

Applications

- Orienting (Bauer, 1984; Tranel and Damasio, 1985)
- Fear conditioning (Öhman)
- Individual Differences
- Deficient anticipatory anxiety (Hare)
- Deception Detection

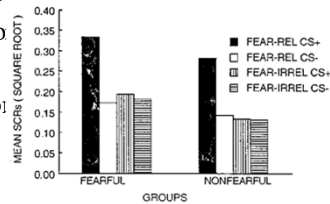


Figure 1. Mean skin conductance responses (SCRs) (square-root transformed) to fear-relevant (snakes, spiders, and rats) or fear-irrelevant (flowers and mushrooms) stimuli previously followed (CS+) or not followed (CS-) by an electric shock unconditioned stimulus among the fearful and nonfearful groups of subjects during extinction.

Neuroticism

- A trait-like tendency to experience negative affect and for increased reactivity to stress and aversive stimuli
- Would skin conductance reflect greater physiological reactivity to negative stimuli, and poorer physiological recovery?



Norris, Larsen, & Cacioppo (2007), *Psychophysiology*

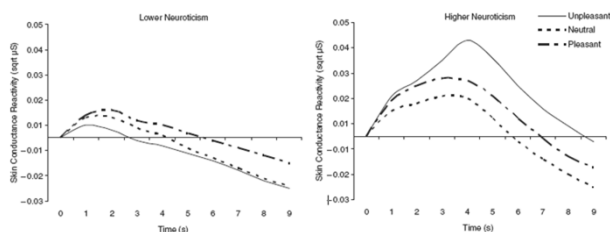


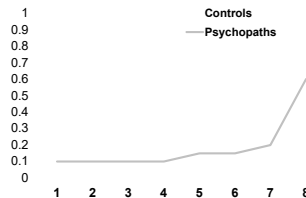
Figure 1. Skin conductance reactivity as a function of picture valence, time, and neuroticism. Pictures were presented from 1–6 s. Estimated means for participants lower (1 SD below the mean) and higher (1 SD above the mean) in neuroticism are plotted separately.

Applications

- Orienting (Bauer, 1984; Tranel and Damasio, 1985)
- Fear conditioning (Öhman)
- Individual Differences in Neuroticism
- Deficient anticipatory anxiety in psychopathy (Hare)
- Deception Detection (Myriad authors)

Anticipatory Arousal in Psychopathy

- Hare Countdown Task (1965)
- #'s appear from 1..8
- At "8" punishment is given (shock):



Fearless Dominance (dual-process model of Psychopathy)

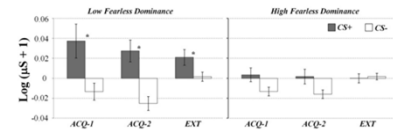


Figure 1. Mean skin conductance change (log (μS + 1)) for high and low fearless dominance groups when viewing CS+ and CS- during acquisition (ACQ-1 and ACQ-2) and extinction (EXT) phases of the fear conditioning procedure.

López, R., Poy, R., Patrick, C.J., & Moltó, J. (2013) *Psychophysiology*

“Lie” Detection: The Problematic Polygraph Test and Some Alternatives

“I don't know anything about lie detectors other than they scare the hell out of people.”

-- Richard Nixon
“I’m not a crook”



People Sometimes Lie An Armchair Taxonomy Of Lies



- Little Harmless Lies
 - The Social Graces
- All Other Lies
 - Accusations
 - about parental habits
 - about fidelity
 - about abuse: physical, sexual
 - Denials
 - about parental habits
 - about fidelity
 - about abuse
 - Inaccuracies
 - income
 - assets
 - about income
 - about assets

The Difficulty in Detecting Lying

Observer Group
Secret Service
Federal Polygraphers
Robbery Investigators
Judges
Psychiatrists
Special Interest
College Students

Accuracy

*chance = 50%

from Eckman & O'Sullivan, 1991

The Polygraph and the American Psyche

Lady 1: [My coworker]'s husband is being sent to polygraph school in Atlanta for three weeks so he can give the polygraph test.
Lady 2: Cool! That's like the test that can read your mind, right?

