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A Field Study on the Validity of the Quadri-track Zone Comparison Technique

Background

This field study is the third published piece of field research on the validity of the Quadri-Track Zone Comparison Technique. 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 in psychophysiological

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veracity (PV) examinations using the polygraph. Its theory and methodology were published in the American Polygraph Association's journal *Polygraph* in December 1978 and in several textbooks (Matte 1980, 1996, 2000 and 2002). The first field validation study on the Quadri-Track Zone Comparison Technique was published in 1989 in *Polygraph* (Matte 1989a: 4-18) from a doctoral dissertation (Matte & Reuss 1989b: 01452-1502). The second field study on the Quadri-Track Zone Comparison Technique was published in *Physiology & Behavior*, the official peer-reviewed journal of the International Behavioral Neuroscience Society (Mangan et al. 2008: 95-1-2). The results of this field study apply only to the Quadri-Track Zone Comparison Technique when used in its pure form without justifiable 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 basic test structure and quantification system of the Backster Zone Comparison Technique (Backster 1963/1979) with some refinements and the addition of a third spot (inside track) consisting of a control/relevant question pair to deal with an innocent examinee's *Fear of Error* and the guilty examinee's *Hope of Error* (See Table 1). Some of the differences between the two techniques include the application of Backster's "Either-Or" rule**, wherein the Quadri-Track ZCT restricts the comparison of each relevant question to the control*** question preceding it within the same track, hence non-selective, and the assignment of a *minus one* score rather than a zero (in the Pneumo and Cardio tracings only) when the relevant question elicits a significant reaction and its neighboring control question also elicits an equally significant reaction, inasmuch as Backster's "Either-Or" rule deems that control question to be defective. Furthermore, the increasing score threshold required for a decision of truth or deception does not diminish with the addition of charts collected and scored.

** Backster's "Either-Or" rule states that a significant reaction should be present in either the red zone (relevant question) or the green zone (control question) but not in both. If the red zone indicates a lack of reaction, it should be compared with the neighboring green zone 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 a serious question defect in the green zone question (Backster 1963/1979).

*** The term "comparison" question has replaced "control" question to comply with the general scientific literature. Nevertheless, this study continues to use the term "control" question to avoid confusion when the term is used in instances such as "comparison of the control and relevant test questions."

The *Fear of Error* by the innocent was recognized by the behavioral scientist Dr. Paul Ekman in his book "Telling Lies" (Ekman 1985). Ekman discusses the elements of "fear" in his book, which is devoted primarily to verbal and non-verbal behavior, which he relates to the polygraph test in his chapter entitled "Polygraph as lie catcher", in which he 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." Ekman states that the polygraph examination, similar to behavioral clues to deceit, is susceptible to what he terms the "*Othello Error*", because Othello failed to recognize that Desdemona's fear might not be a guilty adulterer's anguish about being caught but could be a faithful wife's fear of a husband who would not believe her. Both cause an autonomic nervous response. The *Fear of Error* phenomenon was recognized and cited by the National Research Council of the National Academies' 2003 Report on the Polygraph and Lie Detection as a factor that could appreciably reduce the accuracy of field polygraph tests, and it also cited the use of countermeasures as another factor that offered a serious threat to the accuracy of field polygraph tests.

In the first field validation study (Matte 1989a: 4-18) of the Quadri-Track Zone Comparison Technique involving two separate entities and 122 confirmed cases, the technique's "Inside Track" containing the Fear and Hope of Error questions prevented a 5% false positive error rate and a 2% false negative error, and also 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 must be recognized that the Quadri-Track Zone Comparison Technique'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 in accordance with Backster's Either-Or rule provides a minimum total score that exceeds the threshold or minimum score required to render a decision of truth or deception. This has the effect of nullifying physical and mental countermeasures normally applied to control questions which under the aforementioned circumstance are deemed defective while the neighboring relevant question is considered ideally formulated, hence deserving at the very least a lean towards deception which translates into a minus one score.

