

# LECTURE 4

17 February, 2025

# Announcements (2/17/25)

- Electricity Test Today
  - Lecture resumes at 3:20 pm
- Please do not forget to use the Comment/Question tool on the class website (gives you attendance credit)



Given that skin conductance has been linked to fear condition detection, and psychopathy differences in executive control regulation influence electrodermal specific neural circuit differences, and how might interventions aimed at help anxiety and trauma-related

## The distinctive role of executive functions in implicit emotion regulation



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### ARTICLE INFO

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### ABSTRACT

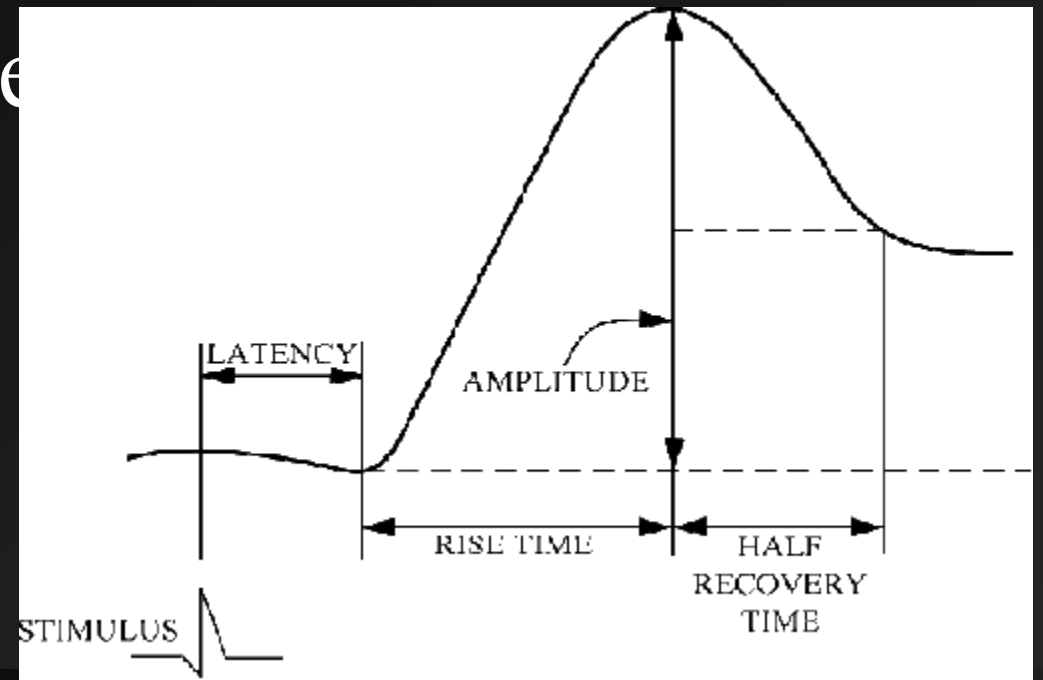
Several theoretical models stress the role of executive functions in emotion regulation (ER). However, most of the previous studies on ER employed explicit regulatory strategies that could have engaged executive functions, beyond regulatory processes per se. Recently, there has been renewed interest in implicit forms of ER, believed to be closer to daily-life requirements. While various studies have shown that implicit and explicit ER engage partially overlapping neurocognitive processes, the contribution of different executive functions in implicit ER has not been investigated. In the present study, we presented participants with negatively valenced pictures of varying emotional intensity preceded by short texts describing them as either fictional or real. This manipulation was meant to induce a spontaneous emotional down-regulation. We recorded electrodermal activity (EDA) and subjective reports of emotion arousal. Executive functions (updating, switching, and inhibition) were also assessed. **No difference was found between the fictional and real condition on EDA. A diminished self-reported arousal was observed, however, when pictures were described as fictional for high- and mild-intensity material, but not for neutral material. The amount of down-regulation in the fictional condition was found to be predicted by inter-individual variability in updating performances, but not by the other measures of executive functions, suggesting its implication even in implicit forms of ER.** The relationship between down-regulation and updating was significant only for high-intensity material. We discuss the role of updating in relation to the consciousness of one's emotional state.

# Questions and Fe

There were many examples of skin potentials shown in class today. Something I was wondering was:

a) is there only one standard shape for the response? (I am thinking of the archetypal "neuron firing" graph) Or can the response look different for different stimuli? Are there any surprising things that can affect the shape of the response?

b) How is between-participant variability handled for analyses? Is the response averaged across participants (like in EEG)?



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

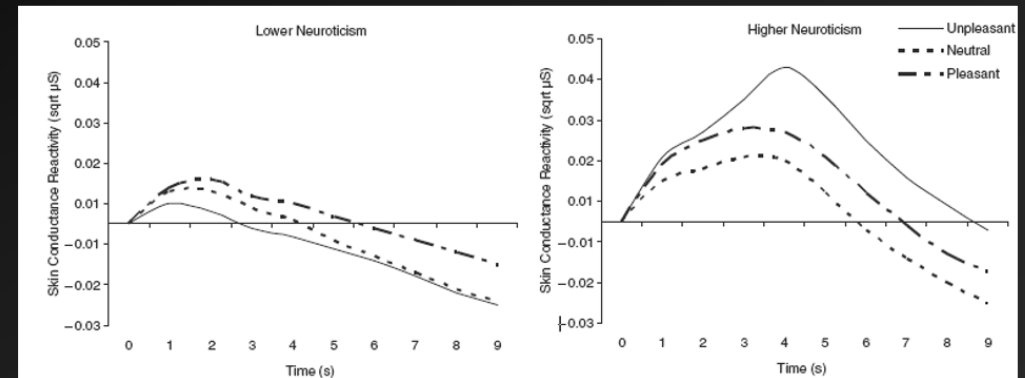


Figure 1. Skin conductance reactivity as a function of picture valence, time, and neuroticism. Pictures were presented from 1–6 s. Estimated means for participants lower (1 *SD* below the mean) and higher (1 *SD* above the mean) in neuroticism are plotted separately.

# Questions and Feedback

Regarding the homunculus, would we see plasticity in that region for people who, for example, use their hands more finely than most (ie people who use sign language as a primary language or people who knit or play piano)?

JOURNAL OF NEUROPHYSIOLOGY  
Vol. 74, No. 3, September 1995. Printed in U.S.A.

## Modulation of Muscle Responses Evoked by Transcranial Magnetic Stimulation During the Acquisition of New Fine Motor Skills

ALVARO PASCUAL-LEONE, NGUYET DANG, LEONARDO G. COHEN, JOAQUIM P. BRASIL-NETO, ANGEL CAMMAROTA, AND MARK HALLETT

*Human Cortical Physiology Unit, Human Motor Control Section, Medical Neurology Branch, National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, Maryland 20892*

## Increased Cortical Representation of the Fingers of the Left Hand in String Players

Thomas Elbert, Christo Pantev, Christian Wienbruch, Brigitte Rockstroh, Edward Taub

Magnetic source imaging revealed that the cortical representation of the digits of the left hand of string players was larger than that in controls. The effect was smallest for the left thumb, and no such differences were observed for the representations of the right hand digits. The amount of cortical reorganization in the representation of the fingering digits was correlated with the age at which the person had begun to play. These results suggest that the representation of different parts of the body in the primary somatosensory cortex of humans depends on use and changes to conform to the current needs and experiences of the individual.