Conversation overheard in W. Lafayette, Indiana, December, 1990

What we, the American people, are witnessing is the beginning of the end of mankind's search for an honest witness. For the first time in the history of civilization, mankind has the opportunity to prove beyond a reasonable doubt the veracity of his testimony through a generally accepted and scientific (sic) valid examination of his own psyche. God gave us the polygraph.

Michael B. Lynch, in *Polygraph*, The Journal of the American Polygraph Association, 1975

Media Portrayals:

- ❑ [Political Ad](#)
- ❑ [Entertainment](#)
- ❑ [More Entertainment](#)



• Polygraph invented in 1915 by Harvard-trained Ph.D., LL.B. William Moulton Marston

• Claimed it could detect lies by measuring blood pressure

• Not his main claim to fame



Roadmap

- Abbreviated History and Overview of the Conventional Polygraph
- Limitations to Conventional Polygraphy
 - The Polygraph Test is especially likely to falsely incriminate the innocent
 - Why polygraphers over-estimate the accuracy of the test
 - No credible scientific exists to support using the Polygraph Test
- Overview of alternatives: Assessing recognition

The Polygraph Test

Fundamental assumption:

Physiological responding differs when one is truthful versus being deceptive

Note: Detects physiological responses, but not lying per se

Uses (and abuses) of Polygraph Tests

➤ Specific Incident Investigations

- Criminal Investigations: Defendants, Complainants, Witnesses
- Insurance Claims Investigations
- Investigating Prison Inmates Accused of Violating Rules
- Substantiation of Claims Made in Civil Suits
- Accusations of parental wrongdoing
- Paternity Suits (historically)

➤ Screening Situations

- Pre-employment Screening
- Screening of Current Employees
- Child Custody Cases
- Convicted Sex Offenders

Uses (and abuses) of Polygraph Tests

➤ Employee Polygraph Protection Act (EPPA; 1988)

- Prohibits Screening Tests for employment in private sector
- Allows tests for those reasonably suspected of involvement in a workplace incident
- “Friendly” Tests to the currently employed and to criminal defendants still permitted
- Federal, State, and Local Government Employers, Federal Contractors, and Police can still use for screening!

➤ And yet...

- *National Defense Authorization Act* of 2000 requires scientists at nuclear weapons laboratories to submit to polygraph tests to maintain their security clearance
- “Maintenance polygraphs”

Instrumentation and Measures

- Polygraph examinations involve multi-channel recorders in a flightcase.
- Typically recorded:
 - Respiration
 - Cardiovascular activity (BP, HR)
 - Skin resistance
- These measures:
 - provide an indication of changes in autonomic activity
 - do *not* index the "lie response"

Conventional Polygraphs

Each instrument comes with a one year warranty on all parts and labor. With each three- or five-pin measuring pen you will receive the following standard accessories: two pressure-arm assemblies, cable electrode set, simulated Kevlar, arm cuff, pump bulb assembly, pens and bottles for each recording medium, one extra set of Kevlar, pen pen, full 100, 10, and 10, one set of clear paper and an instruction manual. Other optional accessories include auto-power conversion, in-case calibration, various styles of event markers and formatted writing capabilities.

The Statement

Zero" case, the clear Ballpoint pen are enhanced by the black increase gain fluid. The case is high impact thermoplastic 1000 points to ensure durability. (Case weight: 2.5 lbs., or 2.5 lbs., with calibration. Dimensions: 17" x 21" x 4.5" x 17.5")