It should be noted that when Matte, a Backster graduate, developed the Quadri-Track ZCT in 1977, the Backster Zone Comparison Technique's "You-Phase" single-issue test format employed two relevant questions for

comparison with neighboring control questions, which formed the basis of the Quadri-Track ZCT. At that time, the Backster Zone Comparison Technique's scoring system eliminated one of the three scores from each of the two spots (tracks), that did not follow the general trend or the weakest score, thus retaining only two scores from each of the two spots (tracks) for a total of 4 scores per chart. In addition, the Backster scoring system's conclusion table required a minimum score of minus or plus 5 for the first chart, minus or plus 9 for two charts, or minus or plus 13 for three charts (Backster 1969). The reduction of the threshold scores with the collection of each chart was to compensate for the examinee's habituation to the testing process. However, Matte observed that the deceptive examinee may habituate to the control questions but his anxiety level would remain constant throughout the collection of each succeeding chart on the relevant questions. Conversely, the truthful examinee may habituate to the relevant questions but his anxiety level would remain constant throughout the collection of each succeeding chart on the control questions. Hence, Matte saw no need to reduce the score threshold with each succeeding chart for the truthful or deceptive examinee. Therefore he adopted an increasing but non-diminishing score threshold of -5 for 1 chart, -10 for 2 charts, -15 for 3 charts, -20 for 4 charts for deception; +4 for 1 chart, +8 for 2 charts, +12 for 3 charts and +16 for 4 charts for the truthful.

Matte reduced the threshold score for the truthful by one point with the explanation that control questions are structurally less intense than the relevant questions, and should therefore require a slightly lower score to reach a decision of truthfulness. At least two charts had to be collected to make a decision of truth or deception, but if the scores were marginal, then more charts had to be collected.

Matte (1978: 7-4) explains that "the four highest scores left for evaluation and tally after elimination of the two weakest scores in each chart must contain at least one -2 (D) score reflecting a strong response. I don't believe that a finding of deception should be based on charts that produce only four -1 (d) scores which I classify as minimum deception scores and which Backster initially labeled as "lean toward deception", placing it in the indefinite category. Therefore, each chart used for evaluation should contain a minimum of one -2 (D) score plus a minimum total score of -3 from the other tracings in the same chart to reach a definite conclusion of "deception". The requirement for only one -2 (D) score on each chart is based upon the principle that the subject's psychological set may be focused upon only one of the relevant

questions, that which was the greatest threat to his well-being. That question may produce a -2 or even a -3 score; however, the other relevant questions may produce only minimal response as a result of the examinee's strong focus on the question which he feels most threatening." Matte further states that "The aforementioned required consistency and uniformity in the analysis and scoring of each chart is also applied in the truthful tally at the conclusion table. The lower score is justified on the basis that weaker responses are expected from control questions, and if each of the four remaining highest scores on average a +1 (t), each reflecting a mild response to those control questions as opposed to no response to the neighboring relevant question, it can be safely assumed that the results reflect truthfulness regarding the issue for which the examinee was tested. The +8 minimum score for two charts for a truthful conclusion is within the limits set forth in the Utah Study. The required minimum scores depicted in the aforementioned conclusion table are unaffected by the insertion or omission of control/relevant questions set N. 23/24 into the control-question technique because its primary role is to recoup response energy otherwise lost by the other preceding relevant/control question sets." (Matte 1978: 7-4. Utah Study, Raskin et al. 1977: 6-1)

In 1980, Matte and Backster discontinued the elimination of the lowest score or the score that does not follow the general trend, which did not affect the decision threshold of the Backster ZCT or the Matte Quadri-Track ZCT. At that time the Federal Polygraph School used a fixed score threshold of plus or minus 6 regardless of the number of charts collected (Matte 1980).

The results of the first field validation study on the Quadri-Track Zone Comparison Technique (Matte, Reuss 1989b: 01452-1502), produced statistical predictive tables for estimating error rates, which revealed that the potential error rate of 0.0 would be attained when the average minimum score per chart reached minus 5 for Deception and plus 3 for truthfulness. The Matte-Reuss study confirmed the existing threshold for deception and caused an immediate change in lowering the threshold for the truthful from plus 4 per chart to plus 3, without increasing the inconclusive or error rate, hence the lower score threshold for the truthful was adopted and factored into the Quadri-Track Zone Comparison Technique's quantification system.

The second field study (Mangan et al. 2008: 06.004), involved 140 confirmed cases. Its 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%. The Quadri-Track ZCT 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. Inconclusive rates excluded, the Quadri-Track ZCT 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%.