Study	Method	Findings
Pascual-Leone et al. (1995)	TMS	Expanded M1 representation in pianists
Elbert et al. (1995)	MEG	Larger sensorimotor cortex in string players
Gaser & Schlaug (2003)	MRI	Increased M1 gray matter in musicians
Bangert & Schlaug (2006)	MRI	Bimanual motor activity in pianists
Karni et al. (1995)	fMRI	Motor maps expand with practice
Lotze et al. (2003)	fMRI	Higher motor cortex activation in pianists
Schlaug (2001)	Review	Long-term neuroplasticity in musicians

*“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
  - Inaccuracies
    - income
    - assets
  - Denials
    - about parental habits
    - about fidelity
    - about abuse
  - about income
  - about assets



# The Difficulty in Detecting Lying

## Observer Group

Secret Service

Federal Polygraphers

Robbery Investigators

Judges

Psychiatrists

Special Interest

College Students

## Accuracy

<sup>a</sup>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

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*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

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Media Portrayals:

[Political Ad](#)

[Entertainment](#)

[More Entertainment](#)



# 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
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- Overview of alternatives: Assessing recognition



- 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



# 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 four- or five-pen instrument you will receive the following standard accessories: two pneumo chest assemblies, GSR electrode set, standard Kovacic arm cuff, pump bulb assembly, pens and bottles for each recording module, one extra ink bottle, pen pad, ink filler, ink, tool kit, two rolls of chart paper and an instruction manual. Other optional accessories include auto power conversion, in-case calibrator, various styles of event markers and thermal writing capabilities.

### The Statesman

Zero® case, the clean Halliburton lines are enhanced by the black morocco grain finish. The case is high-impact thermo-formed ABS plastic to ensure durability. (Total weight: 21.5lbs. or 24.5lbs. with calibrator. Dimensions: 13"W x 21"L x 6.5"D).



### The Factfinder II

The 10" chart drive allows five pens to be used simultaneously with greater pen swing. The practice of "pigeon toeing" the outside pens on a five-pen polygraph is no longer necessary and charts are easier to read because of reduced tracing overlap. This leaves plenty of room for important notations. Every Factfinder II maintains all of the quality and conveniences of our standard 8" chart drive models. Available only in a Statesman case, no thermal models are available.

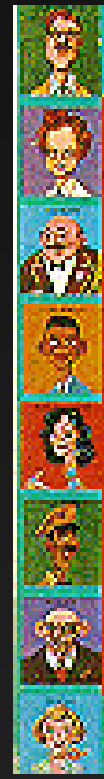
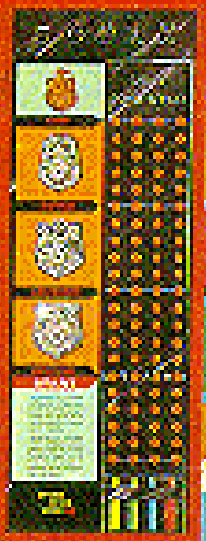
### The Courier II

Our newest conventional case style offers a gold anodized look and compact size. The case was designed with the traveling examiner in mind. The lid is designed with plenty of storage space and includes an in-case calibrator. The case is made of exceptionally strong, deep-drawn aluminum that resists dents and is also dust and weather resistant. (Total weight: 21.5lbs. Dimensions: 13"W x 18"L x 6.5"D).



HERE ARE THE SUSPECTS! A DIFFERENT ONE IS GUILTY EACH TIME YOU PLAY!  
SOLVE CRIMES BY USING THE LIE DETECTOR AND YOUR OWN DETECTIVE SKILL!

# LIE DETECTOR



FOR COMPLETE INSTRUCTIONS, INCLUDING PERSONAL PERSONALITY ADJUSTMENT BY FAMILY



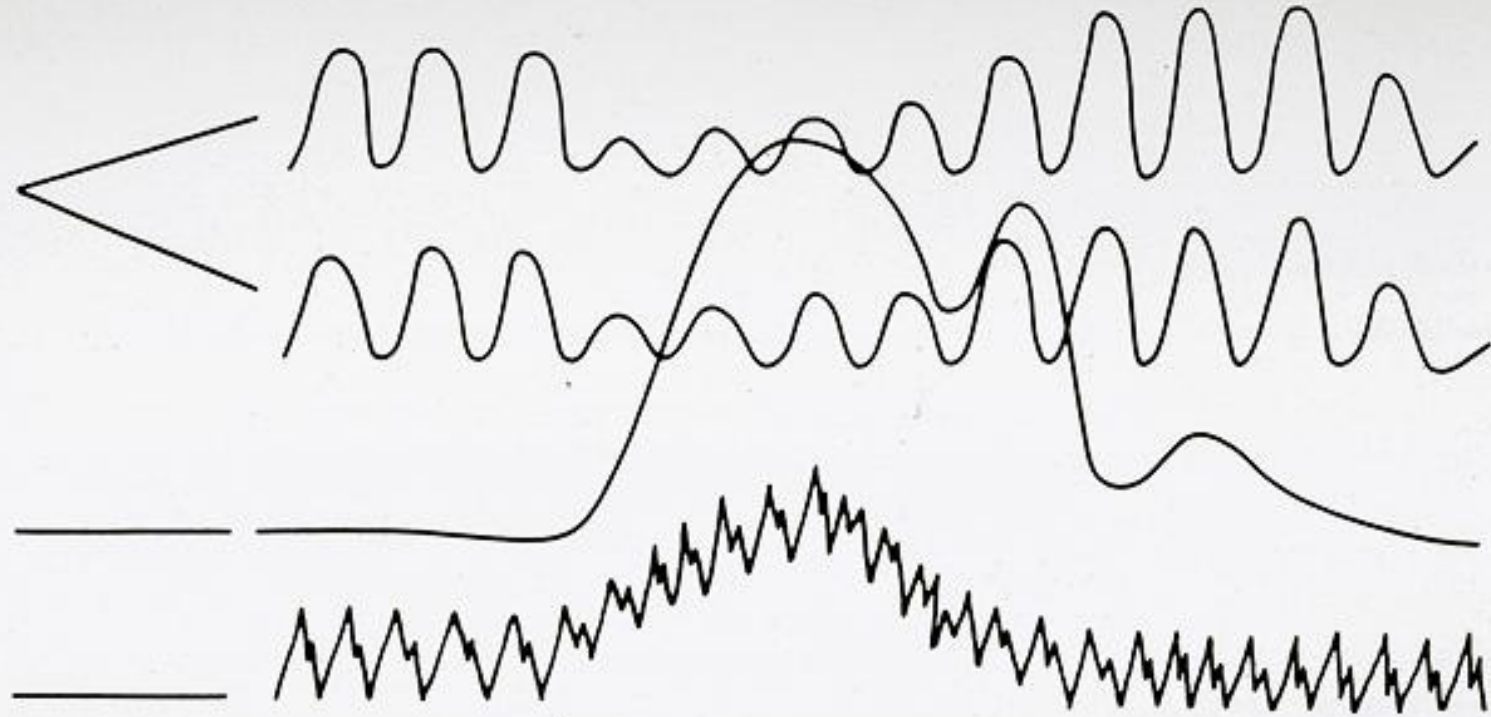
# EXHIBIT "B"

A CLASSIC "LYING" REACTION

PNEUMO  
TRACINGS

GSR  
TRACINGS

CARDIO  
TRACINGS



↑  
THE POINT AT WHICH THE SUBJECT  
ANSWERED A RELEVANT QUESTION.



