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A field study on the validity of the Quadri-Track Zone Comparison Technique ☆

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ABSTRACT

This field study tested and demonstrated the validity and reliability of the Quadri-Track Zone Comparison Technique designed for specific Single-Issue Psychophysiological Veracity (PV) examinations using the polygraph, using one hundred and forty confirmed real-life cases from a private polygraph firm under contract with a metropolitan police department. The Quadri-Track Zone Comparison Technique's unique Inside Track accurately increased the scores for the innocent by 43.6% and the guilty by 37.1% thereby reducing the overall inconclusive rate from 19.5% to 1.4%, which effectively remedies the major cause (Fear/Hope of Error) of inconclusive results in single-issue polygraph tests. The Quadri-Track Zone Comparison Technique correctly identified 100% of the innocent as truthful with no inconclusives and no errors. It further correctly identified 97.8% of the guilty as deceptive and 2.2% as inconclusive, with no errors. Inconclusives excluded, the Quadri-Track Zone Comparison Technique was 100% accurate in the identification of the innocent and the guilty. Inconclusives included, the utility rate was 98.6%. Blind scoring of polygraph charts showed extremely high correlations for the individual and total scores with a combined accuracy of 98.3%.

1. Background of the Quadri-Track ZCT

This field study is the second published research on the validity of the Quadri-Track Zone Comparison Technique (ZCT). The Quadri-Track ZCT was initially developed in 1977 by James Allan Matte as a result of field experiments designed to resolve the problem of false positives[1] in psychophysiological veracity (PV) examinations using the polygraph in a "zone comparison" test. The zone comparison test is a polygraph technique developed by Cleve Backster in 1960 [3,12] that encompasses three zones (black, red and green)[2], two of which (red and green) are compared and quantified for a determination of truth or deception. Since Backster's development of the technique, zone comparison polygraph tests in various formats have comprised the vast majority of polygraph tests conducted in both the private and government sectors. Generally speaking, the zone comparison polygraph technique remains the standard operating method in polygraph circles world wide.

☆ The authors wish to express their gratitude to James Allan Matte for permission to use his illustrations in Tables 1 and 2.
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[1] A false positive occurs when a truthful examinee is erroneously identified as deceptive regarding the relevant issue. A false negative occurs when a deceptive examinee is erroneously identified as truthful regarding the relevant issue. Fear of error by an innocent examinee can cause an autonomic response on the relevant questions that mimic deception [8,19].

[2] The black zone consists of symptomatic questions designed to gain the examinee's confidence regarding avoidance of unreviewed questions embracing outside issues. The red zone consists of relevant questions dealing with the issue for which the examinee is being polygraphed. The green zone consists of control questions that are designed to elicit a negative answer from the examinee to questions that encompass unknown offenses or misdeeds during a period earlier than the time the alleged offense was committed. Each control question is compared against its neighboring relevant question for a determination of truth of deception.

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The theory and methodology of the Matte Quadri-Track Zone Comparison Technique was first published in the American Polygraph Association's journal *Polygraph* [9] and in a textbook [10,11]. The first field validation study on the Quadri-Track Zone Comparison Technique was published in *Polygraph* in 1989 [17] from a doctoral dissertation [18]. The Quadri-Track ZCT has since been fully described in a textbook [12] with a Supplement [14] that incorporates a standardized pretest interview for the Quadri-Track ZCT which is essential for the successful administration of the technique. A third textbook published in 2000 [13], directed primarily at lawyers in preparation for foundation testimony in court, gives a detailed description of the Quadri-Track ZCT. The Quadri-Track ZCT has been taught at several polygraph schools accredited by the American Polygraph Association and has been utilized both in the public and private sector for more than two decades with reported results meeting the high expectations of the first field validation study. It is a technique that requires both astute application and much technical knowledge — including the memorization of a 23-reaction combination guide which must be applied after conducting each polygraph chart. The results of this field study apply only to the Quadri-Track Zone Comparison Technique when used in its pure form without deviation. The Quadri-Track Zone Comparison Technique is a polygraph technique used exclusively for single-issue tests.