The Quadri-Track Zone Comparison Technique utilizes exclusive control questions that separate the period of time covered by the control questions from the period of time covered by the relevant questions to enable the Either-Or rule and facilitate the direction of the examinee's psychological set towards the type of questions (control or relevant) that offer the examinee the greatest threat to his/her well-being. The Fear of Error (control) question is presented to the examinee in a way that restrains an affirmative answer and produces a negative answer. Conversely, all examinees answer the Hope of Error (relevant) question in the negative and these two questions are compared and scored in the same manner as the other two control/relevant question pairs. The diagram of the Quadri-Track ZCT Test Structure in Table 1 shows the scores from all three tracks each containing a pair of control vs. relevant questions, which are added together for a total score, which is then associated to a conclusion table containing a score threshold (Table 2) that must be met or exceeded before a distinct conclusion of truth or deception can be rendered.

The "Fear/Hope of Error" question pair comprises the third track, also known as the inside track, which is located after the two traditional controls 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 for which he is being tested, 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 which only a guilty examinee should experience.

Both the Fear of Error control question and the Hope of Error relevant question contain the suffix "regarding the target issue" which is thoroughly explained to the examinee during the pre-test interview and during the review of the test questions prior to the collection of the physiological data. Both questions contain the exact wording or meaning in cases of foreign translation or comprehension, except for the words "afraid" and "hoping." An example is as follows:

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

The above suffix removes the stigma of using an emotion-laden term associated with a sensitive crime or matter.

The "Fear of Error" question is designed to compensate for the ineffectiveness of the control questions in competing with threatening relevant questions which were caused by the "Fear of Error." Additionally, the inside track containing the Fear and Hope of Error questions provides the polygraphist with the means of determining whether a control question should be strengthened or weakened when there is an equal response to both control and neighboring relevant question or no response to either zone. This choice is not available to other zone comparison tests. It should be noted that both the Backster ZCT and the Quadri-Track ZCT mandate that once the test questions have been reviewed with the examinee, the collection of the data must not be interrupted with any language that would influence the examinee's psychological set towards the control or relevant questions (Matte 2007a: 36-2). The sole exception is when there is no response to either the relevant or the control questions. Then the control questions only are reviewed with the examinee, in accordance with Backster's Eight-Reaction Combination Guide (Backster 1963, 1979, 1983) or Matte's 23-Reaction-Combination Guide (Matte, 1981, 1996).[****]

The developer (Matte) of the Quadri-Track ZCT theorized that an innocent examinee's fear that an error be made on his PV examination will make the relevant questions exceedingly threatening, causing a physiological response that will compete with the control questions and bring about false positive or inconclusive results. This theory was subsequently advanced by the 2003 report of the National Research Council (NRC) of the National Academies, 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

[****] Execution of the Backster or Matte Reaction Combination Guides, after starting the collection of the physiological data, which may influence or redirect the examinee's psychological set, requires the collection of at least two additional charts scored separately to remedy previous chart defects. The necessity to actually execute any of the remedies in the aforementioned guides has been found to be rare.

and repeatable physiological responses to relevant questions in nondeceptive examinees that mimic the responses of deceptive ones." (NRC, page 74).

This report further expressed grave concern regarding the use of countermeasures that could 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 which 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) The NRC further stated that "Perhaps the most serious potential problem with the practical use of the polygraph is the possibility that examinees – particularly deceptive ones – might be able to decrease the test's accuracy by engaging in certain behavior, countermeasures, designed to produce nondeceptive test results." (NRC, page 139)

Unlike some other polygraph techniques that use a selective approach in the comparison of the relevant question to either the control question that elicited a large response or the least response, the Quadri-Track ZCT uses a non-selective approach, in that it confines 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. Inasmuch as 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. However, 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 which would result in zero scores throughout each relevant/control comparison for a final inconclusive decision.

The successful use of countermeasures requires the recognition of all control questions, which is easily obtained through readily available literature on polygraph tests. Therefore, the deceptive examinee will apply his physical or mental countermeasure to all control questions, which, if successful, will create a significant response to each control question. However, the deceptive examinee will not be able to suppress a significant response to the relevant questions

to which he is being deceptive and, 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 minimum scores which would tally at least a minus 6 score 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 employed, whether mental or physical, it will not effectively hamper the decision-making process and a valid and reliable result.

A Field Study of Three Methods of Comparison When the Relevant Question Elicits a Strong Response, (Matte, 2007b) which was presented at the Backster School of Lie Detection, tested Backster's "Either-Or" Rule and Anti-Climax Dampening Concept. The 123 confirmed guilty cases used in that study revealed that the use 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.

