58	0.62	0.61	0.62	0.52	0.50	0.54	0.63	0.53
Filter	0.55		0.24	0.58			0.46								0.62					

Total	54	60	86	67	64	58	64	71	54	69	74	68	71	65	68	58	63	77	58	46
Gate		1	1	1	1											1				
Percent	0.48	0.54	0.27	0.60	0.57	0.52	0.57	0.63	0.48	0.62	0.66	0.61	0.63	0.58	0.61	0.52	0.56	0.69	0.52	0.41
Filter		0.54	0.27	0.60	0.57											0.52				

Total	68	55	90	74	64	50	61	53	51	69	62	62	80	56	75	59	60	67	57	59
Gate	1	1	1	1																1
Percent	0.61	0.49	0.20	0.66	0.57	0.45	0.54	0.47	0.46	0.62	0.55	0.55	0.21	0.50	0.67	0.53	0.54	0.60	0.51	0.53
Filter	0.61	0.49	0.20	0.66																0.53

Figure 8.1-8.5. Comparison of computerized assessment of truth-telling with actual target (Gopher) determined by participant over 5 corresponding trials on 6/23/99.

The next day, on 6-23-99, the then seventeen year old boy chose “Gopher” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” *He did this five times in a row for five consecutive back-to-back experimental trials.* He chose “Gopher” five times in a row, so did Truth Scan. See Figure 8.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	61	66	72	66	65	62	64	66	71	61	65	66	72	66	66	62	66	66	66	66
Gate	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Percent	0.58	0.43	0.64	0.72	0.51	0.58	0.48	0.43	0.52	0.64	0.64	0.46	0.54	0.70	0.59	0.51	0.46	0.50	0.59	0.51
Filter	0.58	0.52	0.68	0.68							0.54	0.59								

Total	59	59	66	76	77	56	54	48	58	72	72	52	60	78	66	57	51	56	66	57
Gate	1	1		1										1		1				
Percent	0.53	0.53	0.59	0.68	0.69	0.50	0.48	0.43	0.52	0.64	0.64	0.46	0.54	0.70	0.59	0.51	0.46	0.50	0.59	0.51
Filter	0.53	0.52	0.68								0.54	0.59								

Total	78	69	81	63	73	48	39	57	110	40	71	68	66	67	73	62	57	59	56	50
Gate						1			1	1						1			1	
Percent	0.70	0.62	0.72	0.56	0.65	0.43	0.35	0.51	0.98	0.36	0.63	0.61	0.59	0.60	0.65	0.55	0.51	0.53	0.50	0.45
Filter						0.35	0.88	0.36								0.55	0.53			

Total	52	59	53	72	66	45	47	55	41	64	41	61	73	64	54	61	74	69	63	68
Gate	1	1	1	1		1									1					
Percent	0.46	0.52	0.47	0.64	0.59	0.40	0.42	0.49	0.37	0.57	0.37	0.54	0.65	0.57	0.48	0.54	0.66	0.62	0.56	0.61
Filter	0.46	0.47	0.64			0.42									0.48					

Total	87	64	61	86	64	80	72	57	47	59	68	80	65	60	78	68	70	54	56	84
Gate	1		1							1	1			1						
Percent	0.78	0.57	0.54	0.77	0.57	0.71	0.64	0.51	0.42	0.53	0.61	0.71	0.58	0.54	0.70	0.61	0.63	0.48	0.50	0.75
Filter		0.57	0.27							0.53	0.61	0.58								

Figure 9.1-9.5. Comparison of computerized assessment of truth-telling with actual target (Bear) determined by participant over 5 corresponding trials on 6/24/99.

