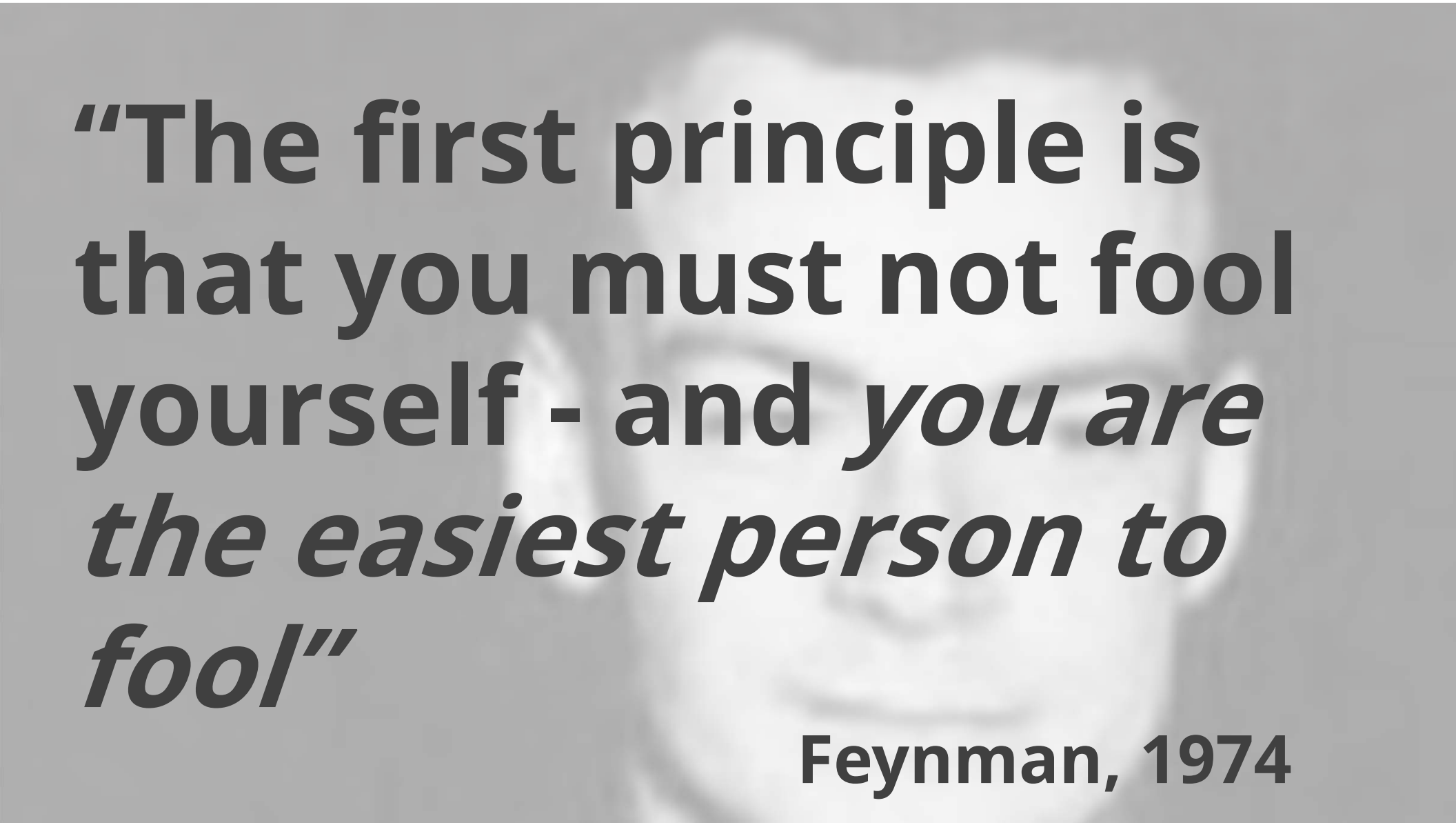
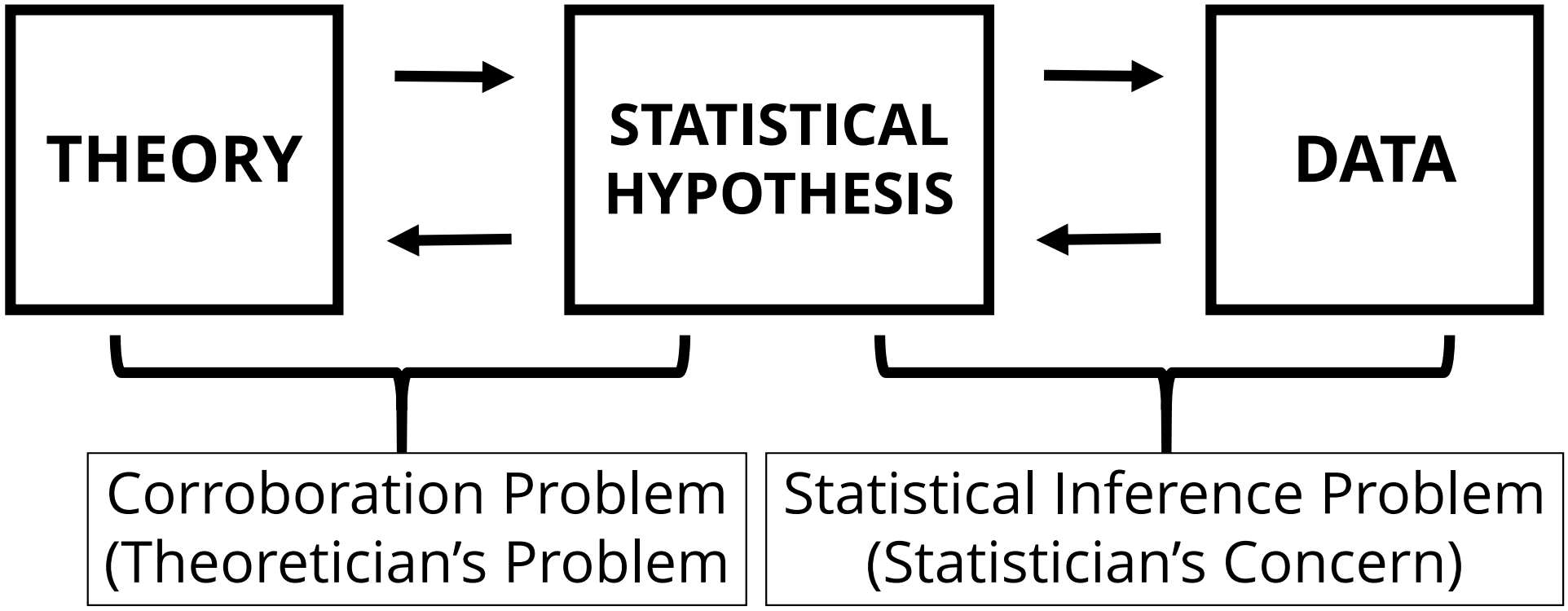
