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?

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

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):

```
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
1 2 3 4 5 6 7 8
```

“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

The Difficulty in Detecting Lying

<table>
<thead>
<tr>
<th>Observer Group</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secret Service</td>
<td></td>
</tr>
<tr>
<td>Federal Polygraphers</td>
<td></td>
</tr>
<tr>
<td>Robbery Investigators</td>
<td></td>
</tr>
<tr>
<td>Judges</td>
<td></td>
</tr>
<tr>
<td>Psychiatrists</td>
<td></td>
</tr>
<tr>
<td>Special Interest</td>
<td></td>
</tr>
<tr>
<td>College Students</td>
<td></td>
</tr>
<tr>
<td>chance = 50%</td>
<td></td>
</tr>
</tbody>
</table>

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 science 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"

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>Thermography</td>
<td>Linguistic Analysis</td>
</tr>
<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?

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

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?
- 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?

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)
Roadmap

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  - No credible scientific exists to support using the Polygraph Test
- Overview of alternatives: Assessing recognition

Types of Validity Studies

- **Laboratory:** Mock Crime
- **Field:** Real Life Cases

The CQT Box Score

<table>
<thead>
<tr>
<th>Study</th>
<th>% Correctly Classified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Polygrapher’s Research</td>
<td>Guilty</td>
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<tr>
<td>Horvath &amp; Reid (1971)</td>
<td>85</td>
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<tr>
<td>Hunter &amp; Ash (1973)</td>
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<tr>
<td>Slovick &amp; Buckley (1975)</td>
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<tr>
<td>Wicklander &amp; Junter (1975)</td>
<td>92</td>
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<tr>
<td>Davidson (1979)</td>
<td>90</td>
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<tr>
<td>Yankee, Powell, &amp; Newland (1976)</td>
<td>100</td>
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<tr>
<td>Weighted Total</td>
<td>91</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>% Correctly Classified</th>
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</thead>
<tbody>
<tr>
<td>Social Scientist’s Research</td>
<td>Guilty</td>
</tr>
<tr>
<td>Bartanda &amp; Raskin (1976)</td>
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<tr>
<td>Horvath (1977)</td>
<td>77</td>
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<tr>
<td>Kleinmuntz &amp; Szucko (1984)</td>
<td>75</td>
</tr>
<tr>
<td>Iacono &amp; Patrick (1988)</td>
<td>98</td>
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<tr>
<td>Weighted Total</td>
<td>88</td>
</tr>
</tbody>
</table>

* is also a trained polygrapher

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>
</tr>
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<tbody>
<tr>
<td>Raskin &amp; Hare (1978)</td>
<td>Psychopath</td>
<td>23</td>
<td>100</td>
<td>~92</td>
</tr>
<tr>
<td></td>
<td>Nonpsychopath</td>
<td>20</td>
<td>100</td>
<td>~90</td>
</tr>
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</table>

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<th>N</th>
<th>Guilty</th>
<th>Innocent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patrick &amp; Iacono (1989)</td>
<td>Psychopath</td>
<td>20</td>
<td>100</td>
<td>~90</td>
</tr>
<tr>
<td></td>
<td>Nonpsychopath</td>
<td>21</td>
<td></td>
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</tbody>
</table>
Effects of Enhancing Realism in Laboratory Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Group</th>
<th>N</th>
<th>% Accuracy</th>
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<tbody>
<tr>
<td>Raskin &amp; Hare (1978)</td>
<td>Psychopath</td>
<td>23</td>
<td>100</td>
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<tr>
<td></td>
<td>Nonpsychopath</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>~92</td>
</tr>
<tr>
<td>Patrick &amp; Iacono (1989)</td>
<td>Psychopath</td>
<td>20</td>
<td>83</td>
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<td></td>
<td>Nonpsychopath</td>
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<td>91</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>63</td>
</tr>
</tbody>
</table>

Problems with Field Studies

- How is ground truth established?
  - Judicial verdicts inadequate
  - 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

- In Fact Guilty
  - Passed Polygraph
    - Confession: 100% of those who confess passed the polygraph
    - Not Selected (False Negative): 0%
  - Failed Polygraph
    - Confession: 0%
    - Not Selected (True Negative): 0%
  - No Confession: 100% of those who are exonerated by another person’s confession passed the polygraph

- In Fact Innocent
  - Passed Polygraph
    - Confession: 100%
    - Not Selected (False Negative): 0%
  - Failed Polygraph
    - Not Confession: 0%
    - Selected (True Positive): 100%

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>
<th>Actual</th>
<th>Guilty</th>
<th>Not Guilty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guilty</td>
<td>9</td>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Not Guilty</td>
<td>40</td>
<td>50</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

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, Paul Shaw, Leonid 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 unconfmed cases. As a result, field studies may overestimate PDD decision accuracy to some degree.”
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

<table>
<thead>
<tr>
<th>Clinical interview</th>
<th>Miller 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

Never Trust the Polygraph

Probability curve for a Polygraph for False
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

Verdict: Not Deceptive

“The 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?”

The Case

Child Custody Case
Polygraph #2

Verdict: Not Deceptive

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 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?

The Case

Child Custody Case
Polygraph #3

Verdict: Deceptive

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
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

---

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End of Detour

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.

GKT Accuracy: Lab Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lykken '59</td>
<td>98</td>
<td>88</td>
</tr>
<tr>
<td>Davidson '68</td>
<td>48</td>
<td>82</td>
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<tr>
<td>Podlesney '78</td>
<td>18</td>
<td>90</td>
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<tr>
<td>Balloun '79</td>
<td>34</td>
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<tr>
<td>Giesen '80</td>
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<tr>
<td>Bradley '81</td>
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<tr>
<td>Bradley '84</td>
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<td>Iacono '84</td>
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<td>87</td>
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<tr>
<td>O'Toole '94</td>
<td>45</td>
<td>77</td>
</tr>
<tr>
<td>Study Median</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.

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”

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.

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

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