The Quadri-Track Zone Comparison Technique employs the Backster Zone Comparison Technique's basic test structure and quantification system [2–4,15], with some refinements and the addition of another spot (the "Inside Track") consisting of a control/relevant[3] question pair to deal with an innocent examinee's Fear of Error and the guilty examinee's Hope of Error. Interestingly, since 1996 the Backster ZCT has incorporated the Inside Track's Fear/Hope of Error questions into its test structure as an option, hence little difference remains between the two techniques. But herein are the key differences: The Backster ZCT uses two relevant questions dealing with the same singular issue which are flanked by earlier-in-life non-current exclusive control questions on both sides of each relevant question numbering a total of three controls. When there are equally significant reactions to both a relevant and its neighboring control question immediately preceding it, that control question is deemed to be defective in accordance with Backster's "Either–Or" rule.[4] Hence that reactive relevant question is compared with the other neighboring control question that immediately follows it which if effective would contain little or no reaction. The same principle applies to the second relevant question.

The Quadri-Track ZCT eliminates that third control question thus leaving each relevant question with one control question immediately preceding it and pairs each control and relevant question into a track, compelling each relevant question to be compared with the preceding control question within its track, hence a non-selective comparison. The Fear of Error control question is then added into a third track with the hope-of-error relevant question for comparison. A seven-position scale is used with values ranging from +3 Maximum Truthful Score, +2 Truthful Score, +1 Minimum Truthful Score, 0 Score — Inconclusive, −1 Minimum Deception Score, −2 Deception Score, −3 Maximum Deception Score. The scores from all three tracks are then tallied for a total score which is then matched to the score table with threshold for a conclusion of truth, deception or inconclusive contained in the conclusion table.

The application of Backster's "Either–Or" rule in the Quadri-Track ZCT is augmented, in an evolutionary sense, by Matte's "Dual Equal Strong Reaction Rule" when warranted. Also, the Quadri-Track ZCT restricts the comparison of each relevant question to the control question preceding it within the same track, hence becoming a non-selective pairing for comparison purposes. When the relevant question elicits a significant reaction and its neighboring control question also elicits a significant reaction, the assignment of a minus one score, rather than a zero, is given in the pneumo and cardio tracings only. The electrodermal tracing is excluded from the Dual Equal Strong Reaction Rule due to that tracing's volatility and sensitivity to extraneous stimuli, and under such circumstance is assigned a score of zero. Under the strict Backster interpretation, the "Either–Or" rule deems that competing control question to be defective. Furthermore, as with the Backster system, the Quadri-Track ZCT utilizes an asymmetrical increasing-score threshold[5] for a determination of truth or deception. As additional charts are collected (a minimum of two are required to make a call), the cut-off thresholds likewise increase.

The other difference in the test structure of the Quadri-Track ZCT versus the Backster ZCT is in the position of the Sacrifice Relevant Question which in the Quadri-Track ZCT is separated from the first control question by the first Symptomatic question, whereas with the Backster ZCT, the Sacrifice Relevant question immediately precedes the first control question.

Therefore, aside from those differences stated above, the Quadri-Track ZCT is similar to the Backster ZCT in structure and procedure. The Quadri-Track ZCT employs the same scoring rules of the physiological data as found in the Backster ZCT, except that it automatically upgrades a score to its maximum value when warranted.

2. Genesis of the Fear of Error and Hope of Error questions

The Fear of Error by the innocent was recognized by Dr. Paul Ekman, a behavioral scientist, in his 1985 book *Telling Lies*. The text is devoted primarily to verbal and non-verbal behavior. Dr. Ekman discusses the elements of "fear" in his chapter on the "Polygraph as Lie Catcher" and states "The severity of the punishment will influence the truthful person's fear of being misjudged just as much as the lying person's fear of being spotted — both suffer the same consequence." Dr. Ekman feels that the polygraph examination, like behavioral clues to deceit, is vulnerable to what he terms the "Othello Error", so named because the Shakespearean character Othello failed to recognize that his wife Desdemona's fear might not be a guilty adulterer's anguish about being caught, but instead could be a faithful wife's fear of a husband who would not believe her. Both cause an autonomic nervous response. Tellingly, the Fear of Error phenomenon was cited by the National Research Council of the National Academies' 2003 Report on the Polygraph and Lie Detection as a factor that could significantly reduce the accuracy of field polygraph tests, and it also cited the use of countermeasures as another factor that presented a serious threat to the accuracy of field polygraph tests. The Quadri-Track ZCT handily addresses both of these concerns.