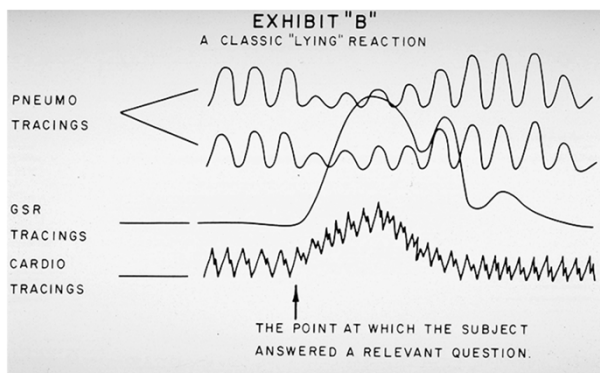
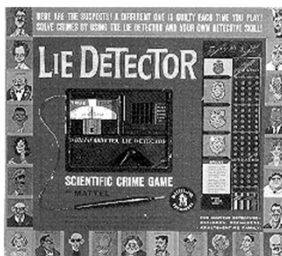
The Facilitator II

The IF chart drive allows five pins to be used simultaneously with greater pen swing. The practice of "pinpen swing" for remote pins on a three-pin polygraph is no longer necessary and charts are easier to read because of reduced tracing overlap. This feature gives of course for response accuracy. Every Facilitator II maintains all of the quality and consistency of our standard IF chart drive models. Available only in a Statement case, an alternate model is available.



The Courier II

Our second conventional case style offers a grid standard look and compact size. The case is designed with the carrying handle in mind. The lid is designed with plenty of storage space and includes a 10 case calibration. The case is made of exceptionally strong, high-grade aluminum that resists dents and is also dust and weather resistant. (Case weight: 2.5 lbs., or 2.5 lbs., with calibration. Dimensions: 17" x 17.5" x 4.5" x 17.5")



Office of Technology Assessment 1983 report:

"There is no known physiological response that is unique to deception."

Thus...

Anyone who claims to measure lying ...
... is lying!

Approaches to Detecting Deception

Emotion/Arousal	Memory/ Recognition	Other Cognitive Correlates
<ul style="list-style-type: none"> ➤ “The” Polygraph ➤ Facial Expression ➤ Voice Stress ➤ Facial Blood Flow ➤ Thermography ➤ Demeanor 	<ul style="list-style-type: none"> ➤ Guilty Knowledge Test <ul style="list-style-type: none"> ➤ Autonomic (SCR) ➤ Central (ERP, fMRI?) 	<ul style="list-style-type: none"> ➤ Response Conflict ➤ Attention and Memory Load ➤ Both ERP and fMRI ➤ Linguistic Analysis

Note that none detect lying *per se*

The Polygraph Examiner

- Requisite skills
 - Knowledge of test construction
 - Knowledge of the basic psychometric properties of tests: reliability and validity
 - Clinical interviewing skills
 - Knowledge of physiology of the autonomic nervous system
 - Knowledge of autonomic psychophysiological recording, scoring, and interpretation
 - Knowledge of the ethics of administering and reporting the results from psychological tests; limits of interpretation, limits of confidentiality
 - ???
- Training
 - Graduated from professional polygraph training school, which are administered and staffed primarily by professional polygraphers (31 schools accredited by the American Polygraph Association (APA) in the U.S. and Canada)
 - Curriculum spans a minimum 320 hours

What is the Polygraph Test?



Control Question Test (CQT; John Reid, 1947) (for Specific Incidents Investigations)

- Approximately 10 questions
- Relevant Questions
 - address the subject matter under investigation
- Control Questions
 - questions developed by the examiner after a pretest interview with the subject
 - address generally questionable behavior
- At least 3 separate *charts* (i.e. 3 separate presentations of the set of questions) are administered
- The pretest interview stresses 2 ways to fail test, and that test is infallible

ZCT MQTZCT
CIT7 IZCT DLST
AFMGQT

CQT “Theory” (Raskin, 1982)