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

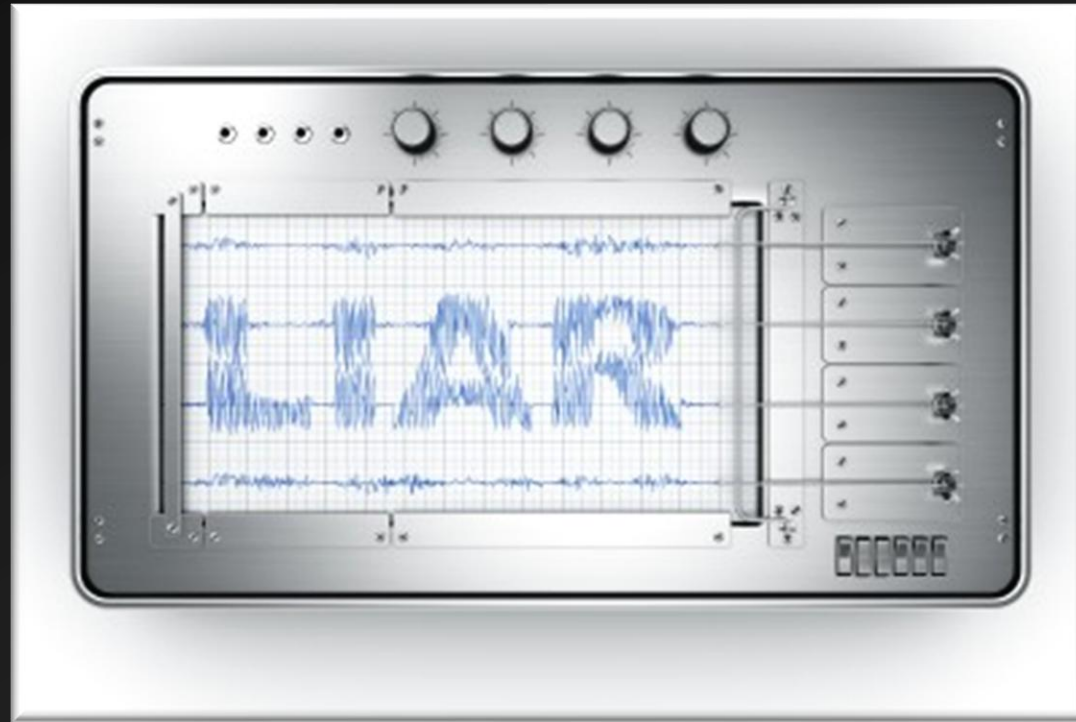
Note that none detect lying *per se*

# 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?



# Comparison 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)

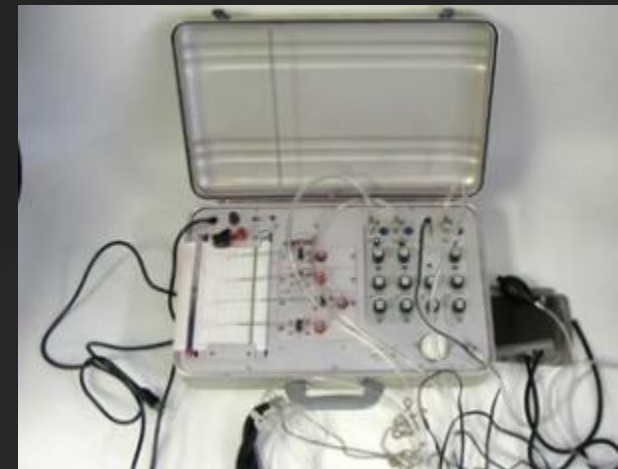
- Innocent subjects should react with stronger emotion to the *Comparison* questions since their content are of greater direct concern
- Guilty subjects should respond with stronger emotion to the *Relevant* questions
- Comparing the magnitude of the responses (usually skin-resistance) to the comparison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

# CQT TEST QUESTIONS

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

**Relevant**

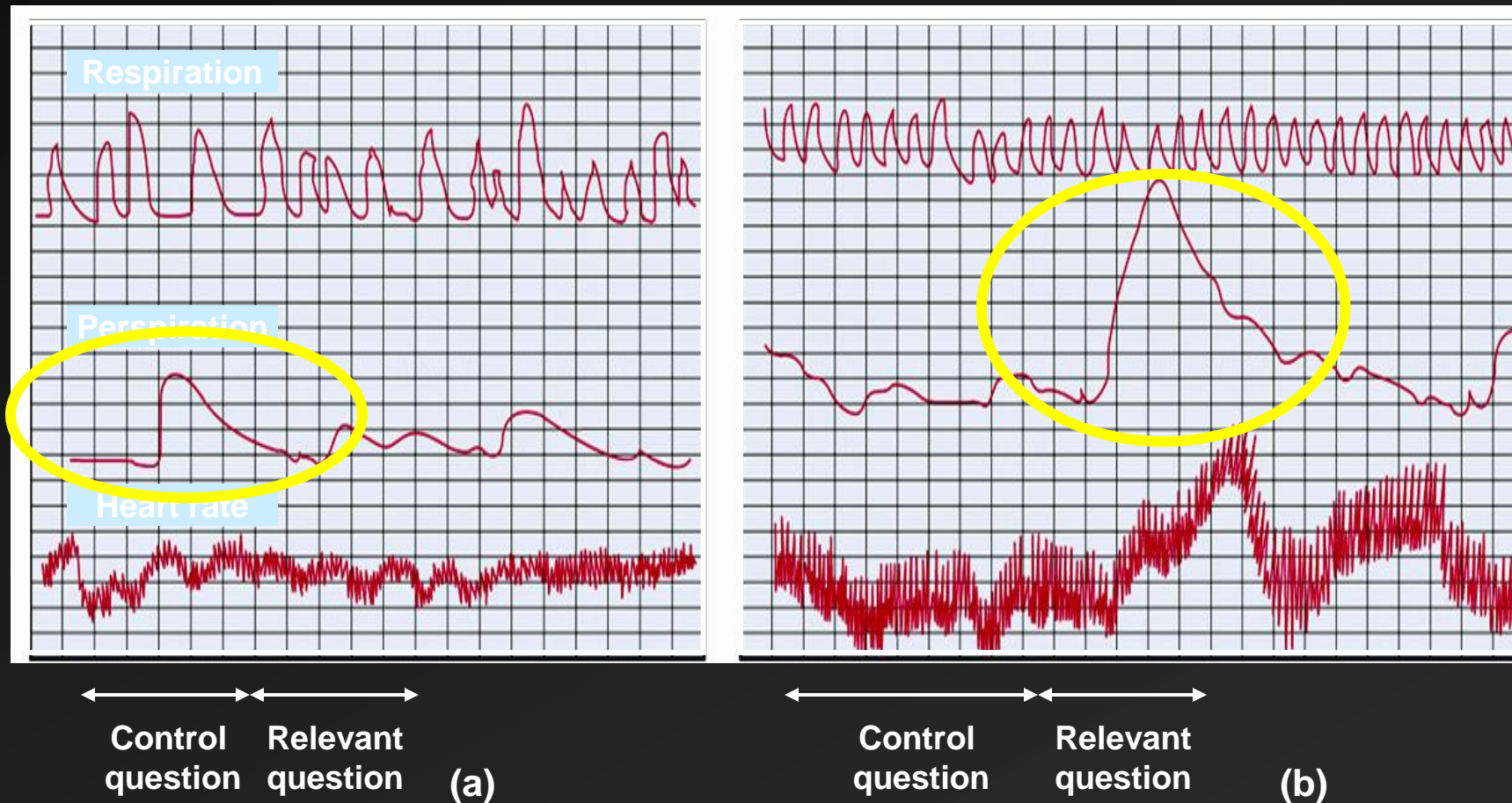
**Comparison**



# Hypothetically...

Innocent

Guilty



## Typical Scoring -- Semiobjective Method

- Each relevant question paired with a "comparison" 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
  - $-5 < \text{Total score} < +5$ : 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**

