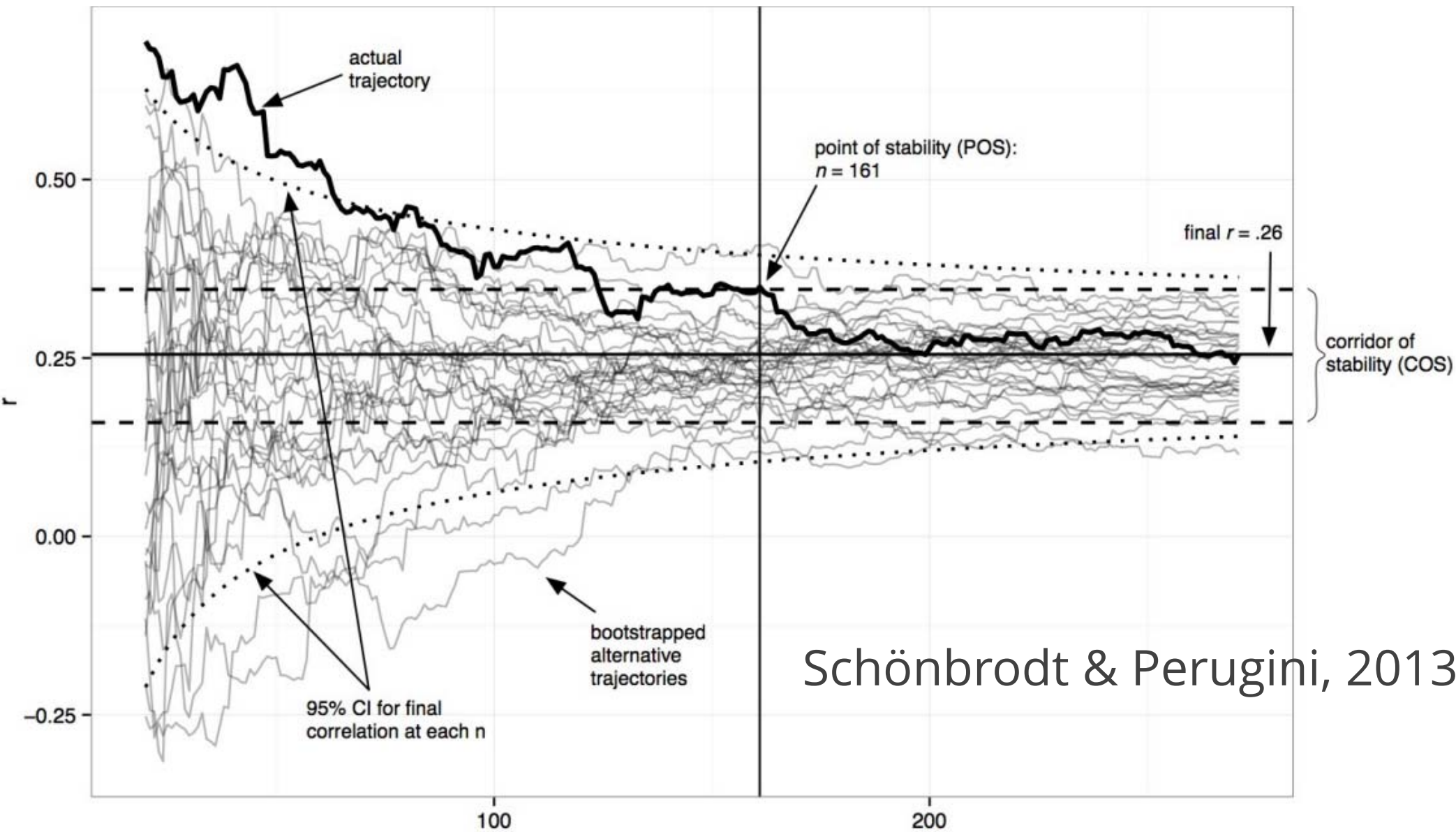


# Sample Size Justification

**How do you  
determine the  
sample size for a  
new study?**

Small samples have  
large variation, more  
Type 2 errors, and  
inaccurate estimates.