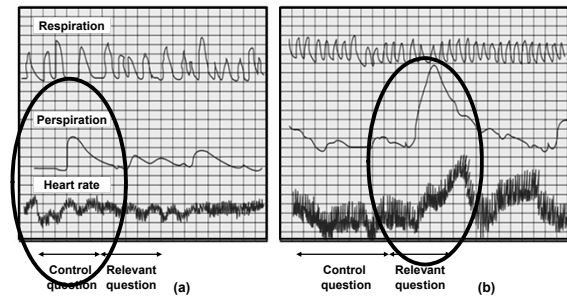
- Innocent subjects should react with stronger emotion to the *Control* questions since their content are of greater direct concern
- Guilty subjects should respond with stronger emotion to the *Relevant* questions
- Comparing the magnitude of the responses (usually skin-resistance) to the control and relevant questions yield a verdict of Guilty, Innocent, or Indeterminate

“CONTROL” TEST QUESTIONS

- Did you touch Susie between her legs?
- Have you found teen girls attractive? **Relevant**
- Have you been naked in sight of Susie? **“Control”**
- Have you lied to try to stay out of trouble?
- Have you viewed pornography?
- Have you fantasized sexually about Susie?



Hypothetically...
Innocent Guilty



Typical Scoring -- Semiobjective Method

- Each relevant question paired with a "control" item adjacent in the sequence of questioning
 - A score of -1 to -3 is assigned if response to relevant item is (a little, somewhat, clearly) larger than response to control item
 - A score of +1 to +3 is assigned if response to relevant item is (a little, somewhat, clearly) smaller than response to control item
- Separate scores derived for each channel, and scores are summed over charts, channels, and question pairs
 - Total score < -6: DECEPTIVE
 - Total score > +6: TRUTHFUL
 - -5 < Total score < +5: INCONCLUSIVE

Typical Scoring (less than objective method)

- Polygrapher uses a global impressionistic decision-making strategy that incorporates:
 - Case facts
 - Examinee behaviors
 - Polygraph Chart data
 - Examiner's "professional" hunches and impressions

The Importance of Blind Scoring

- Expectancy Effects (the "60 Minutes study")
 - Three polygraph firms each examined four employees accused of theft of a camera (none actually stolen)
 - Without the knowledge of the employees, each polygrapher was told that a different employee was suspected by management
 - In each instance, the suspected employee was deemed guilty (probability by chance = 1.5%)

Validity and Ethical Concerns: Examine the Assumptions

- Assumptions that must be met in order for the CQT to produce valid results:
 - Examiner formulates relevant questions that guilty subjects will answer deceptively (*reasonable*)
 - Examiner constructs control questions that subjects will answer untruthfully or with some doubt as to their veracity (*plausible, but difficult*)
 - An innocent person will be more disturbed by the control questions than by the relevant questions (*implausible*)
 - A guilty person must be more disturbed more by the relevant questions (*reasonable*)

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The CQT Box Score

	% Correctly Classified	
	Guilty	Innocent
Professional Polygrapher's Research		
Horvath & Reid (1971)	85	91
Hunter & Ash (1973)	88	86
Slowick & Buckley (1975)	85	93
Wicklander & Junter (1975)	92	95
Davidson (1979)	90	100
Yankee, Powell, & Newland (1976)	100	98
Weighted Total	91	94
Social Scientist's Research		
Barlanda & Raskin ^a (1976)	98	45
Horvatha (1977)	77	51
Kleinmuntz & Szucko (1984)	75	63
Iacono & Patrick (1988)	98	55
Weighted Total	88	57

^a is also a trained polygrapher

after Iacono & Patrick, 1997
Assessing deception: Polygraph techniques.
In R. Rogers, Ed., *Clinical Assessment of Malingering and Deception*
New York: Guilford.

Types of Validity Studies

- Laboratory: Mock Crime
- Field: Real Life Cases

Effects of Enhancing Realism in Laboratory Studies

Study	Group	N	% Accuracy	
			Guilty	Innocent
Raskin & Hare (1978)	Psychopath	23		
	Nonpsychopath	20		

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	Nonpsychopath	21		

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Raskin & Hare (1978)	Psychopath	23	100	~92
	Nonpsychopath	20	100	~90
Patrick & Iacono (1989)	Psychopath	20	83	63
	Nonpsychopath	21	91	50

Problems with Field Studies

➤ How is ground truth established?