Table 1. Matte Quadri-Track ZCT Test Structure

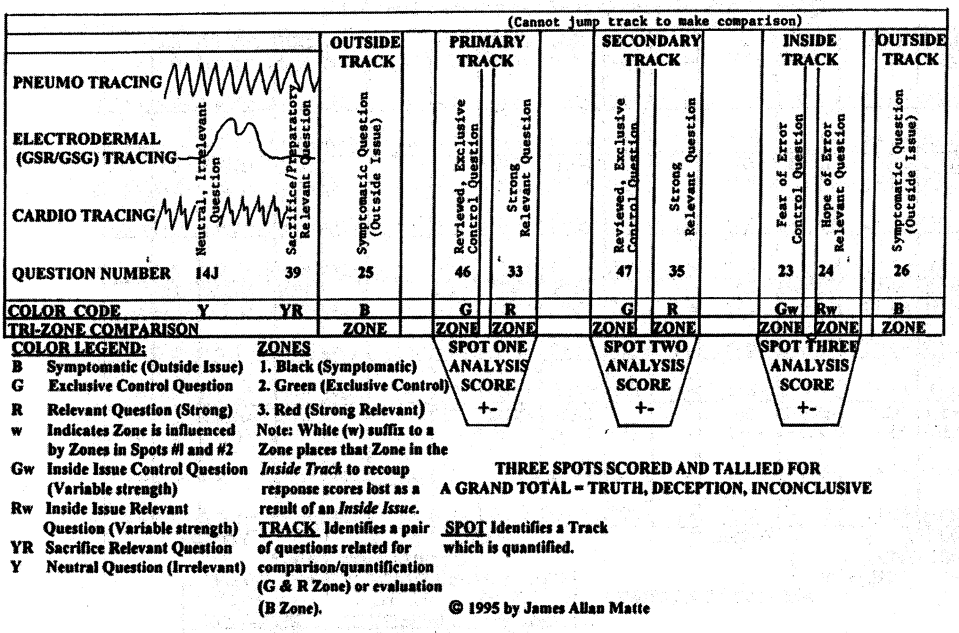


Figure V-3. Matte Quadri-Track Zone Comparison Test Structure.

Format of Quadri-Track Zone Comparison Technique

14 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 Exclusive Control Question.
33 Short and Direct Relevant Question.
47 Reviewed 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.

Table 2

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

	NDI	INDEF	DI			NDI	INDEF	DI			NDI	INDEF	DI	
CHART 1 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 PNE (33)	NDI +3 +2	INDEF +1 0 -1	DI -2 -3	=( )	(35)	NDI +3 +2	INDEF +1 0 -1	DI -2 -3	=( )	(24)	NDI +3 +2	INDEF +1 0 -1	DI -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 PNE (33)	NDI +3 +2	INDEF +1 0 -1	DI -2 -3	=( )	(35)	NDI +3 +2	INDEF +1 0 -1	DI -2 -3	=( )	(24)	NDI +3 +2	INDEF +1 0 -1	DI -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 PNE (33)	NDI +3 +2	INDEF +1 0 -1	DI -2 -3	=( )	(35)	NDI +3 +2	INDEF +1 0 -1	DI -2 -3	=( )	(24)	NDI +3 +2	INDEF +1 0 -1	DI -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.:_____

RESULTS FOR 1 CHART

RESULTS FOR 2 CHARTS

RESULTS FOR 3 CHARTS

RESULTS FOR 4 CHARTS

CONCLUSION TABLE

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

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 trained in the aforesaid technique who are employed by the Liecatcher Polygraph Services and Polygraph Center, Thailand).

A review of the existing literature (Ansley 1983, Matte 1996, 2000) on the validity of psychophysiological veracity PV examinations using the polygraph revealed that twice as many studies were conducted on the validity and reliability of PV examinations in a laboratory setting than those using real-life cases. Research conducted in a laboratory setting using mock paradigms lacks 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. Because the Quadri-Track Zone Comparison Technique particularly addresses the innocent examinee's "Fear of Error" and the guilty examinee's "Hope of Error" it was vital that this study use data acquired from real-life cases.
Thus, in this study we explore the validity of the Quadri-Track ZCT among field cases by comparing the decisions reached by the polygraphists using this technique with the results of confessions which solved these cases to determine the number of false positives, false negatives, and inconclusives, the latter as a measure of utility, not accuracy. We also compare the accuracy of the Quadri-Track ZCT with vs. without the use of the inside track's Fear/ Hope of Error questions.