Schönbrodt & Perugini, 2013

# Power failure: why small sample size undermines the reliability of neuroscience

*Katherine S. Button<sup>1,2</sup>, John P. A. Ioannidis<sup>3</sup>, Claire Mokrysz<sup>1</sup>, Brian A. Nosek<sup>4</sup>, Jonathan Flint<sup>5</sup>, Emma S. J. Robinson<sup>6</sup> and Marcus R. Munafò<sup>1</sup>*

Psychological Bulletin  
1989, Vol. 105, No. 2, 309–316

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0033-2909/89/\$00.75

## Do Studies of Statistical Power Have an Effect on the Power of Studies?

**Peter Sedlmeier and Gerd Gigerenzer**  
University of Konstanz, Federal Republic of Germany

Studies in psychology  
often have low  
power. Estimates  
average around 50%.

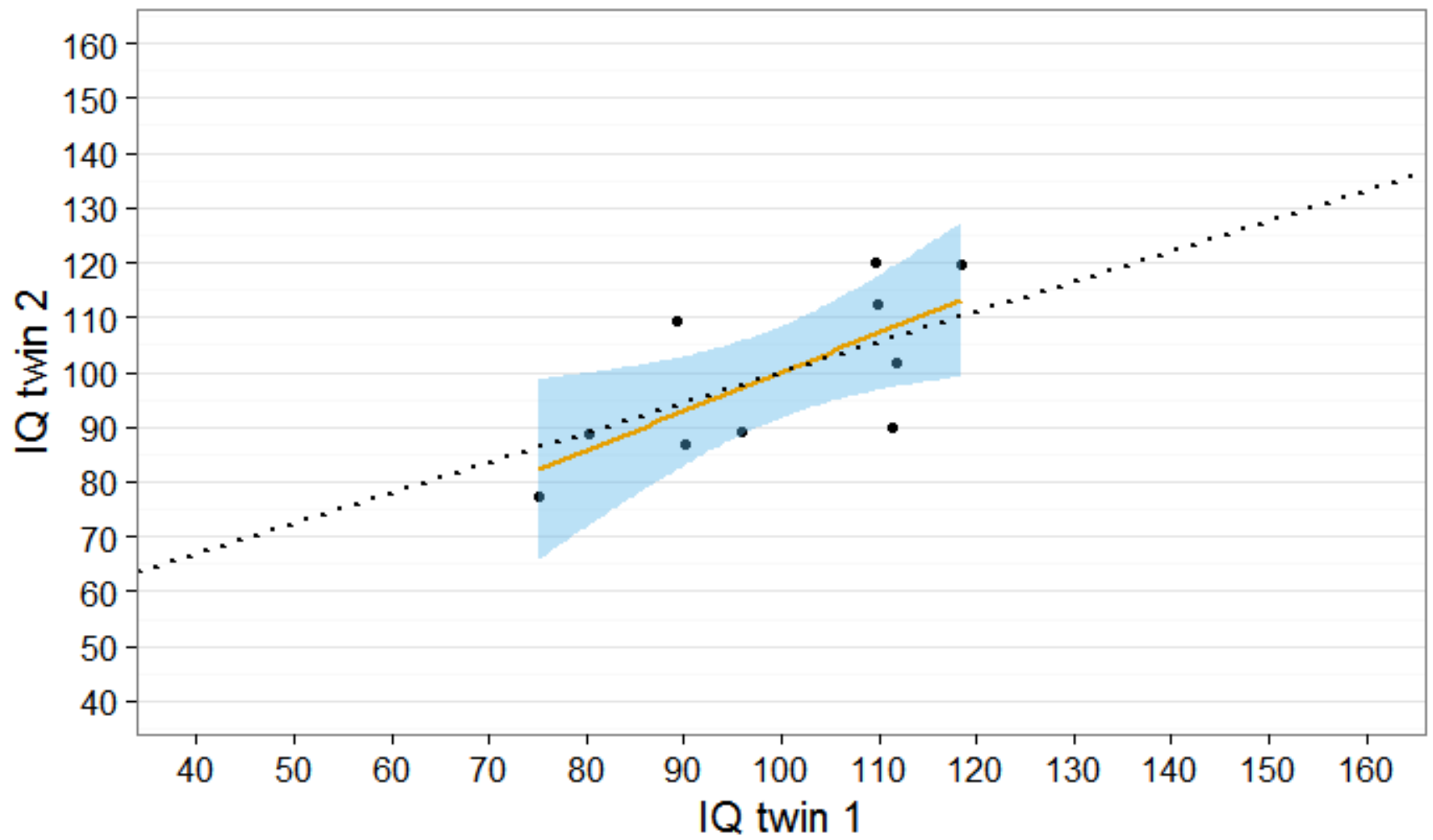
Cohen, 1962; Fraley & Vazire, 2014

One reason for low power is that people use heuristics to plan their sample size.