➤ Judicial verdicts inadequate

➤ plea bargains and false convictions

➤ evidence not beyond a reasonable doubt

➤ judicial verdict may be influenced by outcome of polygraph!

Therefore confessions are used to identify the culpable and to clear the innocent.

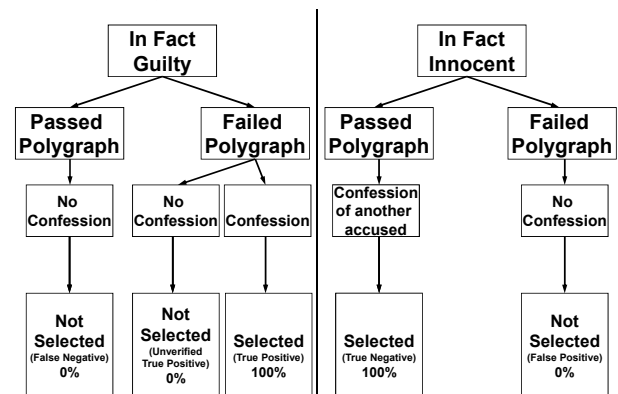


➤ Confessions gathered only after the subject has failed the test, which leads to an unfortunate selection bias

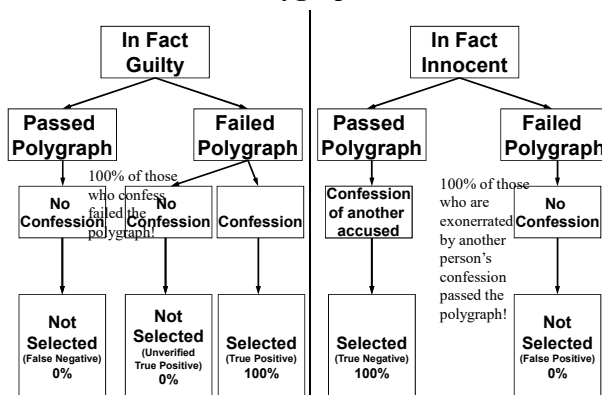
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Why Using Confessions Overestimates Accuracy



Feedback Polygraphers Receive



Screening Tests

- Because these tests have much higher false positive rates than false negative rates, they should not be used in instances where most folks are innocent

	Test Verdict	
	Guilty	Not Guilty
Actual Guilty	9	1
Actual Not Guilty	40	50
		100

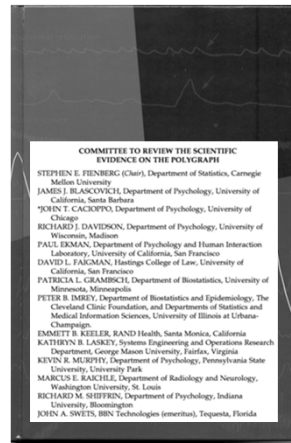
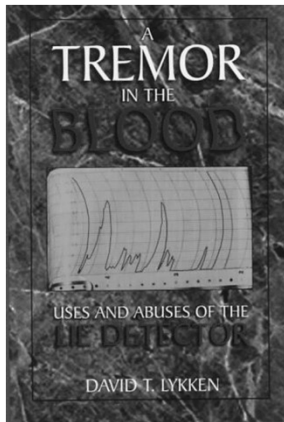
Probability a guilty verdict is correct: 18.4%
Total correct verdicts = 59%

Implications

- If most accused folks are not culpable, a very large number of False-Positives will result
- Impact of False-Positives on the accused and the family
- Cumulative risk of False-Positives with Maintenance Polygraph Tests is substantial (and no evidence to suggest that maintenance polygraphs are effective, Meijer et al. 2008, Int J Law Psych)
- Countermeasures can reduce True Positive rate

