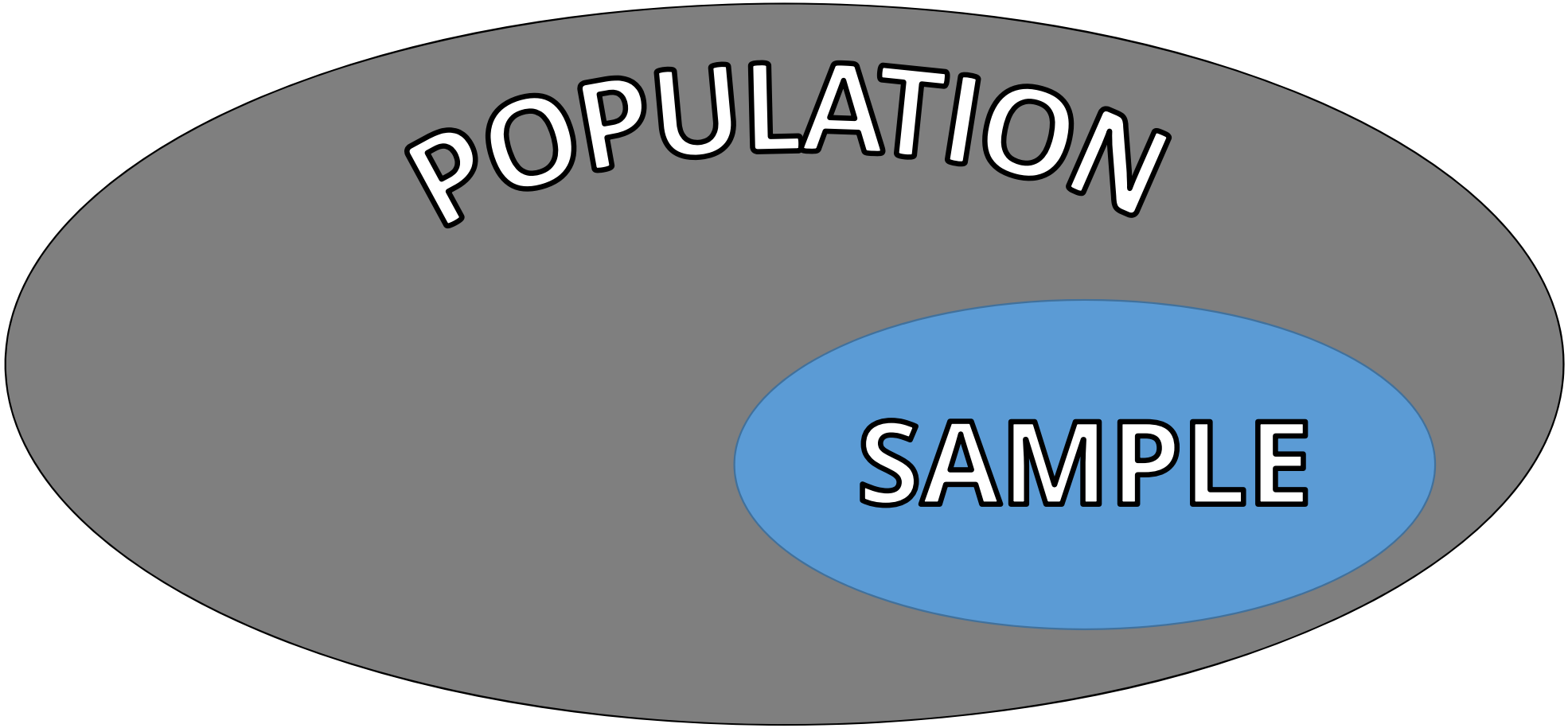
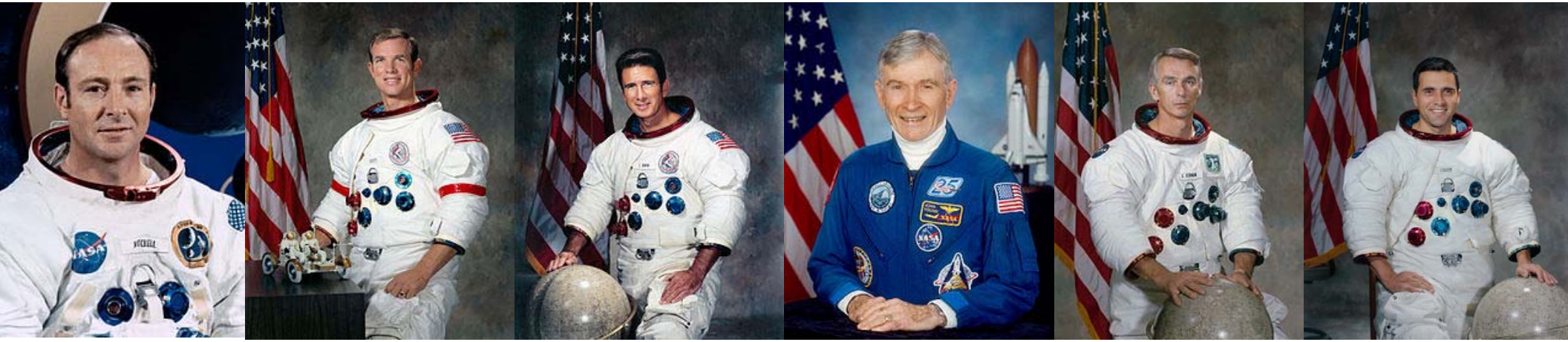
Confidence Intervals