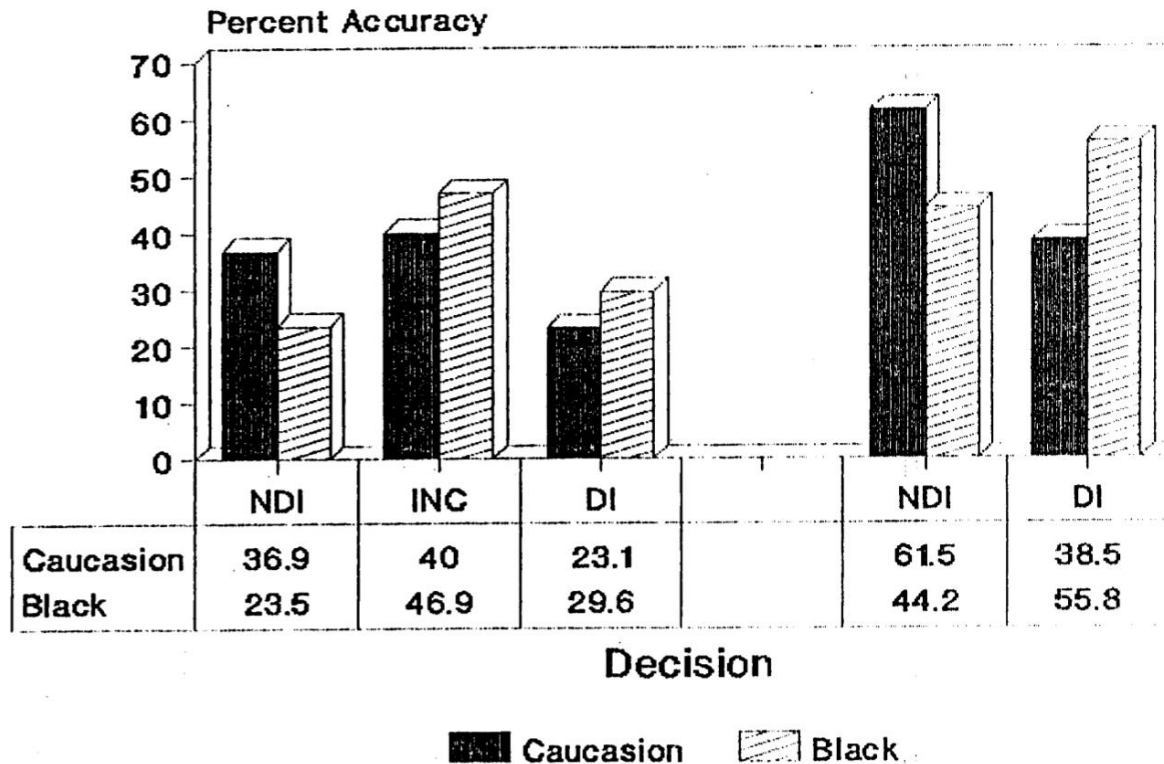
# The Importance of Blind Scoring

- 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%)



# Racial Bias

Race for MGQT and ZCT  
Innocent Examinees



See Also:

➤ ACLU:

<https://www.aclu.org/blog/privacy-technology/how-lie-detectors-enable-racial-bias>

➤ Mark Harris in Wired:

<https://www.wired.com/story/inside-polygraph-job-screening-black-mirror/>

➤ NAS report

<https://www.nap.edu/catalog/10420/the-polygraph-and-lie-detection>

# 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 comparison 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 comparison questions than by the relevant questions (*implausible*)
  - A guilty person must be more disturbed more by the relevant questions (*reasonable*)



# 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 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
Wicklender & Junter (1975)	92	95
Davidson (1979)	90	100
Yankee, Powell, & Newland (1976)	100	98
<b>Weighted Total</b>	<b>91</b>	<b>94</b>
Social Scientist's Research		
Barlanda & Raskin <sup>a</sup> (1976)	98	45
Horvatha (1977)	77	51
Kleinmuntz & Szucko (1984)	75	63
Iacono & Patrick (1988)	98	55
<b>Weighted Total</b>	<b>88</b>	<b>57</b>

<sup>a</sup> 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

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

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	<b>Nonpsychopath</b>	<b>21</b>	<b>91</b>	<b>50</b>

# Problems with Field Studies

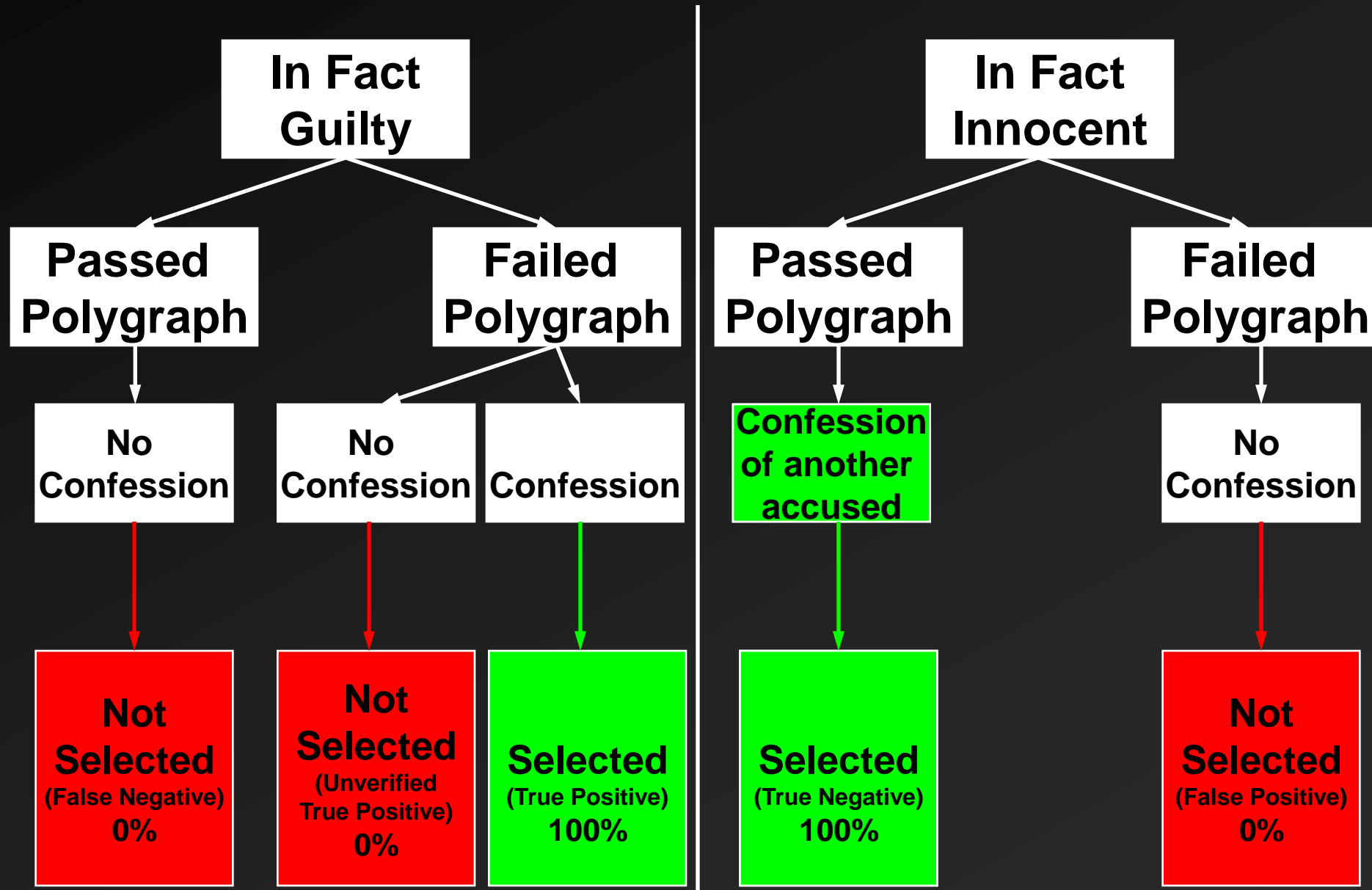
- How is ground truth established?
  - Judicial verdicts inadequate
    - plea bargains and false convictions
    - evidence not beyond a reasonable doubt
    - judicial verdict may be influenced by outcome of polygraph!
  - Therefore confessions are used to identify the culpable and to clear the innocent.
- Confessions gathered only after the subject has failed the test, which leads to an unfortunate selection bias