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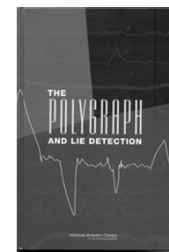
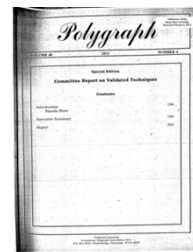


NRC (2003) Key Conclusions

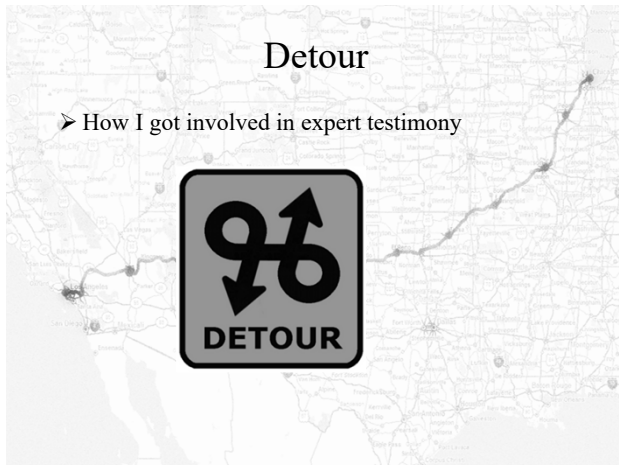
- “What is remarkable, given the large body of relevant research, is that claims about the accuracy of the polygraph made today parallel those made throughout the history of the polygraph: practitioners have always claimed extremely high levels of accuracy, and these claims have rarely been reflected in empirical research.”
- “Almost a century of research in scientific psychology and physiology provides little basis for the expectation that a polygraph test could have extremely high accuracy.”

“Meta-Analytic Survey” by APA

- Ad-hoc Committee (Mike Gougler, Raymond Nelson, Mark Handler, Donald Krapohl, Pam Shaw, Leonard Bierman)
- Scope:
 - 45 samples (majority in *Polygraph*, many by Raymond Nelson)
 - 295 scorers
 - 11,737 examinations
- Omnibus accuracy 86.9% (23.5% inconclusive)
- No break-down of false-positive & false-negative
- Critical admission:
 - “Real world confirmation data are selective ... and confirmed cases more often may have correct PDD results than do unconfirmed cases. As a result, field studies may overestimate PDD decision accuracy to some degree.”



jallen.faculty.arizona.edu/polygraph



Detour

- How I got involved in expert testimony

Syllabus addendum

Notification of Objectionable Materials:

This course will contain material of a mature nature, which may include explicit language or discussion of sexual situations, and/or violence. The instructor will provide advance notice when such materials will be used. Students are not automatically excused from interacting with such materials, but they are encouraged to speak with the instructor to voice concerns and to provide feedback.

Cases involving Sexual Misconduct

- Allegations of sexual misconduct in domestic relations cases
 - Typically custody cases
 - One parent accuses other of sexual misconduct with a child
 - Psychological evaluation ensues

Clinical interview	Millon Clinical Multi-Axial Inv. III
Review of collateral information	Multiphasic Sex Inventory II
Polygraph test	Abel & Becker Sexual Interest Card Sort
Personality Assessment Inventory	Shipley Inst. Of Living Scale

Cases involving Sexual Misconduct

- Allegations of sexual misconduct in domestic relations cases
 - If a parent is deemed to be a risk - correctly or incorrectly - two statutes may impose limits
 - ARS25 403.05 would prohibit awarding that parent sole or joint physical or legal custody
 - ARS25 408 (H1) may further limit the extent and nature of parenting time allowed
 - Thus the evaluation has a pivotal role

Cases involving Sexual Misconduct

- Sex offender monitoring
 - Maintenance Polygraphs



The Case

- Child Custody Case
- Psychological Evaluation: 39 page report
- Highlights
 - Ex-wife accuses defendant of touching daughter, first time at age 2
 - History of domestic disputes with police dispatch (but no arrests)
 - History of calls to CPS (but no action taken)
 - History of parental drug abuse
 - Court found "serious credibility issues with both parents"

