

Five common power fallacies

IGOR Power Panel

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"Power is a single number"

1

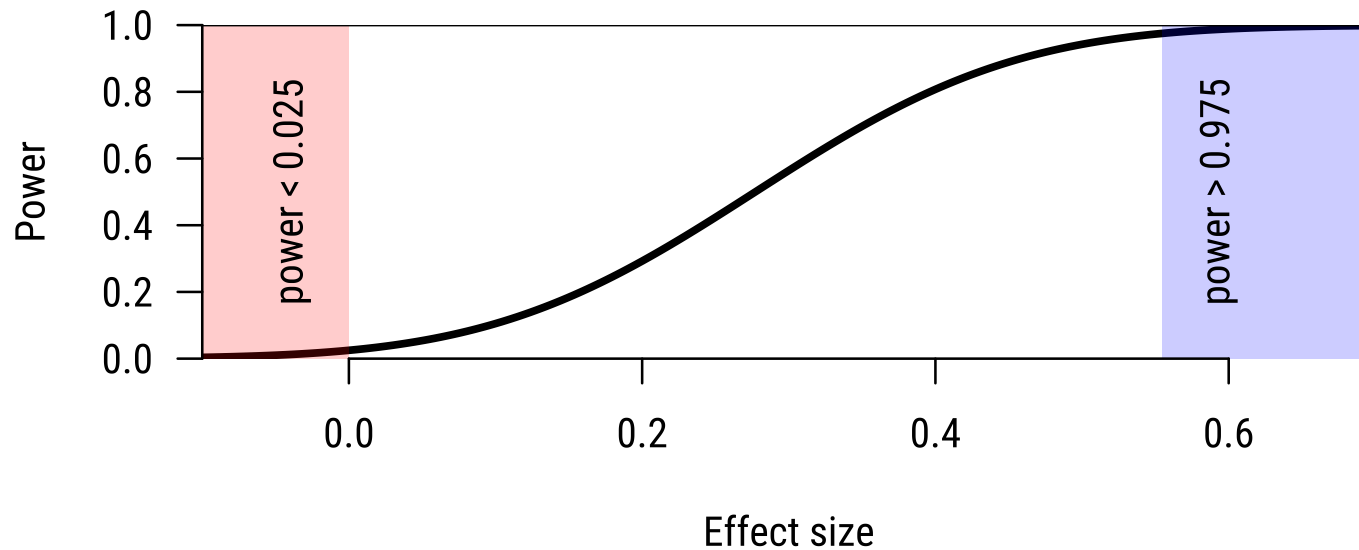
		Null hypothesis is false	Null hypothesis is true
Decision	Reject null hypothesis	Correct decision ($p = 1 - \beta$)	Type I error ($p = \alpha$)
	Accept null hypothesis	Type II error ($p = \beta$)	Correct decision ($p = 1 - \alpha$)

Figure 1 Type I and Type II Errors in Hypothesis Testing

Instead, think: What effect sizes is this test sensitive to, with this design? What effect sizes is it less sensitive to?

"Power depends on truth [in a study]"

2



Instead, think: The design and test together yield a power curve, over all *hypothetical* effect sizes (counterfactual!)

"Power depends on previous results"

3

Would you **rather** base the sensitivity of a test for poison in the water on...

- *previous knowledge* of levels of poison previously found in similar wells, or
- *your desire to rule out* that the level of poison is dangerous?

Instead, think: The purpose of my study determines what effect sizes I'd like my test to be sensitive to.

"Power depends on what you think"

4

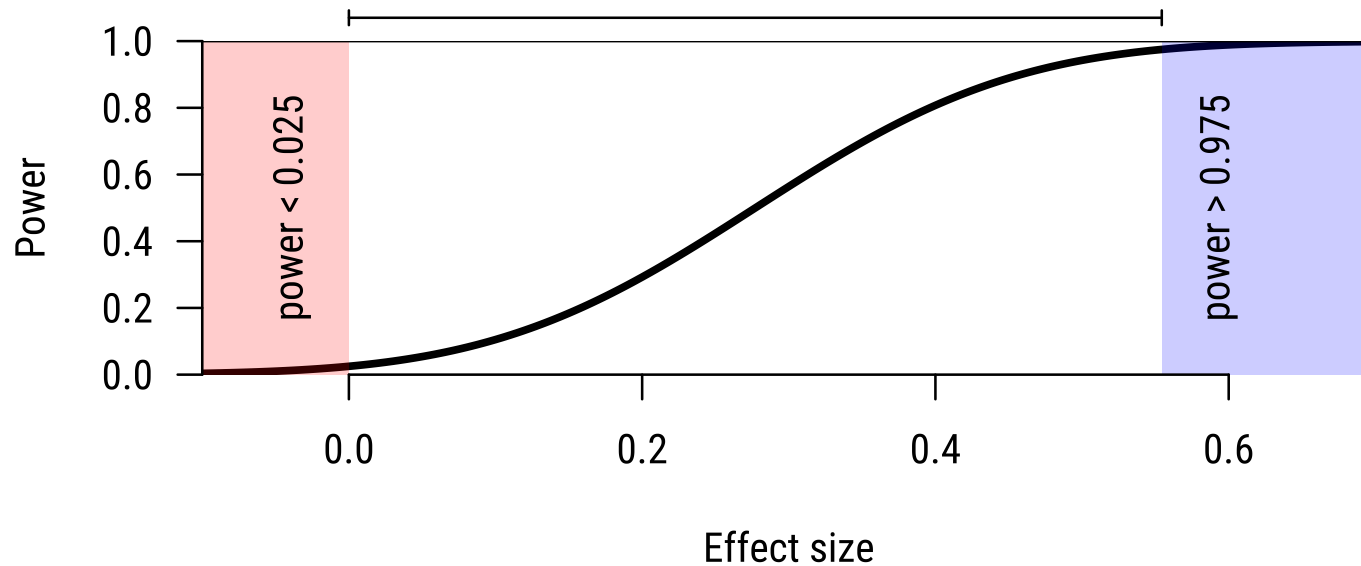
Would you **rather** base the sensitivity of a test for poison in the water on...

- your *belief* that the true level of poison is safe, or
- your *desire to rule out* that the level of poison is dangerous?

Instead, think: The purpose of my study determines what effect sizes I'd like my test to be sensitive to.

"Plan for precision, not power"

5



Instead, think: The power curve tells me how wide my confidence interval will be around the "null" effect size.

Effects of the fallacies

- Studies that are not fit for purpose
- Failure of cumulative science
- Wasted resources
- Poor understanding of statistical reasoning
- Poor critiques of useful procedures