The Value of Accepting the Null Hypothesis

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2022-01-31

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 H_0 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).

> 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*.

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 $u_0 = 0$	Men and women are more similar than different *wrt* 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	$x \rightarrow y$ Association 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*.
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

Gallistel, C R. 2009. "The importance of proving the null." *Psychological Review* 116 (2): 439–53. https://doi.org/10.1037/a0015251.

Kruschke, John K, and Torrin M Liddell. 2018. "The Bayesian New Statistics: Hypothesis Testing, Estimation, Meta-Analysis, and Power Analysis from a Bayesian Perspective." *Psychonomic Bulletin & Review* 25 (1): 178–206. https://doi.org/10.3758/s13423-016-1221-4.

Morey, Richard D., Saskia Homer, and Travis Proulx. 2018. "Beyond Statistics: Accepting the Null Hypothesis in Mature Sciences." *Advances in Methods and Practices in Psychological Science*. https://doi.org/10.1177/2515245918776023.