THE SECRET LIFE OF THE BRAIN

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Research News

Brain Scans Make for More Accurate Lie Detector Tests

by Noah Adams and Ira Flatow 2 December 2004

NewScientistTech

Can a brain scan prove you're telling the truth?

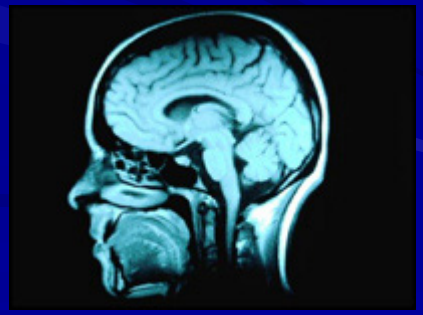
6 February 2007, Phil McKenna

BBC NEWS

Brain scan 'sees hidden thoughts'

The scan picks up subliminal thought activity

Scientists say they can read a person's unconscious thoughts using a simple brain scan. 25 April 2005



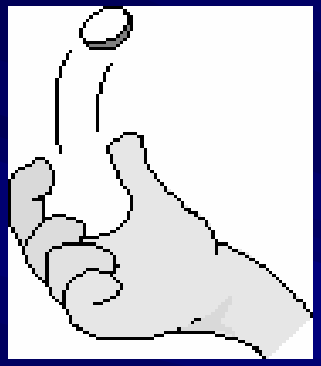
What is the rate of error?

[T]he court ordinarily should consider the known or potential rate of error, see, *e. g.*, *United States* v. *Smith*,869 F. 2d 348, 353-354 (CA7 1989) (surveying studies of the error rate of spectrographic voice identification technique), and the existence and maintenance of standards controlling the technique's operation. See *United States* v. *Williams*, 583 F. 2d 1194, 1198 (CA2 1978) (noting professional organization's standard governing spectrographic analysis).

Subjects correctly classified?

- 90% of all subjects lie
- Test has a 90% chance of reporting “lie” *regardless of whether the subject lies*
- Test has an expected “accuracy” of 82%
  - 90% of the 90% of the deceptive subjects are classified as deceptive (81%)
  - 10% of the 10% of the truthful subjects are classified as truthful (1%)
- Something is wrong here!

Flipping a (weighted) coin



- P (“+”|+) = 0.90
- P(“+”|−) = 0.90
- LR = 1

Measuring probative value

- P(“+”|+) sensitivity
- P(“+”|−) 1 − specificity
- LR = P(“+”|+) / P(“+”|−) likelihood ratio
- Sensitivity: 95 out of 100 subjects who lie are declared to lie: P(“+”|+) = 0.95
- Specificity: 95 out of 100 subjects who do not lie are declared not to lie: P(“−”|−) = 0.95; hence, P(“+”| −) = 0.05
- LR = 19

Accurate test – Low prevalence

- Prevalence of lying is 100 in 2000
- Of the 100 liers, about 95% (95), are “+”
- Of the 1900 nonliers, about 5% (95), are “+”
- Half the “+”s are false positives
- Predictive value positive = 50%

- Seems like coin tossing!

But it isn't!

- Of the 100 liers, the coin toss brands 50 or so as liers (previously 95)
- Of the 1900 nonliers, about 950 are branded as liers (previously 95)
- About 950 of the 1000 "+"s are false (95%, previously 50%)
- PVP = 50 /1000 = 5% (previously 50%)

Which statistic is appropriate?

- For probative value, LR
  - Coin toss sensitivity 50% and specificity 50%
    - LR = 1, Prev = 100/2000 = 5%, PVP = 5%
  - Test sensitivity 95% and specificity 95%
    - LR = 19, Prev = 5%, PVP = 50%
- For strength of the case (in absence of other evidence), PVP

References

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