LECTURE 4

15 February, 2021
Announcements (2/15/21)

- Electricity Test Today
  - Class resumes at 3:10 pm
- UA moving to Stage 2 for Flex-in-person classes < 50 folks on Feb 22
  - Another Poll
- Please do not forget to use the Comment/Question tool on the class website (gives you attendance credit)
You mentioned that tricyclics and some other medications dry out patients. When conducting an experiment in which skin conductance is measured, would this mean that you would need to screen potential subjects for whether they were taking these medications, and exclude them if they were? Or are there corrections you can do in data acquisition and/or analysis to account for this?
Lab Updates

- SCR GKT lab
  - Should ignore first response in series and score remainder
  - How to make dichotomous verdict of guilty?
    - Lykken’s scoring
    - Binomial Probability
Lykken Method
## Binomial Probability

<table>
<thead>
<tr>
<th># with Max Response (N)</th>
<th>Probability of exactly N</th>
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<tbody>
<tr>
<td>0</td>
<td>0.17</td>
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<tr>
<td>1</td>
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<td>0.00</td>
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<tr>
<td>8</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### Many Options…
- Excel: BINOM.DIST function
- R: binom.test function
- Matlab: binocdf function
- SPSS: Nonparametric tests, Legacy Dialogs, Binomial test
Applications

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

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.
Applications

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

After Hare, Frazelle, & Cox (1978) *Psychophysiology*
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.
“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

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<th>Observer Group</th>
<th>Accuracy</th>
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<td>Robbery Investigators</td>
<td>55.8</td>
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<tr>
<td>Judges</td>
<td>56.7</td>
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<tr>
<td>Psychiatrists</td>
<td>57.6</td>
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<tr>
<td>Special Interest</td>
<td>55.4</td>
</tr>
<tr>
<td>College Students</td>
<td>52.8</td>
</tr>
</tbody>
</table>

\(^a\) 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.


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
  - No credible scientific exists to support using the Polygraph Test
- 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: 2 premix chart assemblies, CDR electrode set, standard Kevlar 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 Stateman

Zero- case, the classic ballistics line 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: 17"W x 21.5"L x 6.5"D).

The Factfinder II

The 12" chart drive allows five pens to be used simultaneously with greater precision. The practice of "pigeon hoisting" of 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 convenience of our standard 8" chart drive models. Available only in a Stateman case, no thermal models are available.

The Courier II

Our newest conventional case style offers a grid molded tool and compact case. 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).
EXHIBIT "B"
A CLASSIC "LYING" REACTION

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

<table>
<thead>
<tr>
<th>Emotion/Arousal</th>
<th>Memory/Recognition</th>
<th>Other Cognitive Correlates</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The” Polygraph</td>
<td>Guilty Knowledge Test</td>
<td>Response Conflict</td>
</tr>
<tr>
<td>Facial Expression</td>
<td>Autonomic (SCR)</td>
<td>Attention and Memory Load</td>
</tr>
<tr>
<td>Voice Stress</td>
<td>Central (ERP, fMRI?)</td>
<td>Both ERP and fMRI</td>
</tr>
<tr>
<td>Facial Blood Flow</td>
<td></td>
<td>Lingusitic Analysis</td>
</tr>
<tr>
<td>Thermography</td>
<td></td>
<td></td>
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<tr>
<td>Demeanor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
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? **Relevant**
- Have you been naked in sight of Susie? **Comparison**
- Have you lied to try to stay out of trouble?
- Have you viewed pornography?
- Have you fantasized sexually about Susie?
Hypothetically…

Innocent  Guilty

(a)  (b)

- Respiration
- Perspiration
- Heart rate

Control question  Relevant question  Control question  Relevant question
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 < 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%)

See www.youtube.com/watch?v=ROhp2aS9pQU
Racial Bias

See Also:

- ACLU: [https://www.aclu.org/blog/privacy-technology/how-lie-detectors-enable-racial-bias](https://www.aclu.org/blog/privacy-technology/how-lie-detectors-enable-racial-bias)


- NAS report [https://www.nap.edu/catalog/10420/the-polygraph-and-lie-detection](https://www.nap.edu/catalog/10420/the-polygraph-and-lie-detection)

See antipolygraph.org for this suppressed report
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