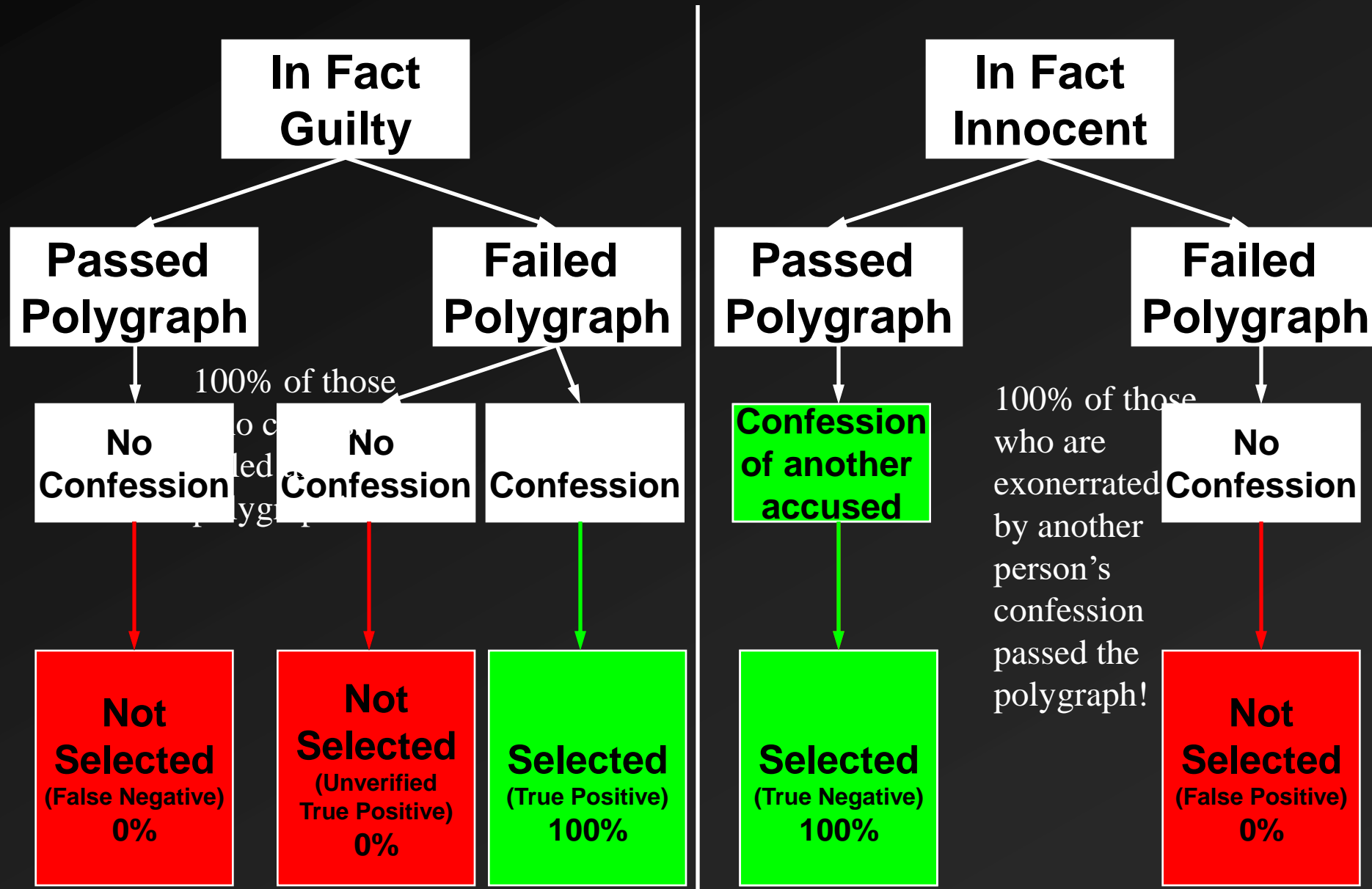
# Roadmap

- Abbreviated History and Overview of the Conventional Polygraph
- Limitations to Conventional Polygraphy
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# Why Using Confessions Overestimates Accuracy



# Feedback Polygraphers Receive



# Screening Tests

- Because polygraph 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		
Actual	Guilty	Not Guilty	
Guilty	9	1	10
Not Guilty	40	50	90
			100

Probability a guilty verdict is correct: 18.4%

Total correct verdicts = 59%

# Implications

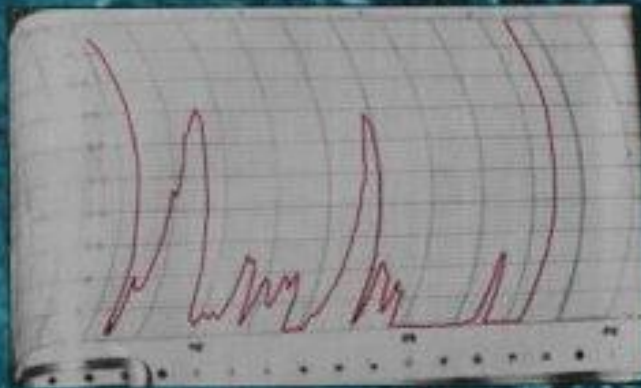
- If most accused folks are not culpable, a very large number of False-Positives will result
- Impact of False-Positives on the accused and the family
- Cumulative risk of False-Positives with Maintenance Polygraph Tests is **substantial** (and no evidence to suggest that maintenance polygraphs are effective,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

# Roadmap

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- **Limitations to Conventional Polygraphy**
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A  
**TREMOR**  
IN THE  
**BLOOD**