The next day, on 6-24-99, the then seventeen year old boy chose “Bear” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” *He did this five times in a row for five consecutive back-to-back experimental trials.* He chose “Bear” five times in a row, so did TruthScan. See Figure 9.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	65	59	64	56	87	53	77	39	55	63	58	65	66	78	81	65	59	64	65	59
Gate	1	1		1	1			1												
Percent	0.58	0.53	0.57	0.50	0.78	0.47	0.69	0.35	0.49	0.56	0.52	0.58	0.59	0.70	0.72	0.58	0.53	0.57	0.58	0.53
Filter	0.58	0.53		0.50	0.78			0.35												
Total	60	52	59	58	86	56	56	53	63	63	63	50	55	69	73	61	61	53	60	66
Gate	1		1		1				1			1								
Percent	0.54	0.46	0.53	0.52	0.77	0.50	0.50	0.47	0.56	0.56	0.56	0.45	0.49	0.62	0.65	0.54	0.54	0.47	0.54	0.59
Filter	0.54		0.53		0.77				0.56					0.45						
Total	60	59	61	60	87	63	47	65	56	52	61	52	60	77	69	60	74	58	66	72
Gate	1	1	1	1	1															
Percent	0.54	0.53	0.54	0.54	0.78	0.56	0.42	0.58	0.50	0.46	0.54	0.46	0.54	0.69	0.62	0.54	0.66	0.52	0.59	0.64
Filter	0.54	0.53	0.54	0.54	0.78															
Total	56	76	69	65	62	55	65	72	44	100	57	57	52	69	70	55	62	52	65	62
Gate			1						1	1		1				1				
Percent	0.50	0.68	0.62	0.58	0.55	0.49	0.58	0.64	0.39	0.89	0.51	0.51	0.46	0.62	0.63	0.49	0.55	0.46	0.58	0.55
Filter		0.62						0.39	0.89		0.51					0.49				
Pick										1										
Total	58	50	60	56	75	46	58	55	49	58	43	61	54	55	53	61	58	50	60	56
Gate	1			1	1												1	1		
Percent	0.52	0.45	0.54	0.50	0.67	0.41	0.52	0.49	0.44	0.52	0.38	0.54	0.48	0.49	0.47	0.54	0.52	0.45	0.54	0.50
Filter	0.52			0.50	0.67												0.52	0.45		

Figure 10.1-10.5. Comparison of computerized assessment of truth-telling with actual target (Cat) determined by participant over 5 corresponding trials on 6/27/99.

Three days later, on 6-27-99, the then seventeen year old boy chose “Cat” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” *He did this five times in a row for five consecutive back-to-back experimental trials.* He chose “Cat” five times in a row, so did TruthScan. See Figure 10.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	58	64	43	71	78	47	56	41	48	57	66	69	66	49	66	66	47	52	63	54
Gate			1		1									1		1	1			
Percent	0.61	0.57	0.38	0.63	0.70	0.42	0.50	0.37	0.43	0.51	0.59	0.62	0.59	0.44	0.59	0.59	0.42	0.46	0.56	0.48
Filter			0.38		0.70									0.44		0.59	0.42			
Total	61	61	66	66	82	60	73	68	55	61	61	64	75	63	74	73	69	59	67	67
Gate		1	1	1	1															
Percent	0.54	0.54	0.59	0.59	0.73	0.54	0.65	0.61	0.49	0.54	0.54	0.57	0.67	0.56	0.66	0.65	0.62	0.53	0.60	0.60
Filter	0.54	0.54	0.59	0.59	0.73															
Total	69	71	61	48	85	62	49	68	46	87	62	60	63	58	77	63	64	64	65	71
Gate		1		1			1		1											
Percent	0.62	0.63	0.54	0.43	0.76	0.55	0.44	0.61	0.41	0.78	0.55	0.54	0.56	0.52	0.69	0.56	0.57	0.57	0.58	0.63
Filter	0.62		0.54		0.76		0.44		0.41											
Total	66	62	62	63	90	49	51	56	61	81	60	55	59	56	85	61	62	54	64	66
Gate		1	1	1	1															
Percent	0.59	0.55	0.55	0.56	0.80	0.44	0.46	0.50	0.54	0.72	0.54	0.49	0.47	0.50	0.76	0.54	0.55	0.48	0.57	0.59
Filter	0.59	0.55	0.55	0.56	0.80															
Total	58	60	66	60	86	55	55	54	55	59	77	68	62	65	68	70	57	66	67	66
Gate				1	1		1	1	1											
Percent	0.52	0.54	0.59	0.61	0.77	0.49	0.49	0.46	0.49	0.53	0.69	0.61	0.55	0.58	0.61	0.63	0.51	0.59	0.60	0.59
Filter				0.61	0.77	0.49	0.49	0.46												

Figure 11.1-11.5. Comparison of computerized assessment of truth-telling with actual target (Cat) determined by participant over 5 corresponding trials on 6/29/99.

Two days later, on 6-29-99, the then seventeen year old boy again chose “Cat” as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said “yes” immediately after hearing each of the five computer delivered statements: “You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat.” *He did this five times in a row for five consecutive back-to-back experimental trials.* He chose “Cat” five times in a row, so did TruthScan. See Figure 11.