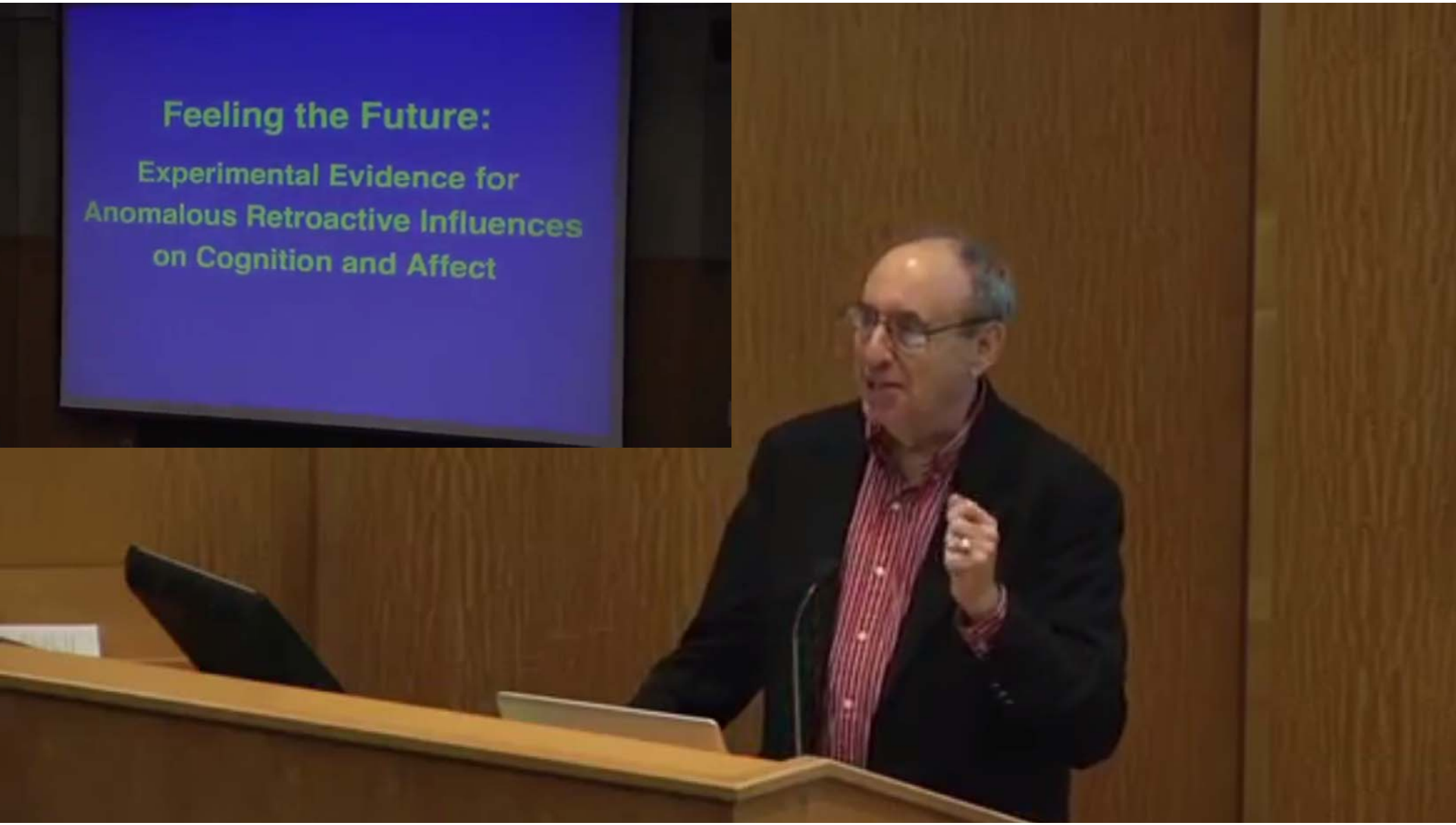
Improving Your Statistical Inferences