USES AND ABUSES OF THE  
**LIE DETECTOR**

DAVID T. LYKKEN

**COMMITTEE TO REVIEW THE SCIENTIFIC  
EVIDENCE ON THE POLYGRAPH**

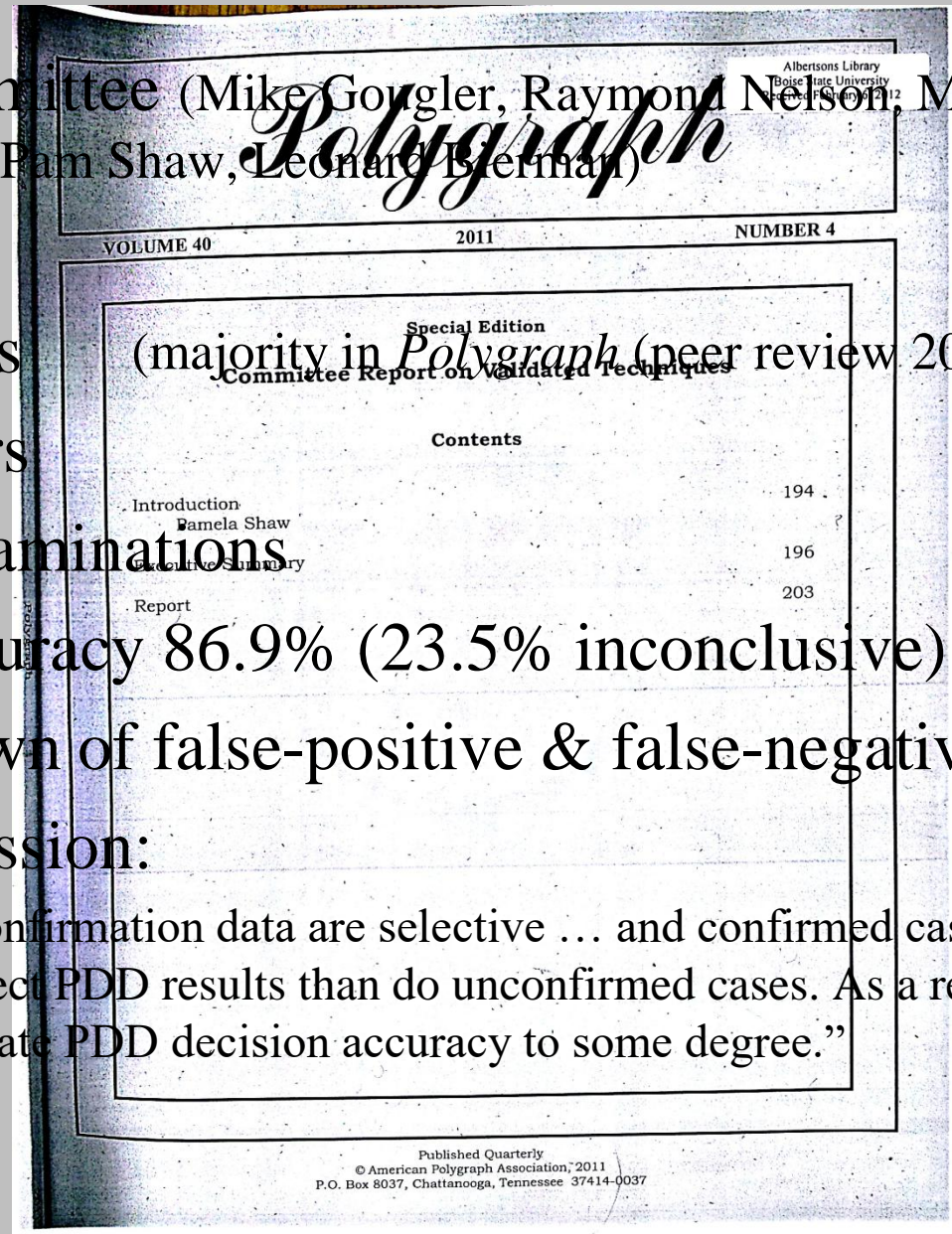
- STEPHEN E. FIENBERG (*Chair*), Department of Statistics, Carnegie Mellon University
- JAMES J. BLASCOVICH, Department of Psychology, University of California, Santa Barbara
- \*JOHN T. CACIOPPO, Department of Psychology, University of Chicago
- RICHARD J. DAVIDSON, Department of Psychology, University of Wisconsin, Madison
- PAUL EKMAN, Department of Psychology and Human Interaction Laboratory, University of California, San Francisco
- DAVID L. FAIGMAN, Hastings College of Law, University of California, San Francisco
- PATRICIA L. GRAMBSCH, Department of Biostatistics, University of Minnesota, Minneapolis
- PETER B. IMREY, Department of Biostatistics and Epidemiology, The Cleveland Clinic Foundation, and Departments of Statistics and Medical Information Sciences, University of Illinois at Urbana-Champaign.
- EMMETT B. KEELER, RAND Health, Santa Monica, California
- KATHRYN B. LASKEY, Systems Engineering and Operations Research Department, George Mason University, Fairfax, Virginia
- KEVIN R. MURPHY, Department of Psychology, Pennsylvania State University, University Park
- MARCUS E. RAICHLE, Department of Radiology and Neurology, Washington University, St. Louis
- RICHARD M. SHIFFRIN, Department of Psychology, Indiana University, Bloomington
- JOHN A. SWETS, BBN Technologies (emeritus), Tequesta, Florida

# 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* (peer review 2003+), 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.”



Albersons Library  
Boise State University  
Received February 6, 2012

# Polygraph

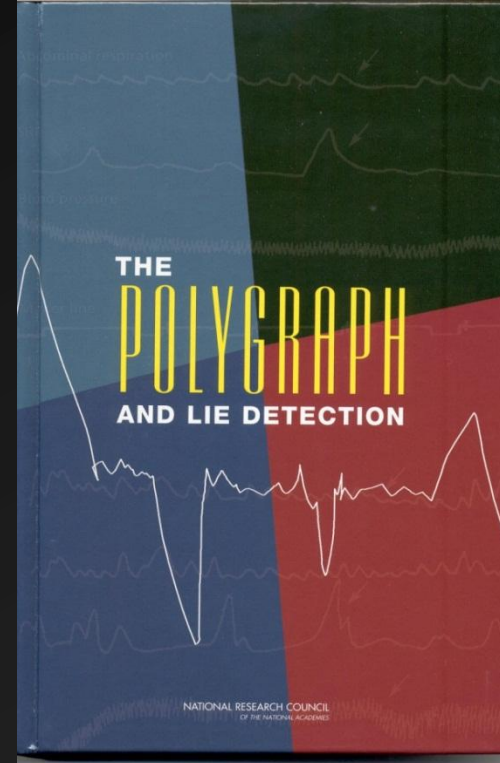
VOLUME 40 2011 NUMBER 4

Special Edition  
**Committee Report on Validated Techniques**

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Report	203

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<https://psychophyslab.arizona.edu/resources-concerning-validity-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

Review of collateral information

**Polygraph test**

Personality Assessment Inventory

Millon Clinical Multi-Axial Inv. III

Multiphasic Sex Inventory II

Abel & Becker Sexual Interest Card Sort

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



# Never Trust the Polygraph

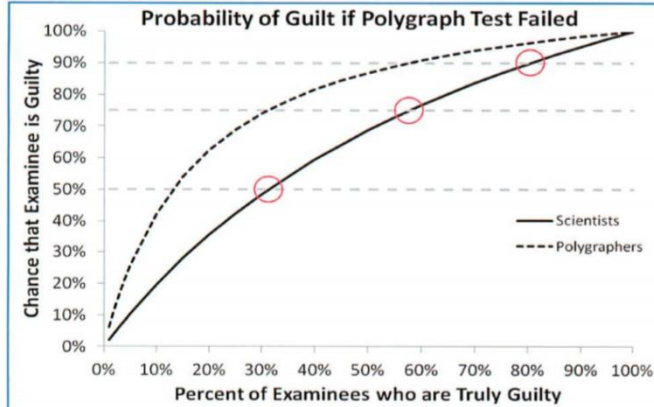
By John J.B. Allen, Ph.D., Distinguished Professor of Psychology, University of Arizona

Editor's Note: This article is abridged with author's permission.

Although polygraph tests are seldom admitted in court, their use influences cases when the results are part of the evaluation process in domains such as child custody, dependency and sexual misconduct. In such cases, the polygraph test may be part of a larger assessment to identify whether a parent poses a significant risk to a child. It is important that these assessments be accurate, as failure to identify a risk endangers children but false identification needlessly damages fundamental relationships. In cases where a parent is deemed to be a risk – correctly or incorrectly – ARS25-403.05 would prohibit awarding that parent legal decision-making, and ARS25-408 (H) (1) can limit the extent and nature of parenting time.

