

“Evaluating evidence”

...and re-evaluating what that means

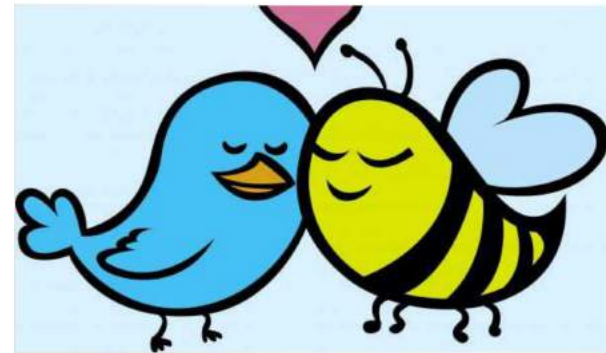
Catherine Case, University of Georgia

The chicken-and-egg of inference

- ▶ George Cobb
(always the provocative prophet)...
- ▶ Why do so many colleges and grad schools teach $p=0.05$?
 - Because that's still what the scientific community and journal editors use.
- ▶ Why do so many people still use $p=0.05$?
 - Because that's what they were taught in college or grad school.

Moving to a world beyond $p < 0.05$

- ▶ If we compare uncertainty to cold weather, “significance tests and dichotomized p-values have turned many researchers into scientific snowbirds trying to avoid dealing with uncertainty by escaping to a “happy place” where results are either significant or not.



Moving to a world beyond $p < 0.05$

- ▶ If we compare uncertainty to cold weather, “significance tests and dichotomized p-values have turned many researchers (and teachers and students) into scientific snowbirds trying to avoid dealing with uncertainty by escaping to a “happy place” where results are either significant or not.



Avoiding uncertainty

- ▶ For students, especially those expecting a math class...

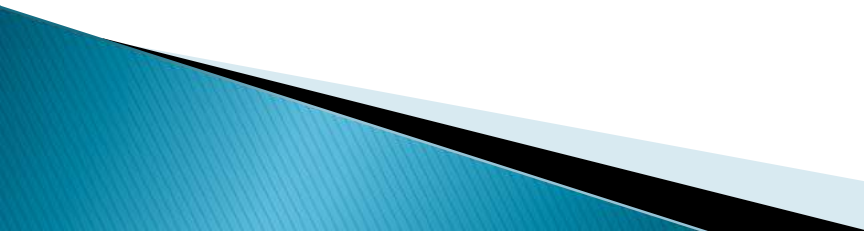
$p\text{-value} = 0.04 \rightarrow \boxed{\text{Reject } H_0}$

- ▶ For teachers, especially those who like tidy grading rubrics...

AP Statistics Scoring Guidelines

- Essentially correct if the response
- References a correct p-value
 - Justifies the conclusion based on the size of the p-value
 - States the conclusion in context


Anyone feeling nervous?

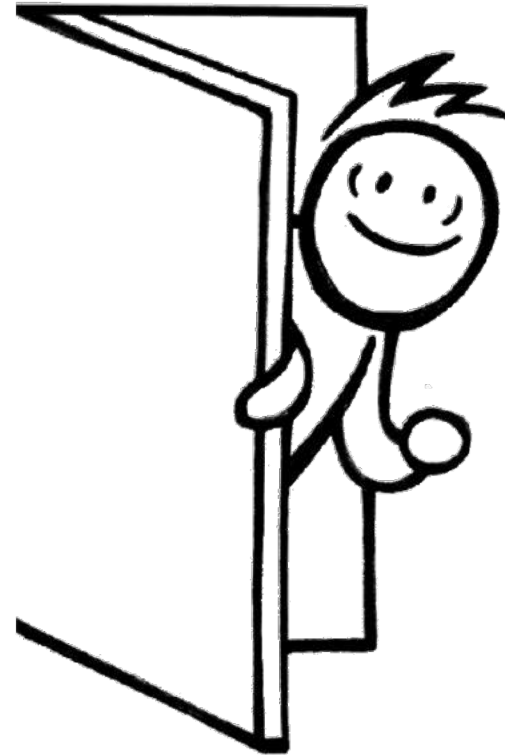
- ▶ We used to have something we called the “consensus curriculum”
 - ▶ Now we’re re-evaluating that curriculum...
 - Do intro stat students still need to learn about degrees of freedom?
 - Do they need to learn Git/Github?
 - ▶ ... accepting new kinds of complexity.
 - How do students define data and relate to it?
 - What are their problem-solving phases?
 - What can we learn from think-alouds?
- 

Teaching more than p-values

- ▶ “No single index should substitute for scientific reasoning.”
 - Closing sentence of the ASA’s statement on p-values.
- ▶ Design of experiments and observational studies
- ▶ Effect sizes
- ▶ Open science / reproducibility
- ▶ Data science / big data
- ▶ Causal diagrams
- ▶ Bayesian methods

Teaching p-values in better ways

- ▶ “P-value, it’s not your fault.”
 - Beth Chance
- ▶ How else are we going to know when to swipe right?! 




Rules to live by

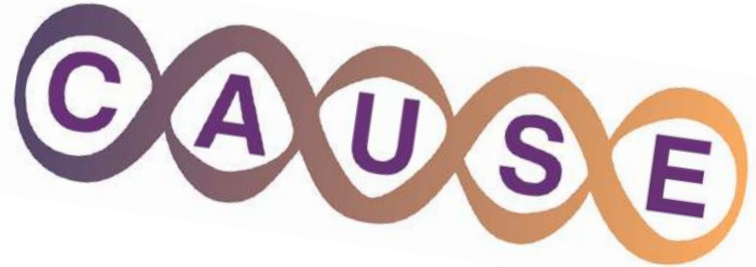
- ▶ “Don’t try to use a word in conversation if you don’t even know how to spell it.”
 - Coach Jim Case
 - JSU baseball (conference champs as of last night!)



Rules to live by

- ▶ “Don’t try to use a word in conversation if you don’t even to know how to spell it.”
 - Coach Jim Case
 - ▶ “We believe a reasonable pre-requisite for reporting any p-value is the ability to interpret it correctly.”
 - Moving to a world beyond $p < 0.05$
 - ▶ How do we teach our students to be responsible users of data?!
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But we don't have to do it alone!



An International Journal on the Teaching and Learning of Statistics

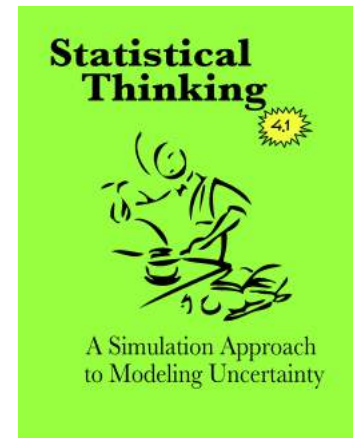
JSE Data Archive

Rossman/Chance Applet Collection



Interactive Web Apps

StatKey



(Non-dichotomous) Conclusion

- ▶ **A**ccept Uncertainty
 - When trying new things in the classroom
 - ▶ Be **T**houghtful
 - About what belongs in the curriculum
 - ▶ Be **O**pen
 - And willing to share resources, lessons, and datasets
 - ▶ Be **M**odest
 - And admit that teaching statistics is a work in progress.
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