In its first field validation study involving two separate polygraph entities, the Quadri-Track Zone Comparison Technique's "Inside Track" containing the Fear of Error and Hope of Error questions, prevented a 5% false positive error rate and a 2% false negative error, and it also

[3] The term "control" question has been replaced with the term "comparison" to conform to the scientific literature, however, in this study we still use the term "control" question because it avoids duplication of the term comparison in succession that could cause confusion, i.e. comparison of comparison v. relevant questions, etc.

[4] The Backster "Either–Or" rule dictates that a significant reaction should be present in either the red zone (relevant question) or the green zone (control question) but not to both. If the red zone (relevant) indicates a lack of reaction, it should be compared with the neighboring green zone (control) containing the larger timely reaction. If the red zone indicates a timely and significant reaction it should be compared with the neighboring green zone containing no reaction or the least reaction. A timely and significant reaction to both the red zone and green zone question being intercompared indicates serious question defect in green zone question [5].

[5] The Quadri-Track ZCT instituted a lower score threshold for the truthful versus the deceptive examinee in 1977 which was published in Polygraph, Vol.7, Nr. 4, December 1978. The Backster ZCT instituted a lower score threshold for the truthful in 1979. ([2] Notepack, Revised).

reduced the inconclusives from 34.5% to 6%. Furthermore it correctly identified 91% of the innocent as truthful with a 9% inconclusive rate and no errors. It correctly identified 97% of the guilty as deceptive with a 3% inconclusive rate and no errors. It should be noted that the Quadri-Track ZCT's quantification system of assigning a minus one score rather than a zero when there is an equal strong reaction to both the relevant and control questions being intercompared (based on Backster's Either–Or rule) provides a minimum total score that exceeds the threshold required to render a determination of truth or deception. This key distinction in the treatment of competing zones effectively nullifies physical and mental countermeasures that today are increasingly found being applied to control questions. Under strict Backster rules, the control question in the aforesaid circumstance is deemed defective while the neighboring relevant question is considered ideally formulated. Practically speaking, this condition warrants at the very least a "lean" towards deception, which translates into a minus one score. It should be noted that Matte's seminal 1989 field validation study on the Quadri-Track ZCT revealed that the minimum score requirement of +4 per chart for the truthful examinee could be reduced to a +3 per chart without increasing the inconclusive or error rate, thus the lower score threshold for the truthful was subsequently adopted and factored into the Quadri-Track ZCT quantification system.

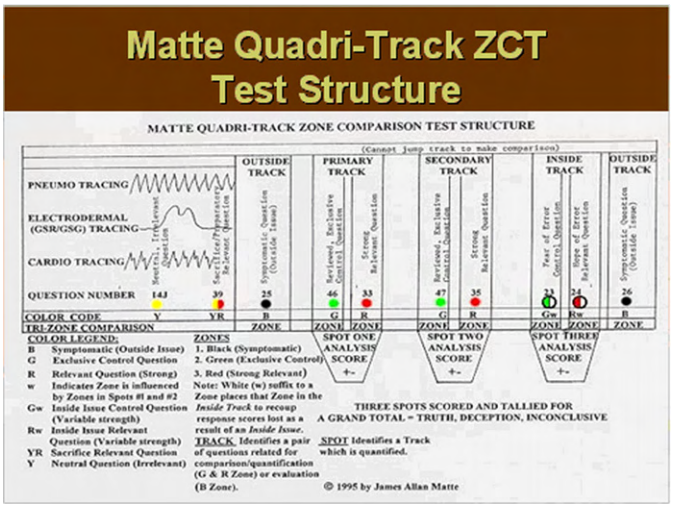
The Quadri-Track Zone Comparison Technique uses non-current exclusive control questions that clearly separate the period of time covered by the control questions from the period of time covered by the relevant questions. This separation enables the Either–Or rule and facilitates the examinee's psychological set[6] [16] towards type of questions (control or relevant) that present the examinee with the greater threat to his or her well-being. The Fear of Error (control) question is presented to the examinee in a manner that inhibits an affirmative answer and produces a negative answer, while all examinees answer the Hope of Error (relevant) question in the negative. These two questions are compared and scored in the same fashion as the other two control/relevant question pairs. As depicted in the diagram of the Quadri-Track ZCT Test Structure at Table 1, the scores from all three tracks each containing a pair of control vs. relevant questions, are added together for a total score, which is then related to a conclusion table containing a score threshold (Table 2) that must be met or exceeded before a definite conclusion of truth or deception can be rendered.