Procedure

All specific-issue PV examinations conducted with the Quadri-Track ZCT by the Liecatcher Polygraph Services and Polygraph Center at Thailand from 1 January 2007 through 30 April 2008 were reviewed. There were 165 cases, of which 57 were later solved by confessions. Thus, 57 of the total of 165 available cases (34.5%) were subsequently solved, providing a base of confirmed cases for study. Of these 57 confirmed cases, 28 were confirmed as deceptive (49.1%) and 29 were confirmed as nondeceptive examinees (50.9%). The subject population of the 57 cases included 26 men and 31 women. There were 42 Thais, 4 Israelis, 4 Chinese, 2 Columbians, 1 American, 1 Vietnamese, 1 Burmese, 1 from the United Kingdom and 1 Australian. The age range was 19 to 61 and averaged 29.9. There were 5 crimes against property and 52 against people.

The polygraph instruments used in this study were Lafayette LX 4000 computerized polygraphs, which recorded thoracic and abdominal breathing patterns, electrodermal and cardiovascular activity, and covert movement.

Four polygraphists participated in this field research. All of them were formally trained in the use of the Quadri-Track ZCT. The 7-position scale scoring system was used in the analysis of the physiological data collected in each PV examination, by both the original polygraphists and quality control reviewers. The final decision as to truth or deception was made after a quality control review by another polygraphist not involved in the polygraph examination.

In this field research, we compared the final decisions reached by the polygraphists and quality control reviewers with the results of the field cases that were solved by confessions, to determine the number of false positives, false negatives, and the inconclusives 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.

Academic arguments against the use of confessions as a criterion for ground truth in field examinations have been published (Iacono 2008: 06.001, Verschuere et al. 2008: 06-002) as objections to field studies that used confessions as ground truth (Mangan et al. 2008a: 03.001). Their objections were primarily based on the assumption that the confessions were coerced from the examinees confronted with the test results, which were allegedly not acquired independently of the confessions. It was also argued that the errors would most likely be found in the unconfirmed cases of examinees whose responsiveness was somehow different from examinees in the confirmed cases. Furthermore, guilty examinees whose test results showed no deception would not be subjected to an interrogation and subsequent confession, and thus would fall into the category of unconfirmed cases. These concerns by Iacono and Verschuere et al. would have some merit under past testing conditions, which they erroneously assumed still exist in all current polygraph techniques. Advances in instrumental technology, which includes motion sensors and the evolutionary progress in the psychological structure of test formats and protocol, have significantly improved the objectivity, accuracy and standardization of psychophysiological veracity examinations using the polygraph. The rebuttal (Mangan et al. 2008b: 06.004) to Iacono and Verschuere et al.'s objections to their use of confessions offers

compelling arguments including research studies (Light & Schwartz 1999: 28.3. Mason, 1991) that support the use of confessions as a criterion for ground truth. Mangan et al. point out that Iacono and Verschuere et al.'s objections presume that polygraph examinations conducted in their field study were conducted in a vacuum. "Unlike laboratory studies where there is no post-test connection, field studies of real-life cases are connected to post-test investigations and adjudications that can reveal errors or corroborate test results, which is another form of validity confirmation." Mangan et al. also pointed out in their rebuttal that they "calculated the average score for the unconfirmed and confirmed cases which revealed no significant difference in the reactivity of the subjects between the confirmed and unconfirmed cases, and there was no significant difference in the inconclusive rate, all of which indicates no significant difference in the examinees whose cases were unconfirmed, and the confirmed cases appear to be a representative sample of the total cases." They further pointed out that the results of all polygraph examinations conducted in their field study were entirely based on the analysis and numerical scores of the physiological data collected from each examinee in strict accordance with the technique's protocol, thus totally independent of any ensuing confessions. Furthermore, all polygraph examinations were audio-video recorded as required by the American Society for Testing and Material (ASTM) and American Polygraph Association (APA) standards of practice, which provided a quality control review that would expose any procedural violations that would invalidate the polygraph examination or the ensuing confession.

