



Statistical Analysis and the Illusion of Objectivity

by



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Statistical Analysis and the Illusion of Objectivity

Thesis: To show that objective data needs subjective input to reach sensible conclusions.

Two reasons for subjectivity:

- 1) Bayesian analysis yield answers which are much easier to understand, less likely to have misinterpretation.
- 2) Standard Statistical methods depends on the intentions of the investigator (the subjective input arises from the producer rather than the consumer of the data)



Setting up the “Experiment”

Study: to find the effectiveness of Vitamin C in treating the common cold

Null Hypothesis (H): Vitamin C has no effect on the common cold

Subjects: 17 matched pairs

Results: 13 pairs (C) was better than (P)
(C) Vitamin C ; (P) Placebo



Standard Statistical Methods

- 1) Identify null-hypothesis and derive probability distribution
- 2) Let R denote the set of possible observations that cast as much or more doubt on H
- 3) Calculate the P-value (observed significance level)



Caution:

- ◆ What were the motives of the investigators?
- ◆ How do people interpret these p-values?

Solution:

- ◆ Bayesian statistics produce “final probabilities” that can be compared.



Bayesian Approach

- 1) Choose initial probability (.01 to .09)
- 2) Calculate final probability (complex equation)



Uneasiness

Standard: P-value hides choices (subjectivity) of investigator

Bayesian: depends on subjectivity of consumer, expert, or your personal beliefs

Standard: P-values change based on observations

Bayesian: greater flexibility; not based on observations



Bayesian Method & Subjectivity

Advantages

- ◆ Probabilities can be calculated and reported any time
- ◆ Experimental plans can be modified at any time (with no loss in drawing valid statistical conclusions)
- ◆ Experiments can be evaluated and planned on the basis of current probabilities, maximizing the amount of information to be gained at a fixed cost
- ◆ Different experiments can be combined to arrive at a final probability.
- ◆ Many problems arising in fields can be vitally important to involve the subjective information possessed by the decision-maker



Conclusion

Note: Bayesian gives similar results in most situations

Two Main situations:

- ◆ Testing of precise hypothesis
- ◆ Accumulating data (clinic trials)