	A					B					C					D				
	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat	Bird	Dog	Goph	Bear	Cat
Total	88	64	60	62	60	69	48	43	72	67	73	66	79	57	57	74	56	55	62	65
Gate	1	1	1	1	1															
Percent	0.79	0.57	0.54	0.55	0.54	0.52	0.43	0.38	0.64	0.60	0.65	0.59	0.71	0.51	0.51	0.66	0.50	0.49	0.55	0.58
Filter	0.79	0.57	0.54	0.55	0.54															

Figure 12. Comparison of computerized assessment of truth-telling with actual target (Bird) determined by participant on 11/26/00.

Seventeen months later, on 11-26-00, the then eighteen year old boy chose "Bird" as his ground truth/special knowledge, checked it off on the standardized stimulus sheet, and subsequently said "yes" immediately after hearing each of the five computer delivered statements: "You chose the Bird. You chose the Dog. You chose the Gopher. You chose the Bear. You chose the Cat." He chose "Bird," so did TruthScan. See Figure 12.

In sum, the exact same core digital brainwave signature, sampled and scored by the exact same program, remained reliably stable and a robustly accurate verifier of truth across thirty-six experimental trials. As previously noted, TruthScan correctly picked all of the thirty-six truthful affirmations from amongst the one hundred and forty-four false affirmations—wherein there existed a separation in time of two years, four months and twelve days between the first experimental trial and the thirty-sixth one.

DISCUSSION

There is a great practical value to be able to use a standardized, computerized presentation of interrogatory stimuli and obtain an objective scoring as to the credibility of the responses of the person so tasked. These preliminary findings are powerful and promising. Even so, further extension of the normative sample to assess this instrument's applicability across greater cultural, regional, and national populations is the next step.

TruthScan technology as applied to the exculpation of the innocent was formulated to address the deficiencies of the Polygraph as directly related to

the author by Dr. Andrew Dollins of the Department of Defense Polygraph Institute in June of 1996. TruthScan's technology and methodology were engineered from the ground up to address the need for a verification of veracity instrument (VOV) that can apply the objective rigors of standardized scientific mythology to the process of exculpating the innocent, while respecting the welfare and dignity of the examinee during the exculpatory process itself.

Judicial acceptance of a test protocol's outcome being the product of "science" and thus presentable as exact scientific evidence in a court of law, strongly rests on the proofs as to whether the claims made are directly based on peer reviewed, standardized mythology; with outcomes/results having been reached by consistent and demonstrable means. TruthScan's VOV technology is on track to meet these standards of federal court admissibility, with the standardized stimulus presentation methodology, sensors used, and method of digital brainwave analysis, having been peer reviewed in respected Medical, Psychological, and Psychophysiological journals including: *The Australian Journal of Psychology*, *New Jersey Medicine*, *Medical Psychotherapy*, *Headache Quarterly*, *Biofeedback and Self-Regulation*, *The International Journal of Psychophysiology*, and *Subtle Energies & Energy Medicine*.

"Scientific" acceptance of a test protocol's outcome being acceptable and/or valid rests on the degree to which the opportunity for bias is minimized in the design and the execution of the protocol. This is basic to the scientific method. Accordingly, TruthScan's VOV implementation is completely automated with respect to standardized stimulus delivery, analysis of the digital brainwave data, and archiving of an individual's digital brainwave data reflecting the affirmation of his/her not having committed a specific volitional act. This then allows the test outcomes to be critically and unequivocally evaluated as to their having met the exacting criteria for outcome significance as utilized in the scientific application of psychophysiology and other sciences. It is critical to remember that the truths and falsehoods changed from person to person and session to session. The results demonstrate robust accuracy. The next question is whether the results meet the scientific community's clearly defined criteria for statistical significance.

The 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. For the TruthScan VOV algorithm to correctly pick the first truth from amongst the first four falsehoods, the odds of the result being the product of pure chance are one in five. For the exact same TruthScan to correctly pick three truths in a row in this manner, the odds of the result being the product of pure chance are one in one hundred and twenty-five. If this experiment had been performed using only three subjects, the results would exceed the five in one hundred cut-off of the five percent rule. After correctly picking ten truths in a row in this manner the odds of the correct pick being the product of pure chance exceed one in nine million. Twenty consecutive picks result in odds of one in ninety-five trillion that the correct pick is the product of pure chance. One hundred and three consecutive correct picks result in odds that the correct pick is the result of pure chance at one in a number so large that it is over seventy digits long.

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