POPULATION
SAMPLE

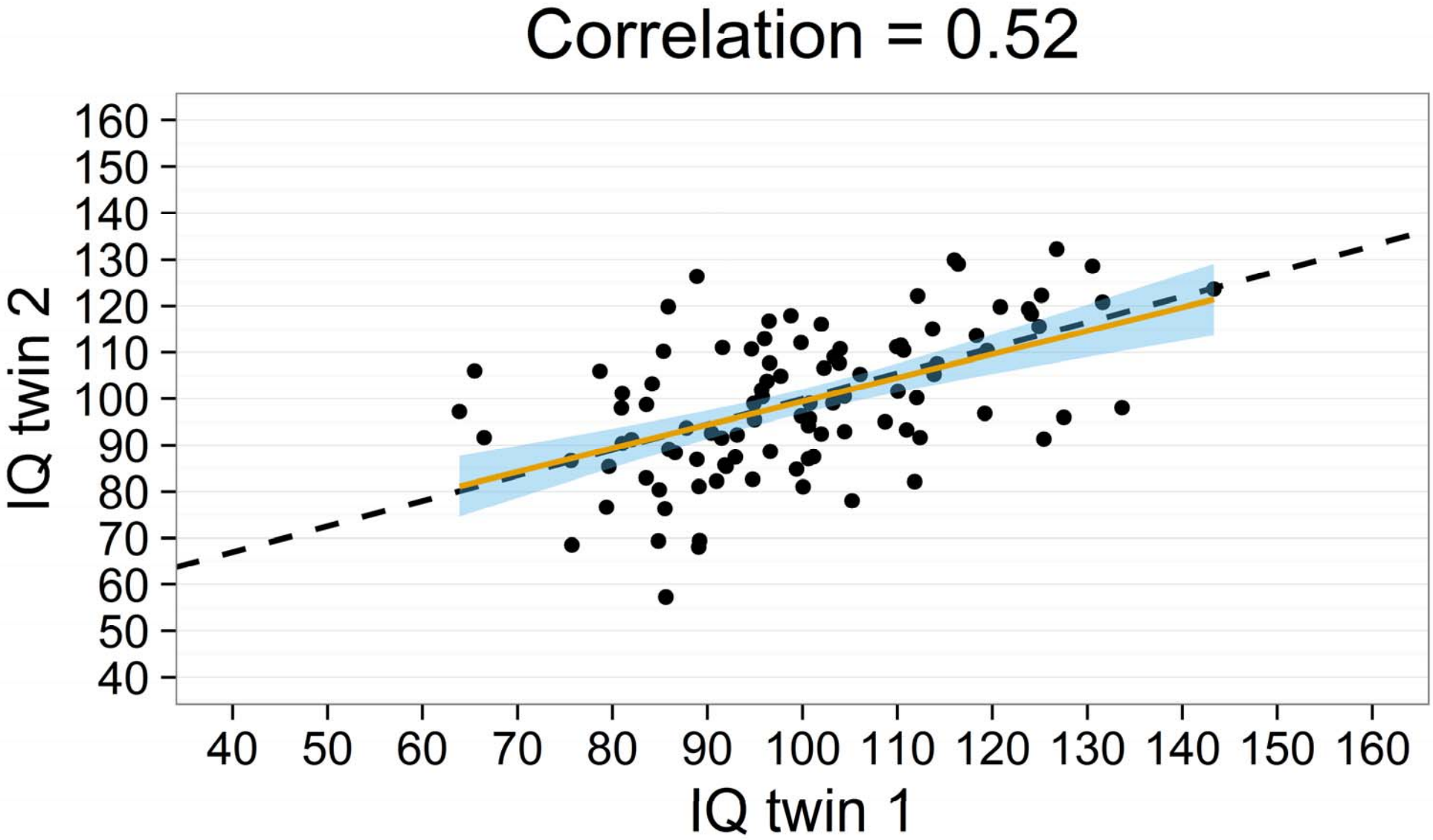
Population of all humans who walked on the moon