The "Fear/Hope of Error" question pair form the third track, which is located after the two traditional control-versus-relevant question pairs or tracks. The "Fear of Error" question is a control question which is designed to determine the degree of fear that an examinee may have that an error will be made on the test regarding the target issue — a response that only an innocent examinee should experience. Conversely, the "Hope of Error" question is a relevant question which is designed to determine whether or not the examinee is hoping that an error will be made on the test regarding the target issue — a response that only a guilty examinee should experience. The term "target issue" is thoroughly explained to the examinee during the pretest interview and the review of the test questions prior to the collection of the physiological data, in that the target issue is the specific issue contained in the relevant question on the test. Use of the term "target issue" rather than "regarding the sexual molestation of Jane Doe" or "regarding the larceny of that $10,000.00 from ABC Market" removes the stigma within the questions.

Example:

Are you afraid an error will be made on this test regarding the target issue?

Table 1
Matte Quadri-Track ZCT Test Structure



Are you hoping an error will be made on this test regarding the target issue?

The only difference between the above two questions (Control vs. Relevant) are the words "afraid" and hoping."

The "Fear of Error" question purportedly helps compensate for any ineffectiveness of the other control questions in competing with threatening relevant questions that cause the examinee legitimate anxiety that a mistake will be made (the Fear of Error). Additionally, the Inside Track containing the Fear of Error and Hope of Error questions provide the polygraphist with the means of determining whether a control question should be strengthened or weakened when there is equal response to both control and neighboring relevant question. This unique psychodynamic feature — and its attendant benefit — are not available in other zone comparison tests.

3. Concurrence of the National Research Council made clear

The creator (Matte) of the Quadri-Track ZCT theorized that an innocent examinee's fear that an error will be made on his polygraph test will make the relevant questions inordinately threatening, causing a physiological response that will compete with the control questions causing inconclusive or false positive results. This theory was subsequently advanced by the National Research Council of the National Academies 2003 report which stated "This theoretical argument also leaves open significant possibilities for misinterpretation of the polygraph results of certain examinees. It is plausible, for instance, that a belief that one might be wrongly accused of deceptive answers to relevant questions — or the experience of actually being wrongly accused of a deceptive answer to a relevant question — might produce large and repeatable physiological responses to relevant questions in non-deceptive examinees that mimic the responses of deceptive ones." (NRC, Page 74)

The National Research Council of the National Academies 2003 Report further articulated their grave concern regarding the use of countermeasures which in their view would seriously degrade the value of an otherwise valid test. The NRC stated that "Basic science and polygraph research give reason for concern that polygraph accuracy may be degraded by countermeasures, particularly when used by major security threats who have a strong incentive and sufficient resources to use them effectively. If these measures are effective, they could seriously undermine any value of polygraph security screening." (NRC, Page 5). NRC further stated that "Perhaps the most serious potential problem with the practical use of the polygraph is the

[6] Psychological Set: Also known as Selective Attention, it is an adaptive psychophysiological response to fears, anxieties, and apprehensions with a selective focus on the particular issue or situation which presents the greatest threat to the legitimate security of the examinee while filtering out lesser threats. [12,22]

Table 2
The Quadri-Track ZCT Numerical Score Sheet and Conclusion Table

The Quadri-Track ZCT Numerical Score Sheet and Conclusion Table

STIMULATION TEST DATA:	NUMBER SELECTED:							
	CHART NUMBER:							

Quadri-Track Tri-Zone Quantification System Score Table

CHART 1	NDI	INDEF	DI			NDI	INDEF	DI			NDI	INDEF	DI			
PNE (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
EDA (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CAR (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CHART 2	NDI	INDEF	DI			NDI	INDEF	DI			NDI	INDEF	DI			
PNE (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
EDA (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CAR (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CHART 3	NDI	INDEF	DI			NDI	INDEF	DI			NDI	INDEF	DI			
PNE (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
EDA (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CAR (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CHART 4	NDI	INDEF	DI			NDI	INDEF	DI			NDI	INDEF	DI			
PNE (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
EDA (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
CAR (33)	+3 +2	+1 0 -1	-2 -3	= ( )	(35)	+3 +2	+1 0 -1	-2 -3	= ( )	(24)	+3 +2	+1 0 -1	-2 -3	= ( )		
TARGET ( )			TOTAL: ( )					TOTAL: ( )					TOTAL: ( )			

GRAND TOTAL: ( )
FOR ( ) CHARTS.