Further published research and arguments in support of confessions used as a criterion for ground truth in field research studies of PV examinations can also be found in Krapohl et al. 2003: 32-4, Hontz 1996: 123-4, Raskin et al. 1988: 85-IJ-CX-0040, Horvath 1977, 62-2). These studies refute Iacono's unsubstantiated claims of sampling bias in the use of confessions as a criterion for ground truth.

Results

The accuracy of the Quadri-Track ZCT with vs. without the use of the inside track's questions was compared among confirmed innocent and confirmed guilty cases. As can be seen in table 3, with the inside track's Fear/Hope of Error the QTZCT scoring system found 100% of the confirmed Innocent cases as truthful, with no errors and no inconclusives. Without the inside track's Fear/Hope of Error, the Quadri-Track ZCT scoring system would have found

69% of the innocent cases as truthful, with 31% inconclusives. Therefore the inside track's Fear/Hope of Error reduced the inconclusives from 31% to 0%, and increased in 31% the rate of accurate truthful decisions. Among the confirmed guilty cases, the Quadri-Track ZCT system with the inside track's Fear/Hope of Error found 92.9% as deceptive, 7.1% as truthful (i.e. false negative) and no inconclusives. Without the inside track's Fear/Hope of Error, the Quadri-Track ZCT system would have found 21.4% of the guilty as deceptive, 7.1% as truthful and 71.5% inconclusives. Therefore the inside track's Fear/Hope of Error questions reduced the inconclusives from 71.5% to 0% and increased in 71.5% the rate of accurate deceptive decisions. Overall, compared to ground truth, polygraph decisions using the Quadri-Track ZCT without the inside track's Fear/Hope of Error were accurate in 45.61% (26/57) of the confirmed cases, wrong in 3.5% (2 cases), and with inconclusive results in 50.89% of the cases. With the inside track's Fear/Hope of Error, polygraph decisions were accurate in 96.5% (55/57) of the confirmed cases, wrong in 3.5% (2 cases), and with inconclusive results in none of the cases.

Table 3. Accuracy of polygraph outcome compared to ground truth, using Matte Quadri-Track ZCT with vs. Without inside track's fear/hope of error

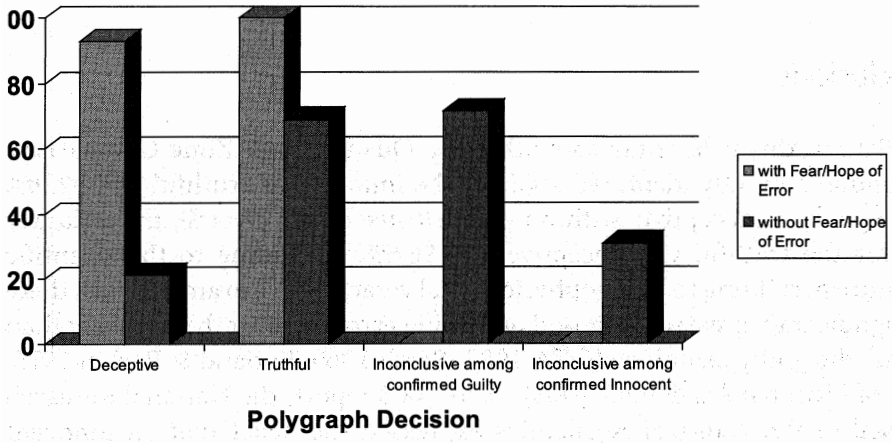
Outcome for the Polygraph Decisions separately for "innocent" and "guilty" cases compared to known confirmed cases. The Matte Quadri-Track ZCT was used to reach the decisions using original/current scoring method for the value of the inside track's Fear/Hope of Error in arriving at decisions.

GROUND TRUTH		POLYGRAPH DECISION				
		Truthful	Deceptive	Inconclusive	c^2	Eta^2
		With *Inside Track*				
Innocent	Number	29	0	0		
	Percentage	100	0	0		
Guilty	Number	2	26	0		
	Percentage	7.1	92.9	0	$c^2_{(1)}=49.28^{***}$	0.87
		Without *Inside Track*				
Innocent	Number	20	0	9		
	Percentage	69.0	0	31.0		
Guilty	Number	2	6	20		
	Percentage	7.1	21.4	71.5	$c^2_{(2)}=24.89^{***}$	0.44

*** P<.001

These comparisons show that the inside track is important in significantly reducing the number of inconclusives and increasing the number of accurate decisions when the Matte Quadri-Track ZCT is used. Moreover, the values of the ETAs presented in table 3 revealed a doubled effect size when the inside track is added for the Quadri-Track ZCT (eta^2=0.87) as compared to the effect size without it (eta^2=0.44). In other words, adding the Inside-Issue adjustment for the Quadri-Track ZCT has significantly increased its accuracy and doubled its utility rate. Figure 1 illustrates the additions in accuracy and utility as a result of adding the inside truck.