The idea of detecting lies with technology is appealing, perhaps because humans are notoriously poor at detecting deception. (1). Unfortunately, anyone who promises to accurately detect lying ... is lying. Why? There is no unique physiological response(s) associated with lying (2). The polygraph cannot assess lying per se, but instead assesses emotion that can arise when specific questions are asked. As such, a verdict of "guilty" or "lying" from a polygraph is best interpreted as "emotionally aroused" or "anxious." Many innocent individuals are nervous or fearful when a polygrapher asks about sexual misconduct or other behavior that can restrict their parenting time. It is no surprise that the test is highly likely to misidentify innocent people as deceptive, misidentifying 40-50% of innocent individuals as culpable (2, 3) (false positives). Likewise, information about countermeasures is easily obtained (e.g., antipolygraph.org) and can create false negatives among dangerous individuals.

The test referred to as "The Polygraph" uses some variant of the Control Question Technique (CQT). A CQT involves about 10 questions, which fall into two categories. Relevant questions inquire about specific details (e.g., "Did you touch the child between the legs?"). Control questions inquire about questionable behavior but they do not directly accuse (e.g., "Do you find teenage girls attractive?"). Although examinees are not told the distinction between the questions, they are led to believe (falsely) that there are two ways to



**The probability that an examinee is in fact guilty after failing a polygraph test, which depends on what percentage of polygraph examinees are in actually guilty.** The probabilities are shown using the accuracy rates provided by scientific research (solid line) as well as those provided by polygraphers (which are higher due to the inherent selection bias in field studies; dashed line). As shown by the red circles in the figure, the probability that an examinee is in fact guilty after failing the polygraph test is: only 50% when about 31% of examinees are truly guilty; 75% when 58% of examinees are guilty; and 90% when 80% of examinees are guilty. These data illustrate & underscore the key conclusion of the scientific review of the National Research Council that "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." (2, p. 2)

fail the test: 1) they can fail the relevant questions, in which case they are guilty; or 2) they can fail the control questions, in which case they appear capable of committing the crime. Thus, it is assumed they will deny both questions, and it is further assumed that for the guilty, relevant questions will be of greater concern and elicit larger physiological responses (a reasonable assumption). It is further assumed (unreasonably) that for innocent, control questions will be of greater concern and thus elicit a larger response than the relevant questions. Examinees that have sufficiently larger responses to relevant questions are deemed deceptive; examinees with larger responses to control questions are deemed innocent. For cases where relevant and control responses are similar, an "indeterminate" outcome is reported, which occurs in 5-20% of examinations.

A comprehensive scientific review by the National Research Council (NRC) of the National Academy of Sciences (2) found that the polygraph test suffers from unacceptably low accuracy. The NRC committee

held public hearings, visited government polygraph facilities, accessed unpublished government reports, including classified material, and produced a comprehensive volume that is available for free at: [www.nap.edu/catalog.php?record\\_id=10420](http://www.nap.edu/catalog.php?record_id=10420). More recently, an ad-hoc committee of the American Polygraph Association published a survey of field polygraph results (4), including more than 45 published samples and 11,000 examinations, and reported overall accuracy of 86.9%, but only after excluding 23.5% of cases with indeterminate verdicts. Unfortunately, more than half the samples came from articles of the lead investigator, and all suffered from the inherent selection bias: to wit, cases selected for inclusion in a field study are biased in favor of demonstrating accuracy because the associated confessions are not independent but a consequence of the polygraph exam. This problem is widely known, and referenced in the executive summary written by this ad-hoc committee of the American Polygraph Association (4).

Continued on Page 18 ...

# 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

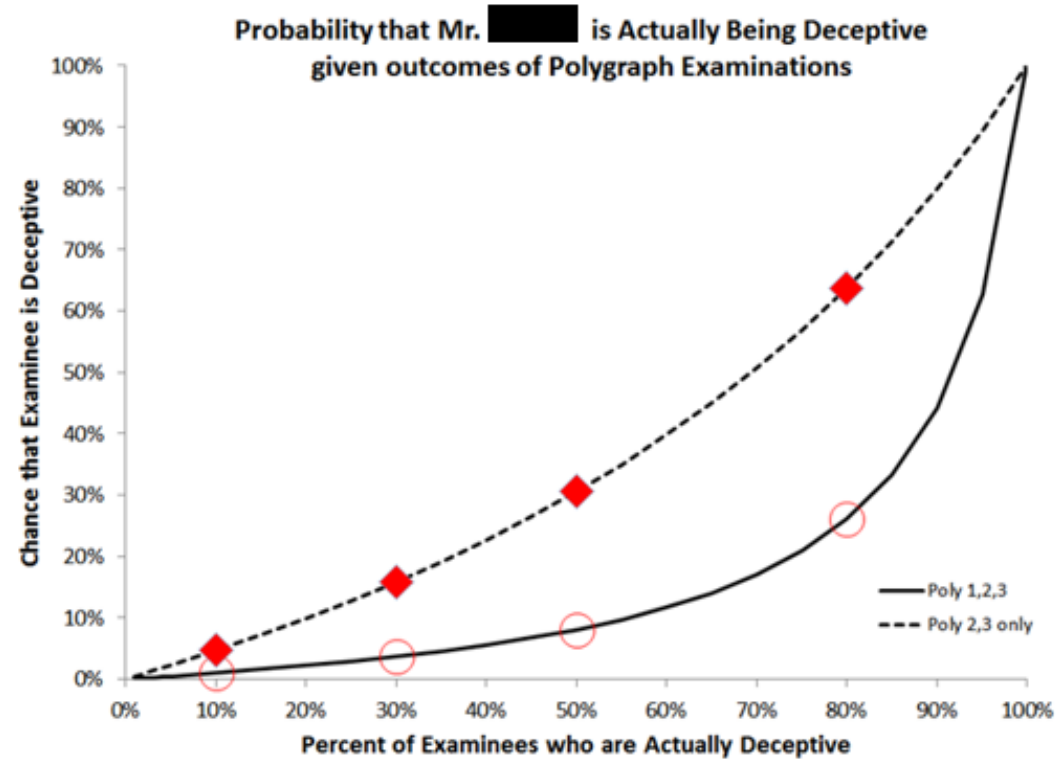
## ◆ Child Custody Case

## ◆ 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



# The Case

## ◆ Child Custody Case

## ◆ My report

- ◆ Overview of Polygraph CIT procedure and logic
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- ◆ 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