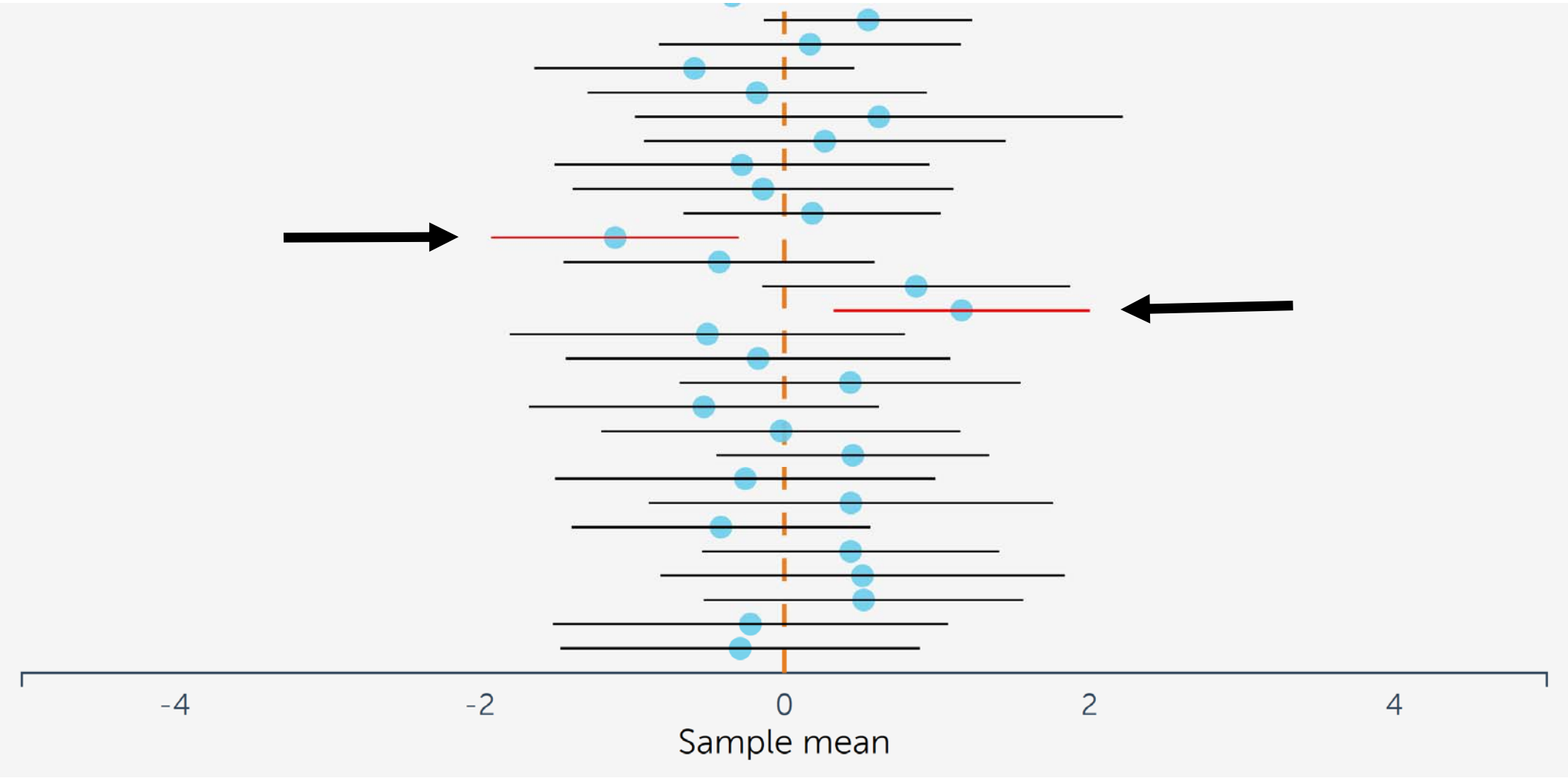
When you generalize from a **sample** to a **population**, there is uncertainty.

It is misleading to report point estimates without illustrating the uncertainty surrounding that estimate.