Figure 1. Percentage of accurate decisions and inconclusives with vs. Without inside track's fear/hope of error



Analysis shows that the inside track's Fear of Error control question generated an adjustment to the confirmed innocent scores by increasing their scores an average of +2 (59%) per case. The average total score per innocent case (i.e. the mean chart score) without the Fear of Error question adjustment was 3.39 and with this question 5.39. Among the confirmed guilty cases, the inside track's Hope of Error relevant question generated an adjustment to the scores by decreasing them (increasing its value) an average of –2.54 (71.75%) per case. The 2 false negative cases had no score adjustment due to the production of zero scores by the inside track. The average total score per guilty case without the Hope of Error question adjustment was -3.54, and with it was -6.08. These adjustments result in the significant reduction of inconclusives accompanied by increasing decision accuracy rate. This indicates that the "Fear/Hope of Error" factor as measured by the inside track significantly fortifies the decision-making process, and cannot be ignored.

Finally, we compared the results of the Matte Quadri-Track ZCT with the inside track, among the confirmed (n=57) vs. the unconfirmed (n=108) cases. The results show no significant difference between confirmed and unconfirmed cases, in the frequency of the three decisions (inconclusives: 0%, 0.9% respectively; "truthful": 54.4%, 52.8% respectively and "deceptive" 45.6%, 46.3% respectively; $c^2_{(2)}$ =0.55, p>.5). The results also show no significant difference in the average score per chart for the confirmed vs. not confirmed cases, both with and without adding the inside track ($t_{(163)}$ = .14, p>.5; $t_{(163)}$ = = .20, p>.5 respectively). These data show that there is no significant difference in the reactivity or responsiveness of the examinees in the confirmed versus the unconfirmed cases. We therefore fail to see any difference in the examinees whose cases were unconfirmed, and the confirmed cases appear to be a representative sample of the total cases.

Conclusions

The data in this field study show that the Quadri-Track Zone Comparison Technique correctly identified 100% of the innocent as truthful and 92.9f% of the guilty as deceptive, with no inconclusive cases. Overall, the accuracy rate for the truthful and deceptive was 96.5%. According to the scientific literature pertaining to psychophysiological veracity (PV) examinations, there is a significantly greater likelihood of making errors against the innocent than against the guilty examinee (OTA 1983, Bersh 1969, Barland & Raskin 1975, NRC of National Academies 2003). In its 2003 report, the National Research Council of the National Academies expressed the belief that an innocent examinee's fear of error regarding the outcome of their PV examination could result in a false positive. Additionally, the NRC of National Academies indicated that PV examinations were susceptible to countermeasures and false negative results. There is no question that these issues merit serious consideration, and we believe that the Matte Quadri-Track Zone Comparison Technique has demonstrated through the Matte & Reuss 1989 field study, that of Mangan et al. (2008), and this current study that it is able to cope with and overcome the Othello error and countermeasures with a very high degree of accuracy.

References

Ansley, Norman (1983). A compendium on polygraph validity. *Polygraph*, 12/2: 53-62.

Backster, C. (1963/1979). Standardized Polygraph Notepack and Technique Guide: Backster Zone Comparison Technique. *Backster School of Lie Detection*, New York, N.Y.

Backster, C. (1969) Standardized Polygraph Notepack and Technique Guide, Backster Zone Comparison Technique.

Backster, C. (1969). Technique fundamentals of the Tri-Zone Polygraph Test. New York: *Backster Research Foundation.*

Backster, C. (1974). Anticlimax Dampening Concept. *Polygraph*, 3/1: 48-50.

Backster, C. (2003, December 15-19). 46th Annual Polygraph Examiner Work Conference. *The Backster School of Lie Detection*, San Diego, CA.