The Case

- Child Custody Case
- Psychological Evaluation: 39 page report
- Highlights
 - As daughter becomes capable of verbal reporting, she reports inconsistent information concerning
 - Who touched her
 - Where she was touched
 - Comprehensive risk assessment could not determine whether nor by whom she was touched
 - Defendant took three polygraphs over 1 year span

The Case

- Child Custody Case
- Polygraph #1
 - "Have you ever put your fingers into Susie's bare vagina, even a little other (sic) cleaning her as a small child?"
 - "Did you lie to me when you said you never put any of your fingers into Susie's vagina, even a little, other than cleaning her as a small child?"
- Verdict: Not Deceptive

The Case

- Child Custody Case
- Polygraph #2
- Verdict: Not Deceptive

The Case

- Child Custody Case
- Polygraph #3
- Verdict: Deceptive

The Case

- Child Custody Case
- My report
 - Overview of Polygraph CIT procedure and logic
 - Scientific opinion of the Polygraph
 - Scientific research on the polygraph
 - NRC Report (and comment on APA report)
 - Specific comment on false positive and true positive rates

Source	Outcome	p for formula	q for formula
Poly 1: [redacted]	Nondeceptive	0.12	0.6
Poly 2: [redacted]	Nondeceptive	0.12	0.6
Poly 3: [redacted]	Deceptive	0.88	0.4
*Polygraph quality review questioned this test		Sensitivity	Specificity
		0.88	0.60

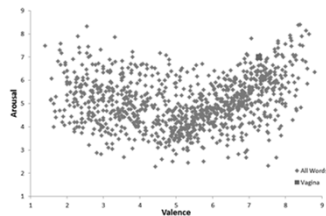
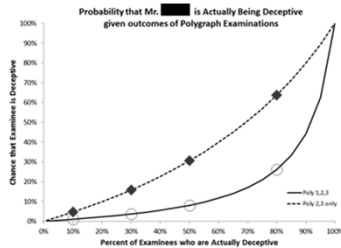


Figure 1. Valence and arousal ratings for 1032 emotional words, with the ratings for "Vagina" shown in red. Ratings are from male research participants (Affective Norms for English Words [ANEW]; Bradley and Lang, 1999, Technical Report C-1, University of Florida). Valence is rated from 1 to 9 (unpleasant to pleasant) and arousal is rated from 1 to 9 (calm to arousing).

The Case

Child Custody Case

My report

- Overview of Polygraph CIT procedure and logic
- Scientific opinion of the Polygraph
- Scientific research on the polygraph
- NRC Report (and comment on APA report)
- Specific comment on false positive and true positive rates
- Specific comment about relevant items

End of Detour



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The GKT as an alternative to Traditional Polygraph Procedures

- **Guilty Knowledge Test (GKT)**
 - Devised by Lykken(1959)
 - Sometimes termed **Concealed Information Test (CIT)**
 - Can utilize **Skin Conductance** or other measures (e.g. **Event-Related Brain Potentials**)



Guilty Knowledge Test (GKT)

- The GKT does not assess lying as indexed by fear of being detected, but probes for guilt as indexed by recognition
- A series of questions is devised, each having several alternatives, only one of which is true about the crime in question
- Chances of an innocent person looking guilty on a 10-item GKT are $1/5^{10}$.

Assessing Recognition: For Specific Incidents Investigations

- Used when information about a crime or event is available that only a real culprit would know
- Series of questions constructed, only one of which has correct critical detail

Regarding the abduction location, do you know for sure it was...

1. ... at a Toy Store?
2. ... at a Shopping Mall?
3. ... at a City Park?
4. ... at a Friend's House?
5. ... at School?
6. ... at a Restaurant?

Other questions about

- Time abductee taken
- Clothing worn
- etc. for 6-10 questions

- Subject instructed to answer "no" to each item, so that if guilty, subject would be lying to the critical item.
- Critical item never positioned at beginning.
- A consistent peak of physiological response on one critical alternative suggests guilt.