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# The CQT Box Score

<table>
<thead>
<tr>
<th>Professional Polygrapher's Research</th>
<th>Guilty</th>
<th>Innocent</th>
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</thead>
<tbody>
<tr>
<td>Horvath &amp; Reid (1971)</td>
<td>85</td>
<td>91</td>
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<tr>
<td>Hunter &amp; Ash (1973)</td>
<td>88</td>
<td>86</td>
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<tr>
<td>Slowick &amp; Buckley (1975)</td>
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<tr>
<td>Wicklander &amp; Junter (1975)</td>
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<td>95</td>
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<td>Davidson (1979)</td>
<td>90</td>
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<tr>
<td>Yankee, Powell, &amp; Newland (1976)</td>
<td>100</td>
<td>98</td>
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<tr>
<td><strong>Weighted Total</strong></td>
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<td>94</td>
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<table>
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<tr>
<th>Social Scientist's Research</th>
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<tr>
<td>Barlanda &amp; Raskin(^a) (1976)</td>
<td>98</td>
<td>45</td>
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<tr>
<td>Horvatha (1977)</td>
<td>77</td>
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<td>Kleinmuntz &amp; Szucko (1984)</td>
<td>75</td>
<td>63</td>
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<td>Iacono &amp; Patrick (1988)</td>
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<td>55</td>
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<tr>
<td><strong>Weighted Total</strong></td>
<td>88</td>
<td>57</td>
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</table>

\(^a\) is also a trained polygrapher

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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

<table>
<thead>
<tr>
<th>Study</th>
<th>Group</th>
<th>N</th>
<th>Guilty</th>
<th>Innocent</th>
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<td>Raskin &amp; Hare (1978)</td>
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<tr>
<td></td>
<td>Nonpsychopath</td>
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## Effects of Enhancing Realism in Laboratory Studies

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<th>% Accuracy</th>
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<tr>
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<td>23</td>
<td>100</td>
<td>~92</td>
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<tr>
<td></td>
<td>Nonpsychopath</td>
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<td>100</td>
<td>~90</td>
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<tr>
<td>Patrick &amp; Iacono</td>
<td>Psychopath</td>
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<tr>
<td>(1989)</td>
<td>Nonpsychopath</td>
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<td></td>
<td>Nonpsychopath</td>
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<tr>
<td>Patrick &amp; Iacono</td>
<td>Psychopath</td>
<td>20</td>
<td>83</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Nonpsychopath</td>
<td>21</td>
<td>91</td>
<td>50</td>
</tr>
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</table>
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
  - 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
Why Using Confessions Overestimates Accuracy

In Fact Guilty

- Passed Polygraph
  - No Confession
    - Not Selected (False Negative) 0%
  - Confession
    - Selected (True Positive) 100%
- Failed Polygraph
  - No Confession
    - Not Selected (Unverified True Positive) 0%

In Fact Innocent

- Passed Polygraph
  - No Confession
    - Not Selected (False Positive) 0%
- Failed Polygraph
  - Confession of another accused
    - Selected (True Negative) 100%
Feedback Polygraphers Receive

In Fact Guilty

Failed Polygraph

Confession

Selected
(True Positive)
100%

100% of those who confess failed the polygraph!

In Fact Innocent

Passed Polygraph

Confession of another accused

Selected
(True Negative)
100%

100% of those who are exonerrated by another person’s confession passed the polygraph!
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.

<table>
<thead>
<tr>
<th>Test</th>
<th>Verdict</th>
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<tbody>
<tr>
<td>Actual</td>
<td>Guilty</td>
</tr>
<tr>
<td>Guilty</td>
<td>9</td>
</tr>
<tr>
<td>Not Guilty</td>
<td>40</td>
</tr>
</tbody>
</table>

Total correct verdicts = 59%

Probability a guilty verdict is correct: 18.4%
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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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. FAIßMAN, Hastings College of Law, University of California, San Francisco
PATRICIA L. GRABBSCH, 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, 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.”
To strategically plan for and ensure our survival in the years ahead, the APA has been implementing initiatives...

We are at a great time in polygraph history and we can be proud of the steps we are taking to move our profession forward.