% Pop:_____
P.E.: _____

CONCLUSION TABLE

	CIRCLE APPROPRIATE NUMBER BELOW		
RESULTS FOR 1 CHART	+27 to +3	+2 to -4	-5 to -27
	TRUTH	INDEFINITE	DECEPTION
	CIRCLE APPROPRIATE NUMBER BELOW		
RESULTS FOR 2 CHARTS	+54 to +6	+5 to -9	-10 to -54
	TRUTH	INDEFINITE	DECEPTION
	CIRCLE APPROPRIATE NUMBER BELOW		
RESULTS FOR 3 CHARTS	+81 to +9	+8 to -14	-15 to -81
	TRUTH	INDEFINITE	DECEPTION
	CIRCLE APPROPRIATE NUMBER BELOW		
RESULTS FOR 4 CHARTS	+108 to +12	+13 to -19	-20 to -108
	TRUTH	INDEFINITE	DECEPTION

possibility that examinees — particularly deceptive ones — might be able to decrease the test's accuracy by engaging in certain behaviors, countermeasures, designed to produce non-deceptive test results." (NRC, Page 139)

4. The importance of separate question pair "tracks"

The Quadri-Track ZCT uses a non-selective approach in the comparison of relevant and control questions by confining each relevant

question with the control question immediately preceding it into a "track" that restricts the comparison of each relevant question to the control question within that same track. Considering that Backster's "Either–Or" rule dictates that when the relevant question and the control question against which it is being compared both contain significant physiological responses, the relevant question having been ideally formulated and based on solid facts is deemed effective whereas the control question must be defective. Thus, Backster will ignore the defective control question and compare the responsive relevant question to the other neighboring control question containing little or no response which is deemed effective. Unfortunately, the use of countermeasures on all control questions would preclude the availability of a control question with "little or no response" against which to make a comparison thus resulting in zero scores throughout each relevant/control comparison for a final inconclusive determination.

The effective use of countermeasures requires the identification of all control questions which is easily acquired through readily available books and websites dedicated to the use of the polygraph. Hence, the deceptive examinee will apply his physical or mental countermeasure to all control questions, which, if successful will cause a significant response to each control question — but he will not be able to suppress a significant response to the relevant questions to which he is being deceptive. In the Quadri-Track ZCT, that deceptive response to the relevant question will be compared with that reactive control question preceding it which will be deemed defective; hence a minimal deceptive score of minus one will be assigned to that track or question pair. Therefore, even with only those minimal scores which would tally at least a minus 6 per chart, a deceptive result would occur in that the minimum score threshold for the Quadri-Track ZCT is an average of minus 5 per chart. As a result, regardless of the type of countermeasure used, whether physical or mental, it will neither effectively hamper the decision-making process nor inhibit a valid and reliable result. Backster's "Either–Or" Rule and Anti-Climax Dampening Concept was tested *in A Field Validation Study of the Backster Zone Comparison Technique and its Scoring System* which is near completion. In that field study, 123 confirmed guilty cases were used which revealed that the employment of Backster's "Either–Or" rule and concept produced the least number of inconclusives and no errors when compared with two other established scoring systems.

5. Format of Quadri-Track Zone Comparison Technique

14J	Neutral, Irrelevant Question.
39	Preparatory Sacrifice Relevant Question dealing precisely with single-issue covered by relevant questions #33 and #35.
25	Symptomatic (Outside Issue) Question.
46	Reviewed Non-Current Exclusive Control Question.
33	Short and Direct Relevant Question.
47	Reviewed Non-Current Exclusive Control Question.
35	More Descriptive version of Relevant Question #33.
23	Fear of Error Control Question.
24	Hope of Error Relevant Question.
26	Symptomatic (Outside Issue) Question.

The purpose of this field study is to conduct an independent evaluation of the Quadri-Track Zone Comparison Technique using confirmed polygraph examinations conducted by qualified polygraphists formally trained in the aforesaid technique.

6. Procedure

A study of existing literature [1,12,13,21] on polygraph validity revealed that twice as many studies were conducted on the validity and reliability of psychophysiological veracity (PV) examinations using the polygraph in a laboratory setting than those using real-life cases. Research conducted in a laboratory setting using mock paradigms lack two very important elements that are present in real-life situations, namely "Fear of Detection" by the guilty examinee, and "Fear of Error" by the innocent examinee. Since the Quadri-Track Zone Comparison Technique specifically addresses the innocent examinee's "Fear of Error" and the guilty examinee's "Hope of Error" it was essential that this study use data obtained from polygraph charts acquired in real-life cases.