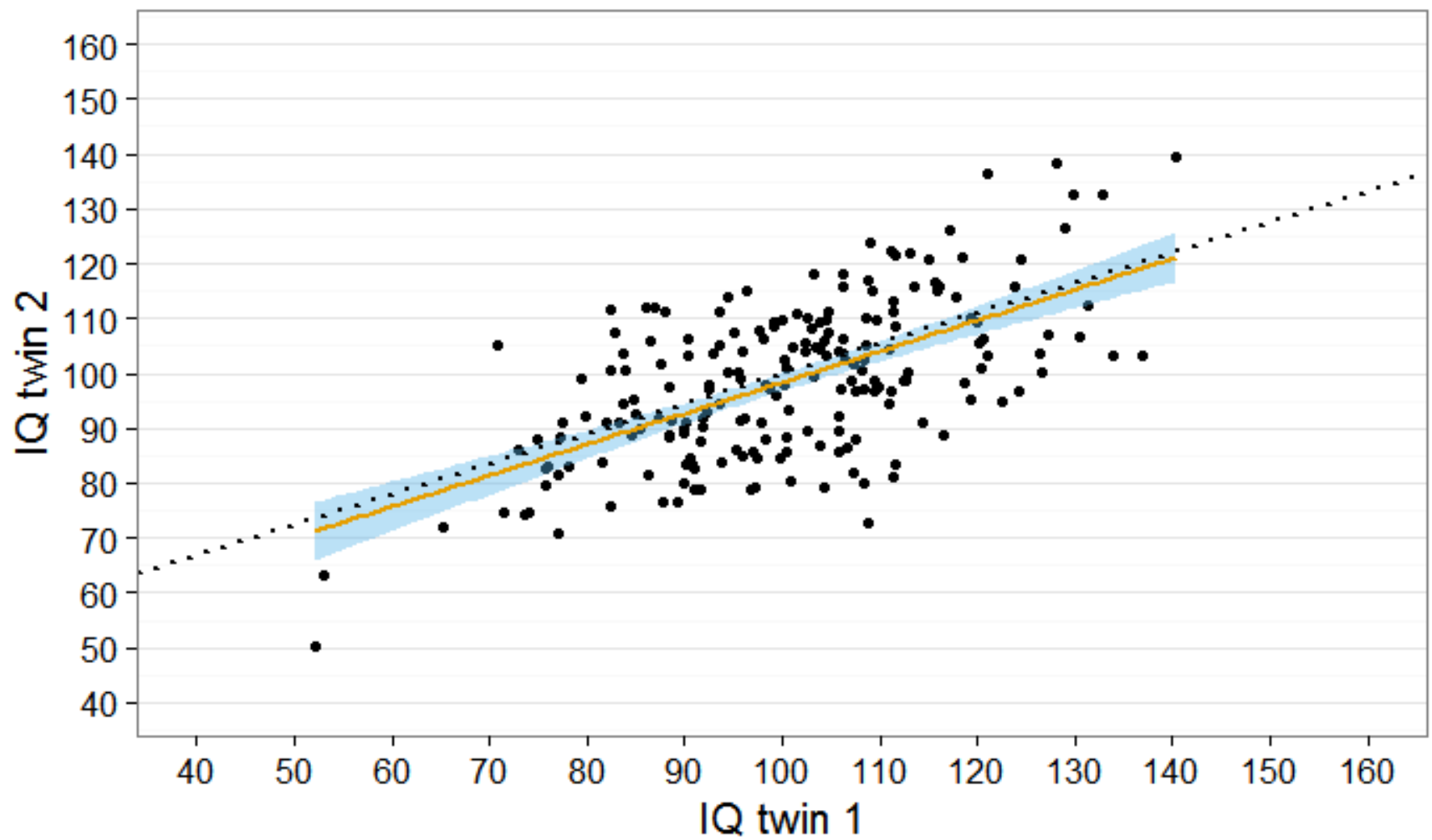
You need to justify the sample size of a study. What goal do you want to achieve?