“The first principle is that you must not fool yourself - and *you are the easiest person to fool*”
Feynman, 1974


THEORY
STATISTICAL HYPOTHESIS
DATA
Corroboration Problem (Theoretician's Problem
Statistical Inference Problem (Statistician's Concern)

Meehl, 1990


Feeling the Future:
Experimental Evidence for
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Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

Summary

There is increasing concern that most current published research findings are false. The probability that a research claim is true may depend on study power and bias, the number of other studies on the same question, and, importantly, the ratio of true to no relationships among the relationships probed in each scientific field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions,

factors that influence this problem and some corollaries thereof.

Modeling the Framework for False Positive Findings

Several methodologists have pointed out [9–11] that the high rate of nonreplication (lack of confirmation) of research discoveries is a consequence of the convenient, yet ill-founded strategy of claiming conclusive research findings solely on the basis of a single study assessed by formal statistical significance, typically for a *p*-value less than 0.05. Research is not most appropriately represented and summarized by *p*-values, but,

is characteristic of the field and can vary a lot depending on whether the field targets highly likely relationships or searches for only one or a few true relationships among thousands and millions of hypotheses that may be postulated. Let us also consider, for computational simplicity, circumscribed fields where either there is only one true relationship (among many that can be hypothesized) or the power is similar to find any of the several existing true relationships. The pre-study probability of a relationship being true is $R/(R+1)$. The probability of a study finding a true relationship reflects the power $1 - \beta$ (one minus

Make better statistical inferences.

p-values, effect sizes, confidence intervals, Bayes Factors, likelihoods

Design more informative experiments

Control error rates, run high-powered studies, theory construction

Evaluate the evidence in the literature

p-curve analysis & publication bias.

Facilitate cumulative science

Replications, pre-registration, open science.

Assignments

Hands on, in depth, learning through simulations

Let’s get started!

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