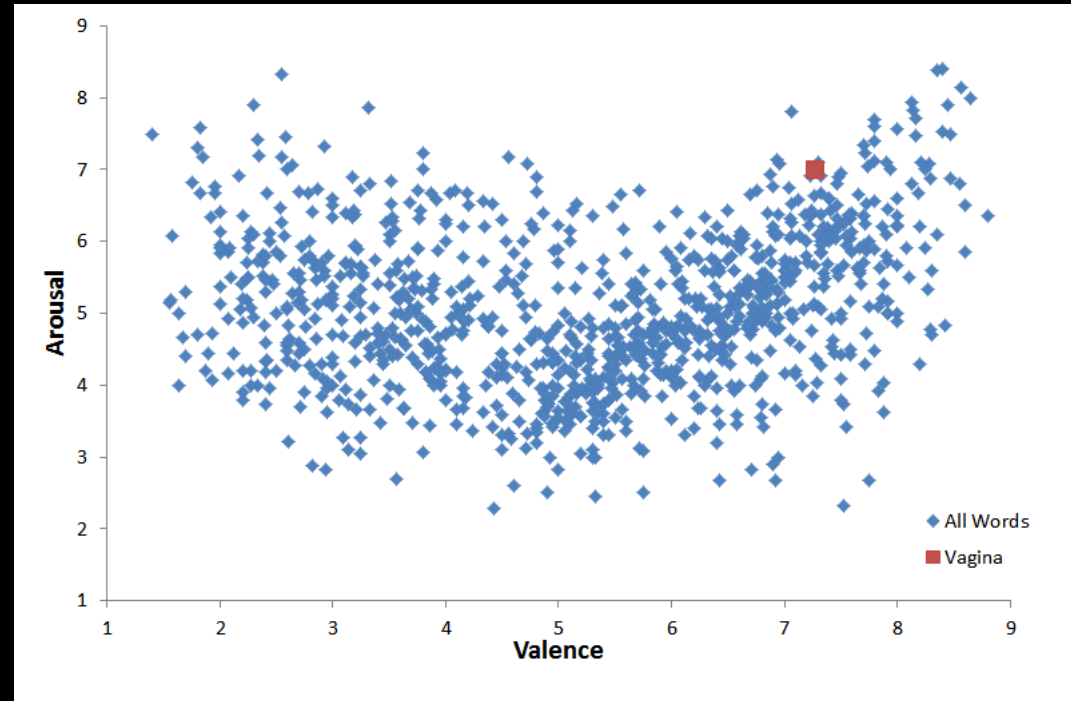
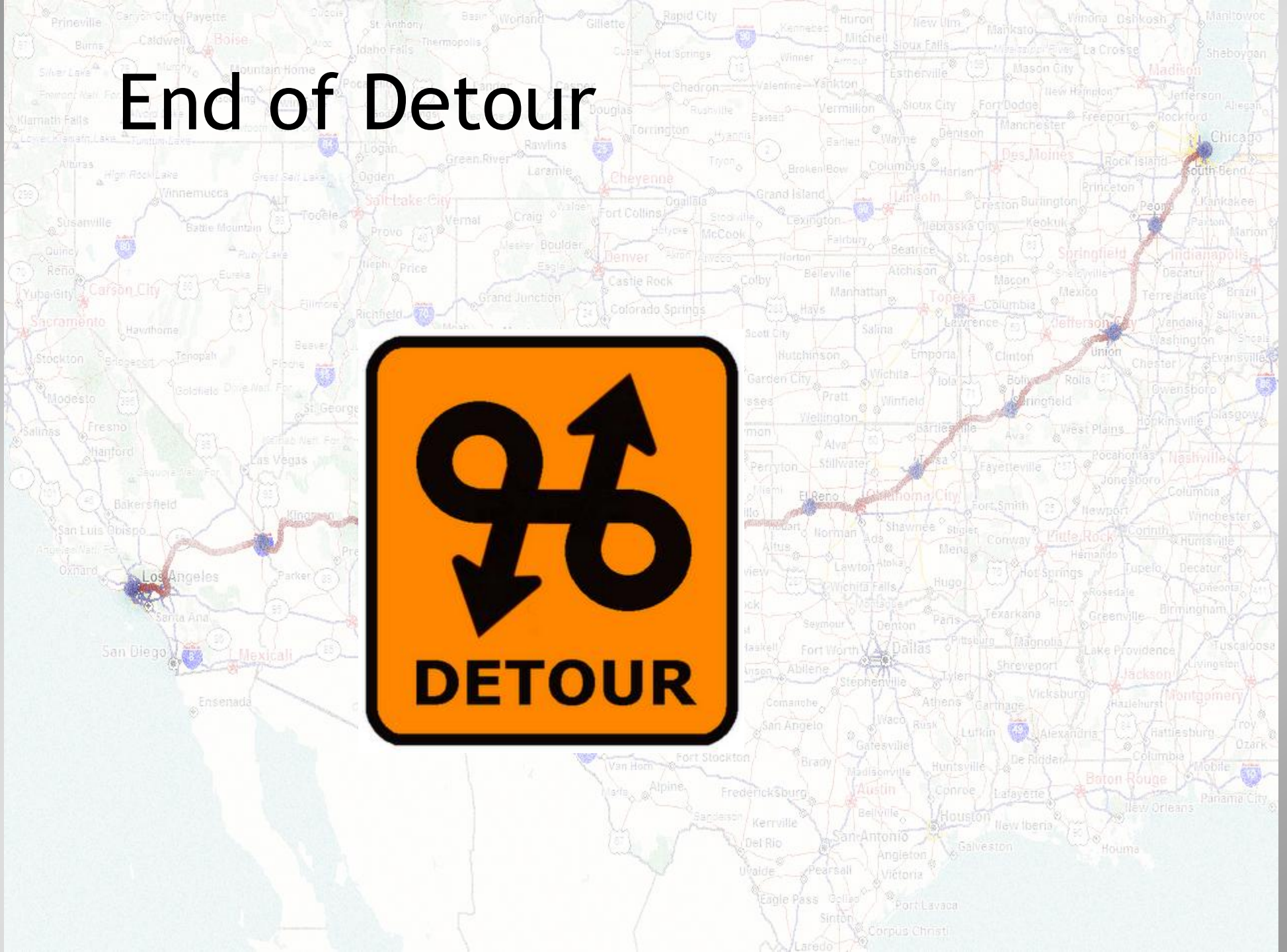


Figure 1. Valence and arousal ratings for 1032 emotional words, with the ratings for “Vagina” shown in red. Ratings are from male research participants (Affective Norms for English Words [ANEW]; Bradley and Lang, 1999, Technical Report C-1, University of Florida). Valence is rated from 1 to 9 (unpleasant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

# End of Detour

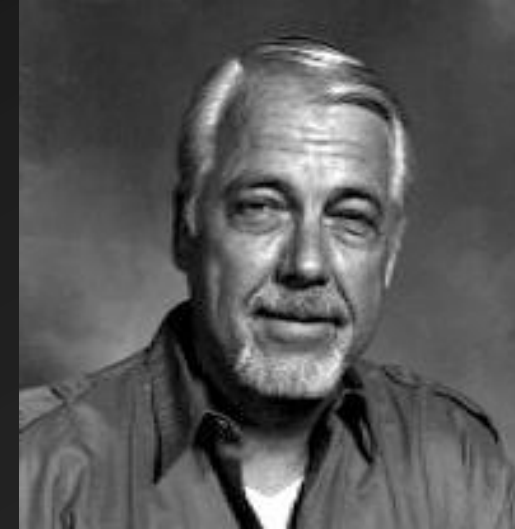


# Roadmap

- 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 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 <sup>st</sup> 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
<b>Study Median</b>	<b>48</b>	<b>88</b>	<b>100</b>

# 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
  - Requires a bit of creativity to derive questions and obtain evidence (e.g. OJ)
- Despite limitations of CQT, may have utility for eliciting confessions
- Over 5,000 GKT tests given in Japan each year, for example



## The current and future status of the concealed information test for field use

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The Concealed Information Test (CIT) is a psychophysiological technique for examining whether a person has knowledge of crime-relevant information. Many laboratory studies have shown that the CIT has good scientific validity. However, the CIT has seldom been used for actual criminal investigations. One successful exception is its use by the Japanese police. In Japan, the CIT has been widely used for criminal investigations, although its probative force in court is not strong. In this paper, we first review the current use of the field CIT in Japan. Then, we discuss two possible approaches to increase its probative force: sophisticated statistical judgment methods and combining new psychophysiological measures with classic autonomic measures. On the basis of these considerations, we propose several suggestions for future practice and research involving the field CIT.

**Keywords:** concealed information test, field application, probative force, statistical judgment, combination of measures

# 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: see [antipolygraph.org](http://antipolygraph.org)
- 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”

# Synopsis

- Procedures that focus on recognition rather than emotional reactions associated with lying:
  - are more accurate overall
  - are much less vulnerable to false positive outcomes
  - create guilty verdicts almost exclusively among the guilty

# 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.*

Carrol, 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 Diatribe, 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



*That's All Folks*



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