Correlation = 0.7



Correlation = 0.61

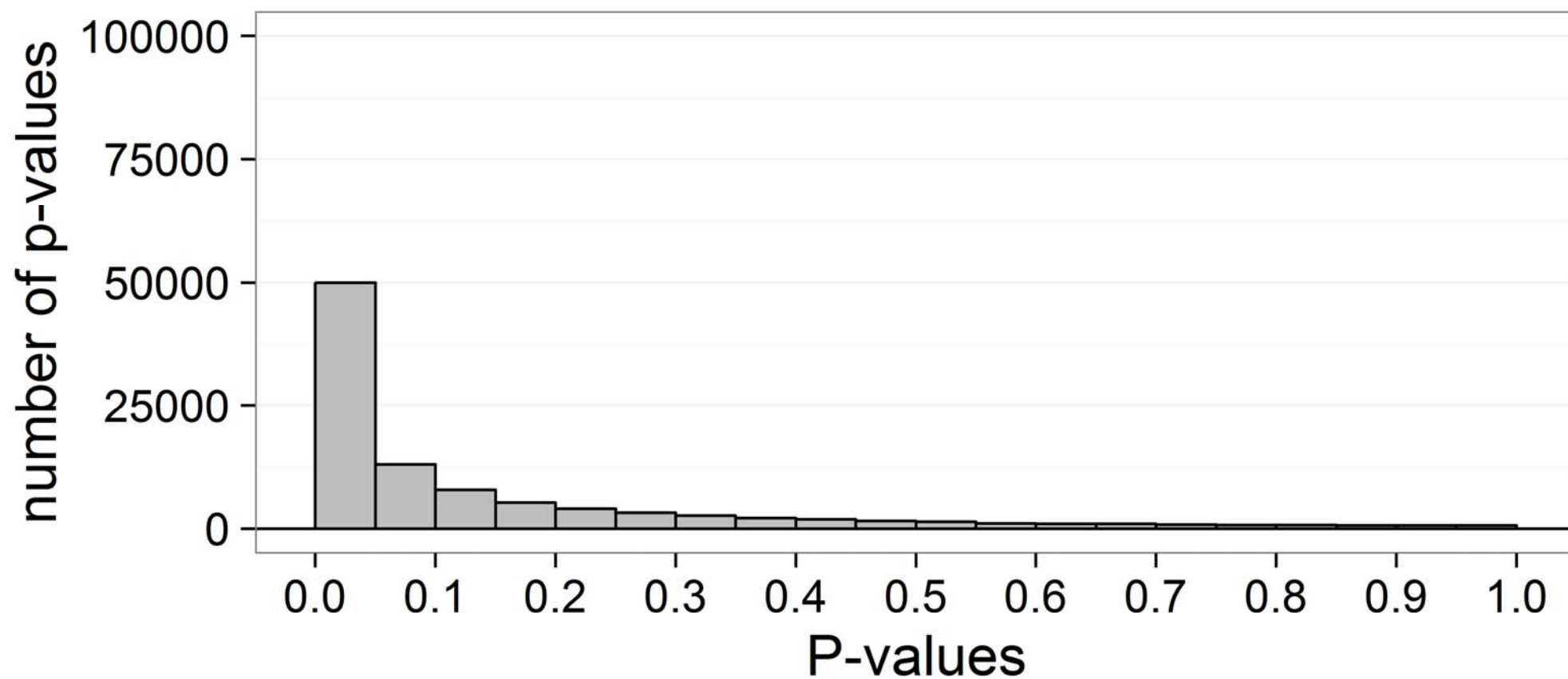


# **Planning for accuracy**