GKT Accuracy: Lab Studies

Study (1 st Author, Yr)	N	Percent Correct	
		Guilty	Innocent
Lykken '59	98	88	100
Davidson '68	48	92	100
Podlesney '78	18	90	100
Balloun '79	34	61	88
Giesen '80	40	92	100
Bradley '81	192	59	89
Bradley '84	16	100	100
Iacono '84	55	91	100
Steller '87	87	85	100
Iacono '92	71	87	71
O'Toole '94	45	77	94
Study Median	48	88	100

GKT – Box Score, and Concerns

- Superior to CQT, especially in protecting the innocent
- Resistance to use among those in the polygraph community
 - Concern about applicability, especially in high profile cases
 - The GKT for OJ
- Despite limitations of CQT, may have utility for eliciting confessions
- Over 5,000 GKT tests given in Japan each year, for example

Synopsis

- There is no unequivocal lie response
- Polygraphy:
 - assesses emotional reactions
 - has an unacceptably high false-positive rate
 - Is vulnerable to countermeasures that can reduce true-positive rate
- Polygraphers overestimate accuracy due to how cases are selected for inclusion in studies
- Assessing recognition may prove more accurate, but potentially less widely applicable
- Polygraphs are useful for eliciting admissions and confessions; i.e. "scare the hell out of people"

jallen.faculty.arizona.edu/polygraph

Science and Pseudo-Science, Debate and Diatribe, Validity versus Vitriol

If proponents wish to convince the scientific community of the merits of polygraph lie detection, I submit that they will have to develop a more convincing case than the one currently on offer. Their case must be founded on studies which include the necessary controls for nonpolygraphic sources of information, that is, studies which compare the accuracy of assessments derived from case-file material and the subject's demeanor during questioning with that based on these sources plus the polygraphic record. I strongly suggest that such studies would confirm what the available data suggest: that polygraph lie detection adds nothing positive to conventional approaches to interrogation and assessment.

Carroll, 1988

Science and Pseudo-Science, Debate and Diatribes, Validity versus Vitriol

If I announce to my scientific colleagues that I have invented a new test that can identify schizophrenia with 90% or 95% accuracy, my colleagues will be interested -- but skeptical. I would be expected to support my assertion with experimental evidence and that evidence would be very critically examined. Even if my proofs withstood such scrutiny, many would reserve judgment until an independent investigator had confirmed my findings. All this skepticism about a claim that I can distinguish "crazy people" from normal ones! The tools of the psychologist are not precision instruments; really high accuracy is seldom achieved. Skepticism is appropriate. Nevertheless, when the polygrapher announces that his psychological test can separate liars from the truthful with a validity of 90%, or 95%, or even 99%, the typical reaction is a kind of marveling acceptance. The critic who questions these claims is greeted with surprise and skepticism. Nearly every American has heard of the lie detector; without really knowing what is involved, many assume that it is nearly infallible. So deeply ingrained is this mystique that, gradually over the last 50 years, the burden of proof has somehow shifted to the critic.

Lykken, in *A Tremor in the Blood*, 1981

Science and Pseudo-Science, Debate and Diatribes, Validity versus Vitriol

Unfortunately, the minute a small handful of psychologists -- one or two pseudo-knowledgeable and one or two completely ignorant of what they were even trying to do -- got into the picture, two expressions, "false positive" and "false negative", came to light. It appears that some people turn out to be weird ducks. Sadly, when that type of inquirer doesn't understand something, he is usually prone to attach strange names to it under the guise of professionalism or scientific exploration on both sides of the same coin. By confusing other people more so than himself he feels he can still call himself an "expert." Those two phrases appeared in a tumor in the brain [sic]. Before then, they had never existed in polygraph language. In all sincerity, however, foul ball psychologists are few and far between.

Ferguson, in *Preemployment Polygraphy*, 1984