

Experience with Empirical Studies in Industry: Building Parametric Models

Response

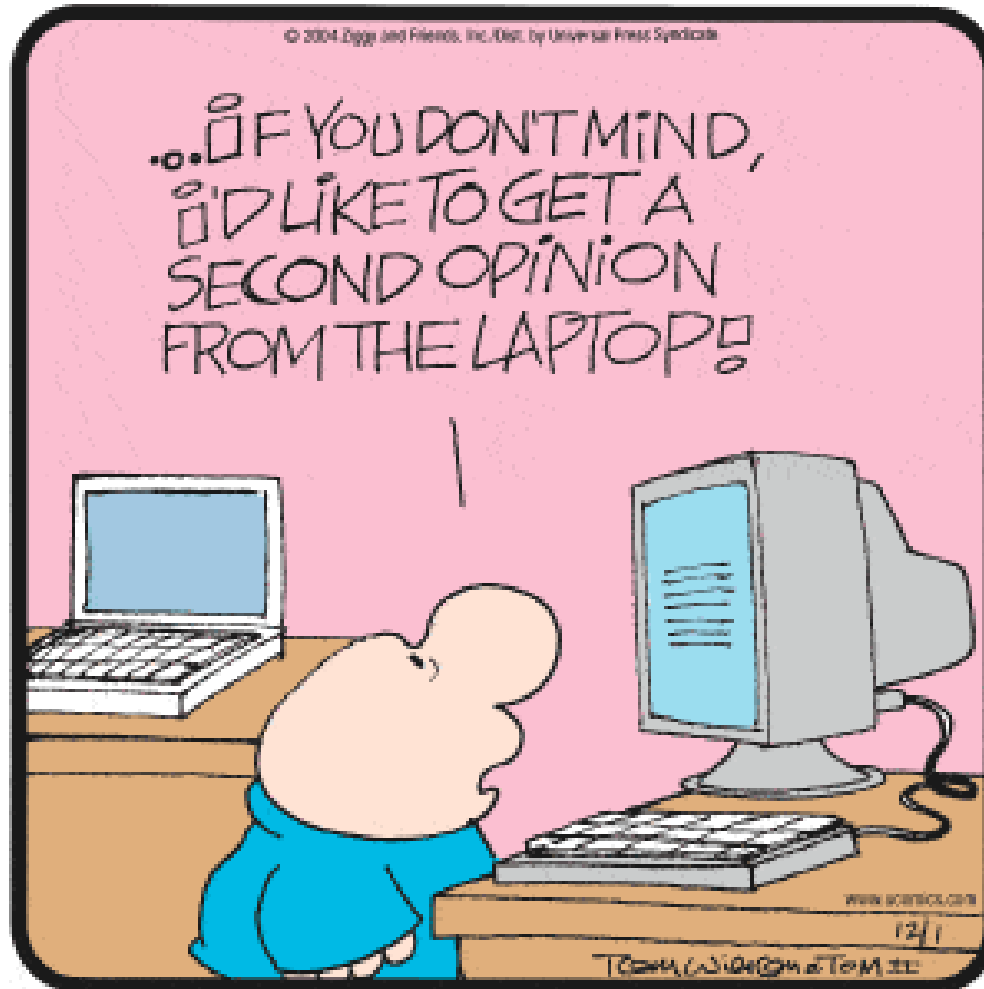
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Wisdom from Ziggy



Immediate Response

- ❖ In violent agreement 😊
- ❖ A great approach - appropriate emphasis on data
- ❖ A really good method
- ❖ Lots of good examples
- ❖ Meaningful results

- ❖ Complaint - not enough about THEORY!
 - ★ Provides a great approach to create/evolve theories
 - ★ General SE problem: not nearly enough emphasis on theory
 - As bases for our work
 - As results for our work

Parametric Models

- ❖ Barry's "Parametric Model" is a software system interpretation/analogy of basic empirical study structure
 - ★ Outcomes = $F(\text{Parameters})$
 - ★ A *Treatment* (F)
 - manipulates the *Independent Variables* (Parameters)
 - producing results in the *Dependent Variables* (Outcomes)
- ❖ Basic software system questions:
 - ★ Are we building the right system?
 - ★ Are we building it right?
 - ★ Is it doing what we expect it to do?
 - ★ What is it useful for?
- ❖ Basic empirical studies questions:
 - ★ Are we measuring/evaluating what we mean to measure/evaluate?
 - ★ Are the results due solely to our manipulations?
 - ★ Are our conclusions justified
 - ★ What are the results applicable to?

Validity Issues

- ❖ **Sequentially dependent**
- ❖ **Construct validity**
 - ★ Are we evaluating/measuring what we meant to evaluate/measure?
 - ★ Abstract constructs
 - ★ Concrete, observable constructs
- ❖ **Internal Validity**
 - ★ Are the results due solely to our manipulations?
 - ★ Or are there confounding variables- ie, alternative explanations
- ❖ **Analysis Logic and Statistical Validity**
 - ★ Are our conclusions justified?
- ❖ **External Validity**
 - ★ What are the results applicable to?
 - ★ Several alternative interpretations here

Construct Validity

- ❖ Are we measuring what we intend to measure
 - ★ Akin to the requirements problem: are we building the right system
 - ★ If we don't get this right, the rest doesn't matter
- ❖ Constructs: abstract and concrete concepts
 - ★ Abstract: theoretical constructions
 - ★ Must be operationalized into concrete for the experiment
- ❖ Necessary condition for successful experiment
- ❖ Divide construct validity into three parts:
 - ★ Intentional Validity
 - Do the constructs adequately represent what we intend to study
 - ★ Representation Validity
 - Do the constructs adequately represent what we intend to study
 - ★ Observation Validity
 - How good are the measures themselves

Internal Validity

- ❖ Are the values of the dependent variables solely the result of the manipulations of the independent variables
 - ★ Analogously, is the output solely a function of the input
- ❖ Have we ruled out rival hypotheses
- ❖ Have we eliminated confounding variables
 - ★ Participant variables
 - ★ Experimenter variables
 - ★ Stimulus, procedural and situational variables
 - ★ Instrumentation
 - ★ Nuisance variables

Internal Validity

- ❖ **Confounding effects**
 - ★ Treatment effect and some other effect cannot be separated
- ❖ **Confounding sources of internal invalidity**
 - ★ **History**
 - Takes place between pre and post test
 - May contaminate post test results
 - ★ **Maturation**
 - Older/wiser/better between pre/post
 - ★ **Instrumentation**
 - Change due to test instrument
 - ★ **Selection**
 - nature of subjects
 - Control over assignment may have effects

Statistical Conclusion Validity

- ❖ Are the presumed causal variable X and its effect Y statistically related
 - ★ Ie, do they co-vary
 - ★ If unrelated then the one cannot be the cause of the other
- ❖ 3 questions (sequentially dependent)
 - ★ Are there enough data points
 - ★ Is the study sufficiently sensitive
 - ★ What is the evidence that they co-vary
 - ★ How strongly do they co-vary

External Validity

❖ Several positions

- ★ The generalizability beyond that studied/observed
 - Strongest: generalizes to all types of domains/systems
- ★ The extent to which the results support the claims of generalizability
 - The specific claim is limited but fully supported to the extent of the claim
- ★ Generalizability not an issue
 - Eg, demonstrating that the treatment produces the effects predicted from the corresponding theory

Wisdom from the Wizard of ID



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