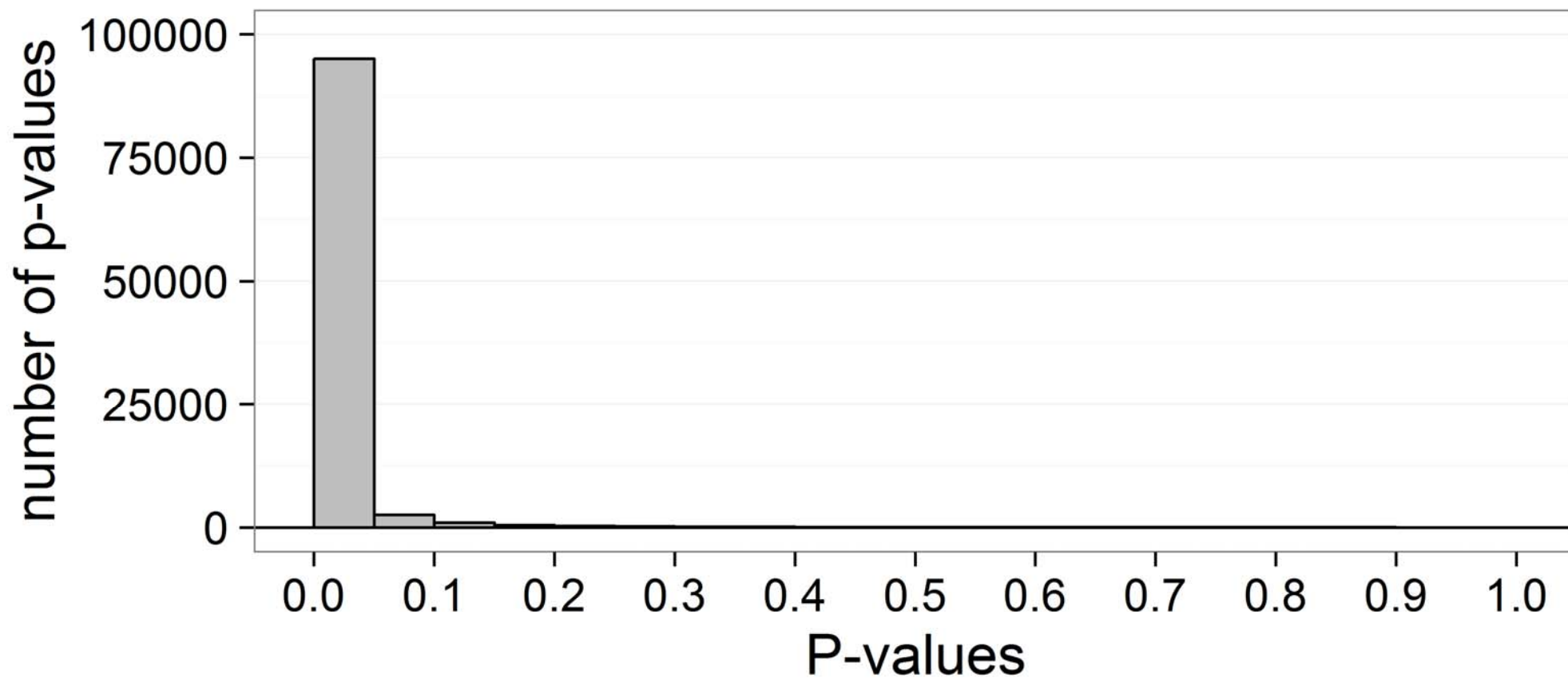
Select a sample size  
based on the width of  
the confidence interval

