The Value of Accepting the Null Hypothesis

Andy Grogan-Kaylor

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1 Background

In standard frequentist models, we cannot formally accept the *null hypothesis* H_0, but can only reject, or fail to reject, H_0.

Bayesian models allow one to both accept and reject H_0 (Kruschke and Liddell 2018).

> Accepting The Null Hypothesis
>
> Accepting H_0 may be very scientifically valuable, and may have consequences for affirming similarity, universality, or treatment invariance (Gallistel 2009; Morey, Homer, and Proulx 2018).
> The ability to accept H_0 may also lead to a lower likelihood of the publication bias that results from frequentist methods predicated upon the rejection of H_0 (Kruschke and Liddell 2018).
> Lastly, the ability to accept H_0 means that one is not only looking for statistically credible–or statistically significant–results as substantively important findings, but that results supporting the null hypothesis can also be seen as substantively important findings that contribute to theory and practice.

Bayesian And Frequentist Perspectives

Figure 1: Thomas Bayes

This handout is written from a *Bayesian* perspective. However, even from a traditional *frequentist* statistical perspective, it may be helpful to think about the *value* of results that are *not statistically significant*.

Statistical Power

A finding of a *null result* is dependent on having enough statistical power that one might plausibly detect an effect were an effect to exist.

Addressing Hard Problems (A Personal View)

Most of the research teams that I work with are addressing *hard problems* like: child abuse; harsh parenting; mental health challenges; and substance use.
Many of these issues are complicated, long-standing, and sometimes seemingly intractable.
I think that in any statistical model, some associations end up not being statistically credible, or in frequentist models, not statistically significant. Unfortunately, I think this is often seen as a "failure" of the statistical model, or as a rejection of the conceptual underpinnings of a particular project in its entirety.
I've been hoping that statistical modeling might be seen more as a process of **discernment**: Which results are credible or significant? Which results are not credible or significant? How does this pattern of results help us understand the issues that we are working with more deeply? What does this imply for our future work? What aspects of our current work do we need to strengthen in the future?
After all, we are usually trying to address longstanding and difficult problems. Not every result in every model is going to be statistically credible or significant, and I think finding results that are statistically not credible, or statistically insignificant can be informative.

2 Important Substantive Cases

The Value of Accepting the Null Hypothesis H_0

case	description	H_0	example
Equivalence Testing	Equivalence Of 2 Treatments Or Interventions	$\beta_1 = \beta_2$	The effect of Treatment 1 is indistinguishable from the effect of Treatment 2 (especially important if one treatment is much more expensive, or time consuming than another).
Equivalence Testing	Equivalence Of 2 Groups On An Outcome	$\bar{y_1} = \bar{y_2}$ or in multilevel modeling $u_0 = 0$	People identifying as men and people identifying as women are more similar than different with regard to psychological processes (Hyde2005).
Retiring Interventions	There Is No Evidence That Intervention X Is Effective	$\beta_{intervention} = 0$	Evidence consistently suggests that a particular treatment has near zero effect.
Contextual Equivalence	Equivalence of a Predictor Across Contexts (Moderation)	$\beta_{interaction} = 0$ or in multilevel modeling $u_k = 0$	Warm and supportive parenting is equally beneficial across different contexts or countries.
Family Member Equivalence	Equivalence of a Predictor Across Family Members	$\beta_{parent1} = \beta_{parent2}$	Parenting from one parent is equivalent to parenting from another parent
Full Mediation	Association of x and y Is Completely Mediated; No Direct Effect	$\beta_{xmy} \neq 0$ $\beta_{xy} = 0$	The relationship of the treatment and the outcome is completely mediated by mechanism m.

case	description	H_0	example
No Mediation	No Indirect Effect; Association of x and y Is Not Mediated by m	$\beta_{xmy} = 0$ $\beta_{xy} \neq 0$	The relationship of the treatment and the outcome is not mediated at all by mechanism m.
Theory Simplification	Removing An Association From A Theory	$\beta_x = 0$	There is no evidence that x is associated with y.
Theory Rejection	Rejecting A Theory	$\beta_{theory} = 0$	There is strong evidence (contra Theory X) that x is not associated with y.

References

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