Barland, G. H., Raskin, D. C. (1975). An evaluation of field techniques in the detection of deception. *Psychophysiology*, 12: 321-230.

Bersh, P. J. (1969). A validation of polygraph examiner judgments. *Journal of Applied Psychology*, 53/5: 399-403.

Ekman, P. (1985). Telling *Lies – a How-To-Guide for all those who want to detect lies.* Berkley Books, New York: NY

Honts, C. R. (1996). Criterion development and validity of the CQT in field application. *Journal of General Psychology*, 123/4: 399-324.

Horvath, F. (1977). The effect of selected variables on interpretation of polygraph records. *Journal of Applied Psychology*, 62/2: 127-136.

Iacono, W. C. (1991). Can we determine the accuracy of polygraph tests? *Psychophysiology*, 4/20: 207.

Iacono, W. C. (2008). The accuracy of polygraph techniques: Problems using confessions to determine ground truth. *Physiology & Behavior*, 95/1-2: 24-26.

Krapohl, D. J., Shull, K. W., Ryan, A. H. (2003). Does the confession criterion in case selection inflate polygraph accuracy estimates? *Polygraph*, 32/4: 234-244.

Light, C. C., Schwartz, J. R. (1999). The relative utility of the forensic disciplines. *Polygraph*, 28/3: 240-258.

Mason, P. (undated). Association between positive urinalysis drug tests and exculpatory examinations. Unpublished doctoral dissertation. United States Army Criminal Investigation Command. Baltimore: MD.

Mangan, D. J., Armitage, T. E., Adams, G. C. (2008a). A field study on the validity of the Quadri-Track Zone Comparison Technique. *Physiology & Behavior*, 95/1-2: 17-23.

Mangan, D. J. Armitage, T. E., Adams, G. C. (2008b). Rebuttal to objections by Iacono and Verschuere, et al. *Physiology & Behavior*, 95/1-2: 29-31.

Matte, J. A. (1976). A polygraph control question validation procedure. *Polygraph*, 5/2: 170-177.

Matte, J. A. (1978). Quadri-Zone Comparison Technique. *Polygraph*, 7/4: 266-280.

Matte, J. A. (1980). *The Art and Science of the Polygraph Technique*. Springfield, Illinois: Charles C. Thomas.

Matte, J. A. (1980). Polygraph Quadri-Zone reaction combination guide. *Polygraph*, 10/3: 186-193.

Matte, J. A. (1996). *Forensic Psychophysiology Using The Polygraph: Scientific Truth Verification – Lie Detection*. Williamsville, New York: J.A.M. Publications.

Matte, J. A. (2002). *2002 Supplement to Forensic Psychophysiology Using The Polygraph*. Williamsville, New York: J.A.M. Publications.

Matte, J. A. (2007a). Psychological structure and theoretical concept of the Backster Zone Comparison Technique and the Quadri-Track Zone Comparison Technique. *Polygraph*, 36/2: 84-90.

Matte, J. A. (2007b). A field study of three methods of comparison when the relevant question elicits a strong response. Data presented at the Backster School of Lie Detection. San Diego: CA.

Matte, J. A., Reuss, R. M. (1989b). Validation study on the polygraph Quadri-Zone Comparison Technique. *Research Dissertation Abstract,* LD 01452, Vol. 1502, 1989 Proquest Information and Learning (Formerly known as University Microfilm International).

Matte, J. A., Reuss, R. M. (1989a). A field validation study of the Quadri-Zone Comparison Technique. *Polygraph,* 18/4: 187-203.

Patrick, C. J., Iacono, W. G. (1991). Validity of the control question polygraph test: The problem of sampling bias. *Journal of Applied Psychology,* 76/2: 229-238.

National Research Council of the National Academies. (2003). *The Polygraph and Lie Detection.* Washington, D. C.: The National Academies Press.

Raskin, D. C., Barland, G. H., Podlesny, J. A. (1977). Validity and reliability of detection of deception. *Polygraph,* 6/1: 1-39.

Office of Technology Assessment. (1983, November). *Scientific Validity of Polygraph Testing – A Research Review and Evaluation.* Washington, D.C.

Verschuere, B., Meijer, E. Merckelbach, H. (2008). The Quadri-Track Zone Comparison Technique: It's just not science. A critique to Mangan, Armitage, and Abrams. *Physiology & Behavior,* 95/1-2: 27-28.