Maxwell, Kelley, & Rausch, 2008

## P-value Distribution with 50 % Power



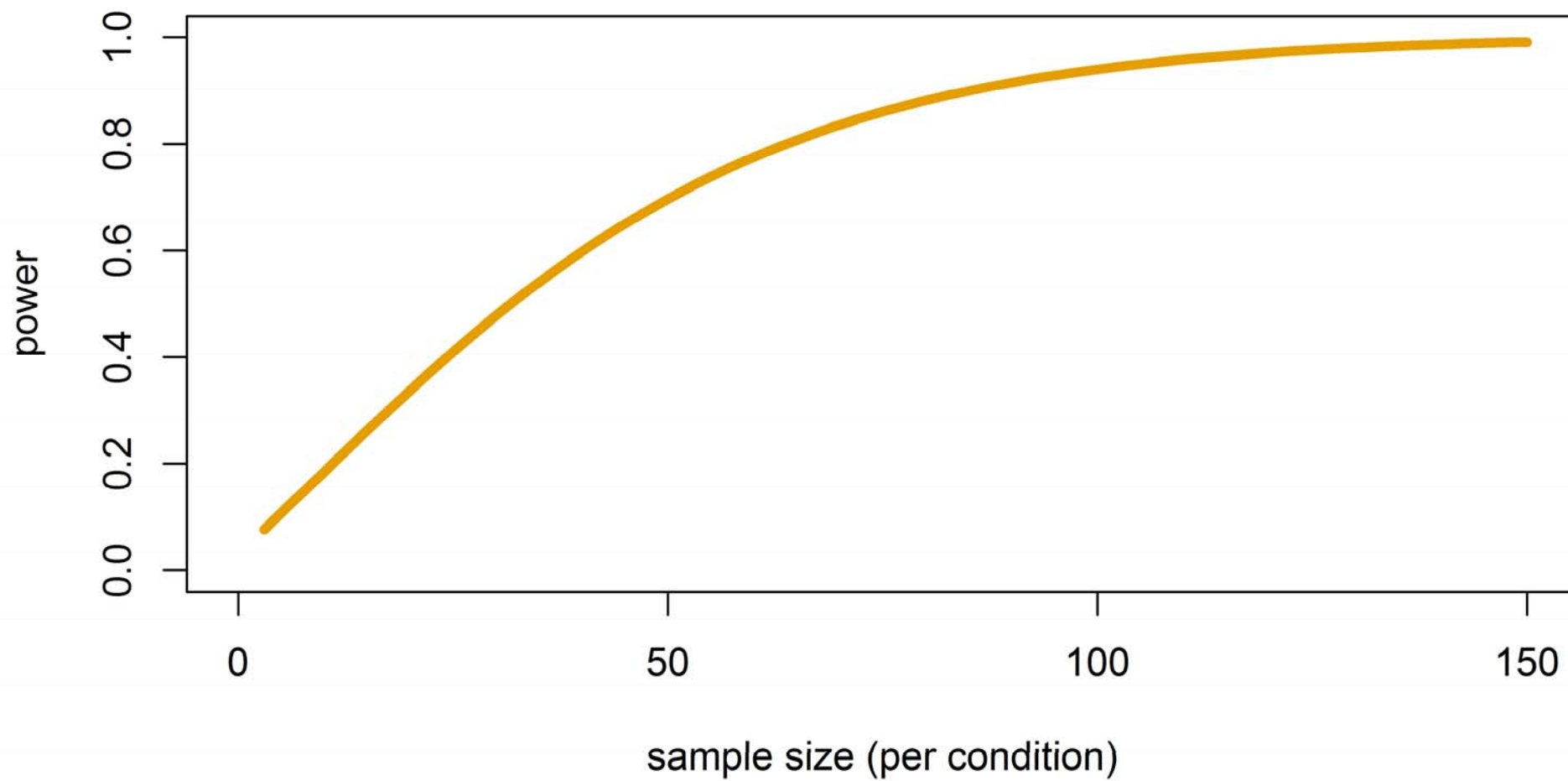
## P-value Distribution with 95 % Power



# Planning for power

Select a sample size  
based on probability  
of finding  $p < 0.05$ .

### power for independent t-test, $d=0.5$



Take care when using effect sizes from the literature. Publication bias inflates effects.



Use **unbiased** effect  
size estimates in  
power analyses  
(Hedges'  $g$ ,  $\varepsilon$ ,  $\omega$ )

If effect sizes are  
uncertain **sequential  
analyses** let you look  
at data as it comes in.

# **Planning for feasibility**

Select a sample size based on the time, money, or participants you have available.

# Bayesian statistics

“It is entirely appropriate to collect data until a point has been proven or disproven, or until the data collector runs out of time, money, or patience.”

Edwards, Lindman, & Savage, 1963

# **Bayesian statistics**

Much more flexible.

But no easy way to  
control Type 1 errors.

The sample size is an important part of the design of a study.  
Don't ignore it.