All specific issue PV examinations conducted with the Quadri-Track Zone Comparison Technique by the Armitage Polygraph Service, Incorporated under contract with the Buffalo Police Department from 1 January 2000 through 31 December 2006 were reviewed. There were 140 cases which were later solved by confessions[7], either by the examinee or other suspects in same case. Thus, 140 of the total of 244 available cases (57.0%) were subsequently solved, providing a base of confirmed cases for study. The original polygraphist's decisions at the end of these 140 confirmed cases were: 89 Deception Indicated (DI), 49 No Deception Indicated (NDI), and 2 Inconclusives (INC). Of the 2 Inconclusive cases, both were solved as guilty.

In the order of preference for establishing ground truth, confessions are generally considered the best, convictions the next, and forensic evidence third. While there is often overlap, confession and conviction, forensic evidence and conviction and other combinations, we have elected to include only those cases that were confirmed by confession of the examinee or other suspect in the same case, due to the current controversy in the use of judicial convictions and other forms of evidence in establishing ground truth. To avoid any such debate, all confirmed DI cases and NDI cases included in this field study were solved by confessions.

The subject population of the 140 confirmed cases included 127 men and 13 women. There were 62 white persons, 73 black persons, and 5 Hispanic persons. The age range was 16 to 65 and averaged 31. The educational level ranged from 4 years to 20 years and averaged 11.6 years. The average education level for the guilty was 11.6 years and the innocent 12 years. There were 31 crimes against property, 209 against persons.

The three polygraphists who participated in this field research were Daniel J. Mangan, certified graduate of the Backster School of Lie Detection, Thomas E. Armitage, certified graduate of the New York School of Lie Detection, and Gregory C. Adams, certified graduate of the Backster School of Lie Detection. All of the above polygraphists were formally trained in the use of the Quadri-Track Zone Comparison Technique.

The polygraph instrument used by Thomas E. Armitage during the period from 1 January 2000 thru 31 December 2006 was a fully electronic Stoelting UltraScribe which recorded thoracic and abdominal breathing patterns, electrodermal and cardiograph activity.

In this field research we compared the polygraphist's original decision with the results of following activities which solved the cases, namely confessions, to determine how many false positives occurred, how many false negatives occurred, and the inconclusive rate. The latter as a measure of utility, not accuracy.

We also collected the scores from each polygraph chart on each track where a comparison was made between a control and a relevant question to determine the effect that the Inside Track (Fear/Hope of Error) had on the results of each polygraph test.

In addition, a random selection of the polygraph charts from 30 (15 DI, 15 NDI) of the aforementioned confirmed cases totaling 72 charts were

[7] Since 1980 when co-author Armitage took over the polygraph unit at the Buffalo Police Department, he instituted a policy that permits both prosecutors and defense attorneys to view live through close-circuit television the entire polygraph examination including the posttest interview with the result that no confessions have ever been challenged. Furthermore, the Quadri-Track ZCT protocol absolutely forbids the use of any accusatory or interrogative approach during any portion of the pretest interview and collection of the physiological data.

independently read and numerically scored blind by two polygraphists who did not conduct nor observe any of the examinations. The blind reviewers did not have any case information and based their decisions solely on their scoring of the physiological data contained in each confirmed case. They worked separately and at different times and locations.

7. Results

The base rate of deception was 91 out of 140 (65%). Of the 91 confirmed deceptive examinees, the original polygraphist's decisions were DI in 89 (97.8%), NDI none and Inconclusive in 2 (2.2%). Of the 49 confirmed non-deceptive examinees, the original polygraphist's decisions were DI none, NDI 49 (100%), and Inconclusive in none (0%). The original polygraphist was correct in 138 of 140 cases (98.6%), wrong in none of the cases, with inconclusive results in 2 cases (1.4%). When the inconclusives were excluded, the polygraphists made 100% correct decisions. The 2 inconclusives and no errors gave a utility rate of 98.6%. There were 2 deceptive inconclusives and no truthful inconclusives (Tables 3 and 4).