Specific-incident polygraph tests can discriminate lying from truth telling at rates well above chance, though well below perfection. Polygraph accuracy for screening purposes is almost certainly lower than what can be achieved by specific-incident polygraph tests in the field.
Detour

- How I got involved in expert testimony
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

<table>
<thead>
<tr>
<th>Clinical interview</th>
<th>Millon Clinical Multi-Axial Inv. III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of collateral information</td>
<td>Multiphasic Sex Inventory II</td>
</tr>
<tr>
<td>Polygraph test</td>
<td>Abel &amp; Becker Sexual Interest Card Sort</td>
</tr>
<tr>
<td>Personality Assessment Inventory</td>
<td>Shipley Inst. Of Living Scale</td>
</tr>
</tbody>
</table>
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 statues 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
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 – ARS25-403,55 would prohibit awarding that parent legal decision-making, and AM25-408 (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(ies) 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 polygraph asks about sexual misconduct or other behavior that can impair 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., polygraph.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 teenagers girls attractive?”). Although examiners are not told the distinction between the questions, they are led to believe (falsely) that there are two ways to 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. Examines that have sufficiently larger responses to relevant questions are deemed deceptive; examines 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=10450. More recently, an ad-hoc committee of the American Polygraph Association published a survey of field polygraph results (6), including more than 43 published samples and 11,000 examinations, and reported overall accuracy of 86.9%, but only after excluding 23.3% of cases with indeterminate verdicts. Unfortunately, more than half the samples come from articles of the lead investigator, and all suffer from the inherent selection bias: to win, 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).
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

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>R5 As an adult, have you had physical, sexual contact with anyone younger than 16 YOA that you have not reported?</td>
<td>C3 N As an adult, have you engaged in any deviant masturbation behaviors you have not reported?</td>
</tr>
<tr>
<td>R7 As an adult, have you had unreported hands-on sexual contact with any minors younger than 16?</td>
<td>C6 N As an adult, were you sexually attracted to any minor girls or boys you have not reported?</td>
</tr>
<tr>
<td>C8 N As an adult, have you done anything sexual that you lied about or that could compromise your court case?</td>
<td></td>
</tr>
</tbody>
</table>

Verdict: Not Deceptive
The Case

Child Custody Case
Polygraph #3

R5 Have you touched your daughter's vagina for a sexual purpose?
R7 Have you touched your daughter's vagina for any sexual purpose?
R10 Have you touched your daughter's Susie's vagina for a sexual purpose?

C4 In general, are you now the type of person that would lie or conceal important information when you were supposed to tell the truth?
C6 Besides what you reported, have you ever lied to or falsified information to persons in authority to avoid serious consequences?
C9 Have you lied about or made something up to get someone else into serious trouble?

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
Polygraph quality review questioned this test.

<table>
<thead>
<tr>
<th>Source</th>
<th>Outcome</th>
<th>p for formula</th>
<th>q for formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly 1</td>
<td>Nondeceptive</td>
<td>0.12</td>
<td>0.6</td>
</tr>
<tr>
<td>Poly 2</td>
<td>Nondeceptive</td>
<td>0.12</td>
<td>0.6</td>
</tr>
<tr>
<td>Poly 3</td>
<td>Deceptive</td>
<td>0.88</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Sensitivity | Specificity
---|---
0.88 | 0.60

Probability that Mr. is actually being deceptive given outcomes of polygraph examinations.

![](chart.jpg)
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
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?

- 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.

Other questions about
- Time abductee taken
- Clothing worn
- etc. for 6-10 questions
<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Guilty</td>
</tr>
<tr>
<td>Lykken '59</td>
<td>98</td>
<td>88</td>
</tr>
<tr>
<td>Davidson '68</td>
<td>48</td>
<td>92</td>
</tr>
<tr>
<td>Podlesney '78</td>
<td>18</td>
<td>90</td>
</tr>
<tr>
<td>Balloun '79</td>
<td>34</td>
<td>61</td>
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<tr>
<td>Giesen '80</td>
<td>40</td>
<td>92</td>
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<tr>
<td>Bradley '81</td>
<td>192</td>
<td>59</td>
</tr>
<tr>
<td>Bradley '84</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>Iacono '84</td>
<td>55</td>
<td>91</td>
</tr>
<tr>
<td>Steller '87</td>
<td>87</td>
<td>85</td>
</tr>
<tr>
<td>Iacono '92</td>
<td>71</td>
<td>87</td>
</tr>
<tr>
<td>O’Toole '94</td>
<td>45</td>
<td>77</td>
</tr>
<tr>
<td><strong>Study Median</strong></td>
<td>48</td>
<td>88</td>
</tr>
</tbody>
</table>
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
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
- 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
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
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.

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 sincerely, however, foul ball psychologists are few and far between.

Ferguson, in Preemployment Polygraphy, 1984