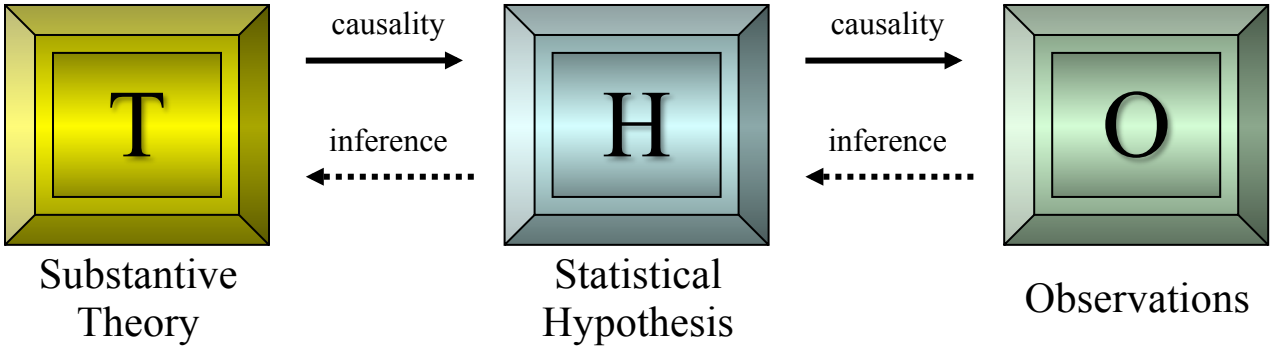
Causal and inferential relations between substantive theory, statistical hypothesis, and observational data:



Corrroboration problem:
Appraising theory by facts
(Metatheorist's and logician's concern)

Inferential statistics problem:
Estimating parameters from sample
(Statistician's concern)

Based on Fig. 2 in Meehl (1990) Appraising and amending theories: The strategy of Lakatosian defense and two principles that warrant using it. *Psychological Inquiry*, *1*, 108–141, 173–180.

Four figures of the implicative syllogism:

I	**II**	**III**	**IV**
p ⊃ q	**p ⊃ q**	**p ⊃ q**	**p ⊃ q**
p	**~p**	**q**	**~q**
∴ q	**∴ ~q**	**∴ p**	**∴ ~p**
Modus ponens	**Denying the antecedent**	**Affirming the consequent**	***Modus tollens***
(valid)	**(invalid)**	**(invalid)**	**(valid)**

Corroboration formula for appraising theories:

$$T \,.\, [T_{aux} \,.\, C_p \,.\, A_I \,.\, C_n] \rightarrow (O_1 \supset O_2)$$

where:

T : The theory of interest

T_{aux} : Auxiliary theories relied on in the particular experiment

C_p : *Ceteris paribus* clause

A_I : Instrumental auxiliaries

C_n : The particulars stated

O_1 : An observation

O_2 : Another observation

Selected references:

Morrison, D. E. & Henkel, R. E. (Eds.). (1970). *The significance test controversy*. Chicago: Aldine.

Meehl, P. E. (1967). Theory-testing in psychology and physics: A methodological paradox. *Philosophy of Science*, *34*, 103-115. [Reprinted in D. E. Morrison & R. E. Henkel (Eds.), *The significance test controversy* (pp. 252-266). Chicago: Aldine, 1970.]*

Meehl, P. E. (1978). Theoretical risks and tabular asterisks: Sir Karl, Sir Ronald, and the slow progress of soft psychology. *Journal of Consulting and Clinical Psychology*, *46*, 806-834. [Reprinted in Meehl, *Selected philosophical and methodological papers* (pp. 1-43; C. A. Anderson and K. Gunderson, Eds.). Minneapolis: University of Minnesota Press, 1991.]*

Meehl, P. E. (1990). Why summaries of research on psychological theories are often uninterpretable. *Psychological Reports*, *66*, 195-244. Also in R. E. Snow & D. Wiley (Eds.), *Improving Inquiry in social science: A volume in honor of Lee J. Cronbach* (pp. 13-59). Hillsdale, NJ: Lawrence Erlbaum Associates, 1991.*

Meehl, P. E. (1990). Appraising and amending theories: The strategy of Lakatosian defense and two principles that warrant using it. *Psychological Inquiry*, *1*, 108-141, 173-180.*

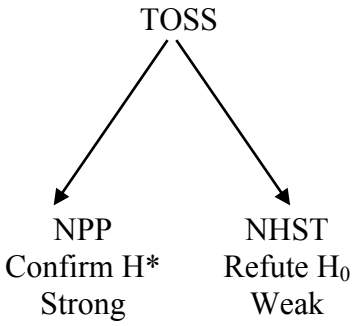
Meehl, P. E. (1992). The Miracle Argument for realism: An important lesson to be learned by generalizing from Carrier's counter-examples. *Studies in History and Philosophy of Science*, *23*, 267-282.*

Meehl, P. E. (1997). The problem is epistemology, not statistics: Replace significance tests by confidence intervals and quantify accuracy of risky numerical predictions. In L. L. Harlow, S. A. Mulaik, & J.H. Steiger (Eds.), *What if there were no significance tests*? (pp. 393-425). Mahwah, NJ: Erlbaum.*

* These reprints are available at http://meehl.umn.edu

Written on blackboard:

Diagram:



(NPP = Numerical Point Prediction)

Bayes' formula: $$p(h_i/e) = \frac{P_i p(e/h_i)}{P_i p(e/h_i) + \sum P_j p(e/h_j)}$$

Abstract for Dr. Meehl's talk to CCS 1/30/03:

Critique of Null Hypothesis Significance Testing

Null hypothesis significance testing (NHST) is usually not a good method for appraising psychological theories in the "soft" fields, because H_0 is quasi-always false; thus, whether one refutes H_0 depends more on the power function than on whether the theory is true or false. In the advanced sciences (e.g., physics) where theories are strong enough to make numerical point predictions, refuting a statistical hypothesis H* speaks against the theory; hence high statistical power puts a theory at high risk. We should be careful not to conflate the probability of a statistical hypothesis H with the probability of a substantive causal theory T which is almost never equivalent to H. Psychologists should try to invent theories strong enough to make point or narrow interval predictions rather than the weak prediction that the difference between two groups is on one side of zero.

Outline of PEM's talk if needed:

Weak/Strong --- Power
T ≠ H
Meehl's Sc theory: syllogism
Crud factor, 2 pots
Confirmation formula: Schachter
Box score 7:3
Agronomy, pharmacology
Meta-analysis
Cliometrics

(afterthought: should have mentioned "magic" of .05 level)