Comparison of the data for the innocent and guilty show that the mean chart score of the innocent for Tracks 1 and 2 only was +4.0, and the mean chart score of the innocent for Tracks 1, 2 and 3 (Fear/Hope of Error) was +7.1 for a difference and score increase of +3.1 or 43.6%. The mean chart score of the guilty for Tracks 1 and 2 only was −6.29 and the mean chart score of the guilty for Tracks 1, 2 and 3 (Fear/Hope of Error) was −10.0 for a difference and score increase of −3.71 or 37.1%.

The Inside Track's Fear of Error control question generated an adjustment to the 49 Innocent case scores by increasing the scores to an average of +3.1 per case (43.6%). The average total score per innocent case without the Fear of Error question adjustment was +4.0 and with the Fear of Error question adjustment was +7.1. This shows that the “Fear of Error” factor is extremely significant and cannot be ignored in the scoring of innocent cases.

The Inside Track's Hope of Error relevant question generated an adjustment to the 89 guilty case scores by decreasing the scores (increasing its value) an average of −3.71 per case. The average total score per guilty case without the Hope of Error question adjustment was −6.29 and with the Hope of Error question adjustment was −10.0. This shows that the “Hope of Error” is a significant factor, increasing the guilty case score by 37.1%.

The accuracy of the Quadri-Track Zone Comparison Technique with and without the use of the Inside Track's Fear/Hope of Error questions is compared in Table 5. With the Inside Track's Fear/Hope of Error the Quadri-Track ZCT scoring system found 100% of the innocent cases as truthful, 0% deceptive and 0% inconclusive. Without the Inside Track's Fear/Hope of Error the Quadri-Track ZCT scoring system would have found 67.4% of the innocent cases as truthful, 0% deceptive and 32.6% inconclusive. Therefore the Inside Track's Fear/Hope of Error reduced the inconclusives from 32.6% to 0%. With the Inside Track's Fear/Hope of Error the Quadri-Track ZCT system found 97.8% of the guilty cases as deceptive, 0% truthful and 2.2% inconclusive. Without the Inside Track's Fear/Hope of Error the Quadri-Track ZCT system would have found 87.7% of the guilty as deceptive, 0% truthful and 12.3% inconclusive. Therefore the Inside Track's Fear of Error and Hope of Error questions reduced the inconclusives from 12.3% to 2.2%. This comparison shows that the Inside Track is important in reducing the number of inconclusives when the Matte Quadri-Track Zone Comparison Technique is used.

The significance of this reduction in inconclusives from 12.3% to 2.2% for deceptive examinees by the Inside Track is important when

Table 3
Accuracy of polygraph outcome compared to ground truth

		Polygraph outcome			
		Truthful NDI	Deceptive DI	Inconclusive INC	Total decisions
Innocent NDI	Number	49	0	0	49
	Percentage	100%	0%	0%	100%
Ground truth					
Guilty DI	Number	0	89	2	91
	Percentage	0%	97.8%	2.2%	100%
Summary totals				Accuracy of decisions:	
				Total cases	140
				Number correct	138
				% correct	98.6
				Number of errors	0
				% of errors	0%
				Number of inconclusives	2
				% inconclusives	1.4%

Percent outcome for the polygraph decisions separately for innocent cases and guilty cases including inconclusives compared to known confirmed cases. The Matte Quadri-Track Zone Comparison Technique was used to reach the decisions.

Table 4
Accuracy of polygraph decisions compared to ground truth

		Polygraph outcome			
		Truthful NDI	Deceptive DI	Inconclusive INC	Total decisions
Innocent NDI	Number	49	0	0	49
	Percentage	100%	0%	0%	100%
Ground truth					
Guilty DI	Number	0	89	2	91
	Percentage	0%	100%	2.2%	100%
Summary totals				Accuracy of decisions:	
				Total cases	140
				Total decisions	138
				Number of correct decisions	138
				% of correct decisions	100%
				Number of errors	0
				% of errors	0%
				Number of inconclusives	2
				% of inconclusives	1.4%

Percent outcome for the polygraph decisions separately for innocent cases and guilty cases excluding inconclusives compared to known confirmed cases. The Matte Quadri-Track Zone Comparison Technique was used to reach the decisions.

Table 5
Summary table comparing accuracy of the Matte Quadri-Track Zone Comparison Technique's original/current scoring method for the value of the Inside Track's Fear/Hope of Error in arriving at decisions

Ground truth	Polygraph decisions %		
	Truthful	Deceptive	Inconclusives
1. Percent data including the inconclusives			
Comparing Matte Scoring Guide with (WI) the Inside Track and without (WO) the Inside Track (Questions #23 and #24).			
Innocent	100%	0%	0%
With Inside Track			
Guilty	0%	97.8%	2.2%
Innocent	0%	67.4%	32.6%
Without Inside Track			
Guilty	87.7%	0%	12.3%
2. Percent data excluding the inconclusives			
Comparing Matte Scoring Guide with (WI) the Inside Track and without (WO) the Inside Track (Questions #23 and #24).			
Innocent	100%	0%	0%
With Inside Track			
Guilty	0%	100%	2.2%
Innocent	100%	0%	32.6%
Without Inside Track			
Guilty	0%	100%	12.3%

we consider that guilty examinees who attempt to defeat the examination process usually employ countermeasures on the control questions that hopefully will equalize their expected response to the neighboring relevant questions thereby producing inconclusive results, thus avoiding a conclusion of deception. Clearly, the Inside Track prevents the successful use of countermeasures. In addition, the score increase of 37.1% by the inside track provides a higher accuracy rate and significantly lessens the potential for a false positive result.

The 32.6% reduction in inconclusives for the truthful examinees by using the Inside Track is testimony of the significant fear that innocent examinees may have regarding the accuracy of the test and the threatening aspects of the relevant questions compared to the structurally less intense (not as threatening) control questions. The Inside Track thus provides significant assistance in reaching the required numerical threshold for a decision of truthfulness.

The original scoring of the polygraph charts included in this study applied the "minus one" score when appropriate only to the pneumograph and cardiograph tracings, consistent with the previous research [17,18]. A score of zero was assigned to the electrodermal tracing when the relevant and control question pair both elicited equal, strong reactions. The rule of applying a zero score in the electrodermal tracing when the relevant and control question pair elicited equal, strong reactions is due to the tracing's volatility and sensitivity to extraneous stimuli.

In terms of reliability of chart interpretation, the two blind reviewers who applied numerical scoring to the Quadri-Track chart sets of 30 randomly selected confirmed cases came to the same decision as the original polygraphist in all but one case (false positive). Blind-review polygraph examiner A attained 96.6% accuracy; blind-review polygraph examiner B attained 100% accuracy. Their combined blind-score accuracy was 98.3%. It should be noted that the original examiner (Armitage) had 27 years of experience in the administration of the Quadri-Track Zone Comparison Technique. Both blind reviewers each had two and one half years experience as polygraphists.

When the Inside-Issue adjustment is added for the Quadri-Track ZCT, the Inconclusives are significantly reduced from 32.6% (n. 16) to 0% for the innocent cases, from 12.3% (n. 11) to 2.2% (n. 2) for the guilty cases, and from 19.5% to l.4% overall. This indicates that a major psychodynamic factor is the "Fear of Error/Hope of Error" factor as measured by the Inside Track. The Quadri-Track ZCT adjustment of scores significantly strengthens the decision-making process and reduces the inconclusive rate.

We noted no significant difference in the number of inconclusives between the confirmed (n. 2 of 140) and unconfirmed (n. 2 of 104) cases. Furthermore, the average score per chart for the unconfirmed truthful and deceptive cases were +6.2 and −8.2 respectively, versus the average score per chart for the confirmed truthful and deceptive cases which were +7.1 and −10.0 respectively. Interestingly, the average score per chart in the Matte-Reuss 1989b [18] field study for the confirmed truthful and deceptive cases were +6.0 and −9.1 respectively. The threshold or average minimum score per chart required to reach a conclusion of truthful is +3 and for deception is −5. We fail to see any significant difference in the examinees whose cases were unconfirmed and the confirmed cases appear to be a representative sample of the total cases.

A review of the scientific literature pertaining to psychophysiological veracity (PV) examinations revealed that there is a significantly greater potential for making errors against the innocent than against the guilty examinee [20,7,6,19]. Furthermore, the National Research Council of the National Academies' 2003 report articulated their belief that an innocent examinee's Fear of Error regarding the outcome of their PV examination could result in a false positive. In addition, the National Research Council of National Academies indicated PV examinations were vulnerable to countermeasures and false negative results. Both of these aforementioned issues deserve the utmost of consideration. It is our belief that the Matte Quadri-Track Zone Comparison Technique has clearly demonstrated — through its 1989a and 1989b field studies (Matte and Reuss), and this current field study — that it is able to overcome the troublesome Othello error, nullify the effect of countermeasures, and provide a very high degree of accuracy.

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