Kelley & Rausch (2006)


Correlation = 0.52
IQ twin 2
160
150
140
130
120
110
100
90
80
70
60
50
40
40 50 60 70 80 90 100 110 120 130 140 150 160
IQ twin 1

Confidence intervals are a statement about the percentage of **confidence intervals** that contain the true parameter value.



http://rpsychologist.com/d3/CI/

95% of future 95% **confidence intervals** will contain the true population parameter (**in the long run**).

After collecting the data a confidence interval either contains the population parameter or not.

You can calculate CI around any estimate. Common: CI around means or effect sizes.

For normal distribution:

$$M \pm Z_{critical} \times SE$$

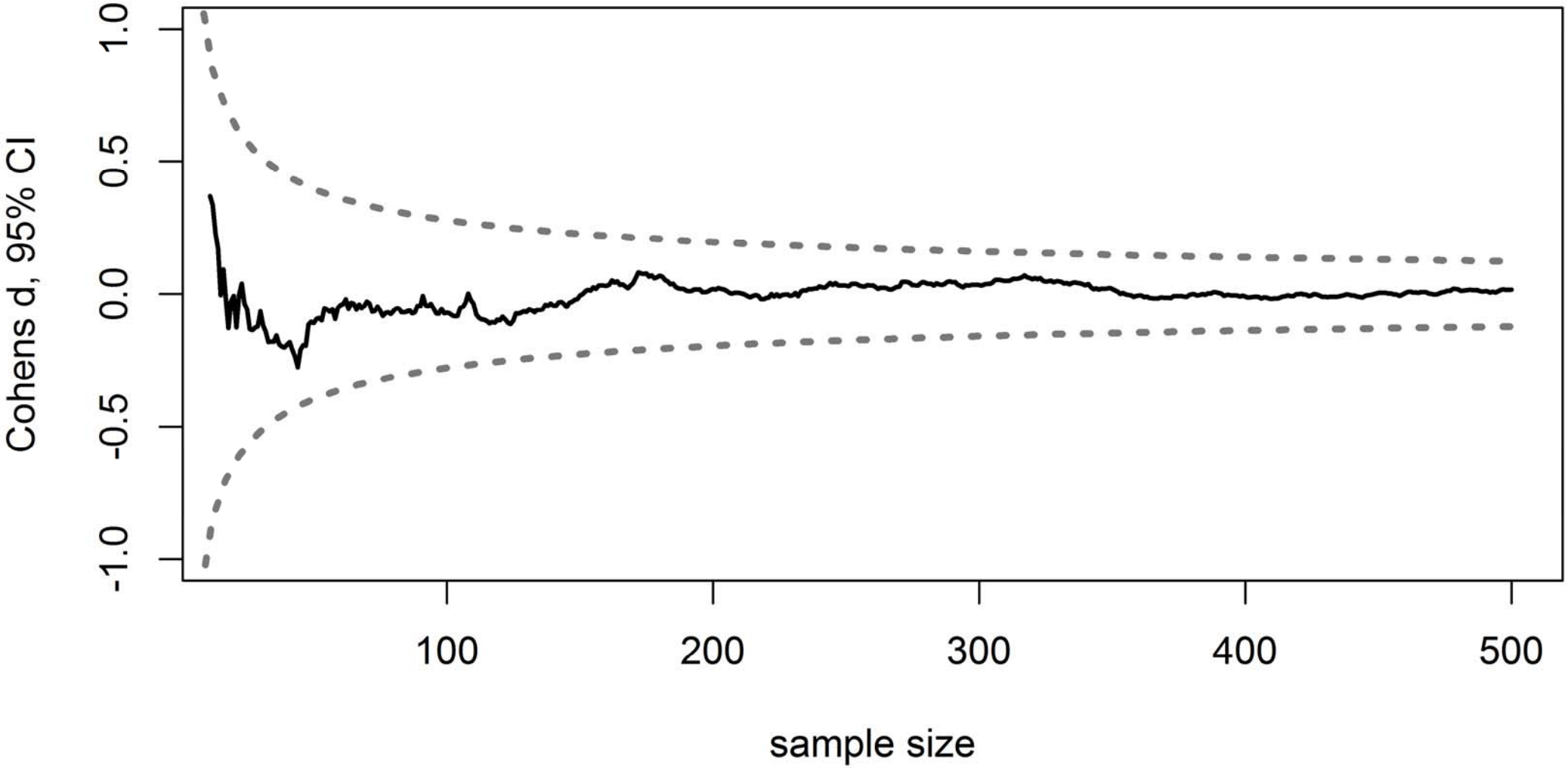
Standard Error (SE) = SD/√N

For normal distribution:

$$M \pm 1.96 \times SE$$

Standard Error (SE) = SD/√N

As the sample size increases confidence intervals become more narrow.

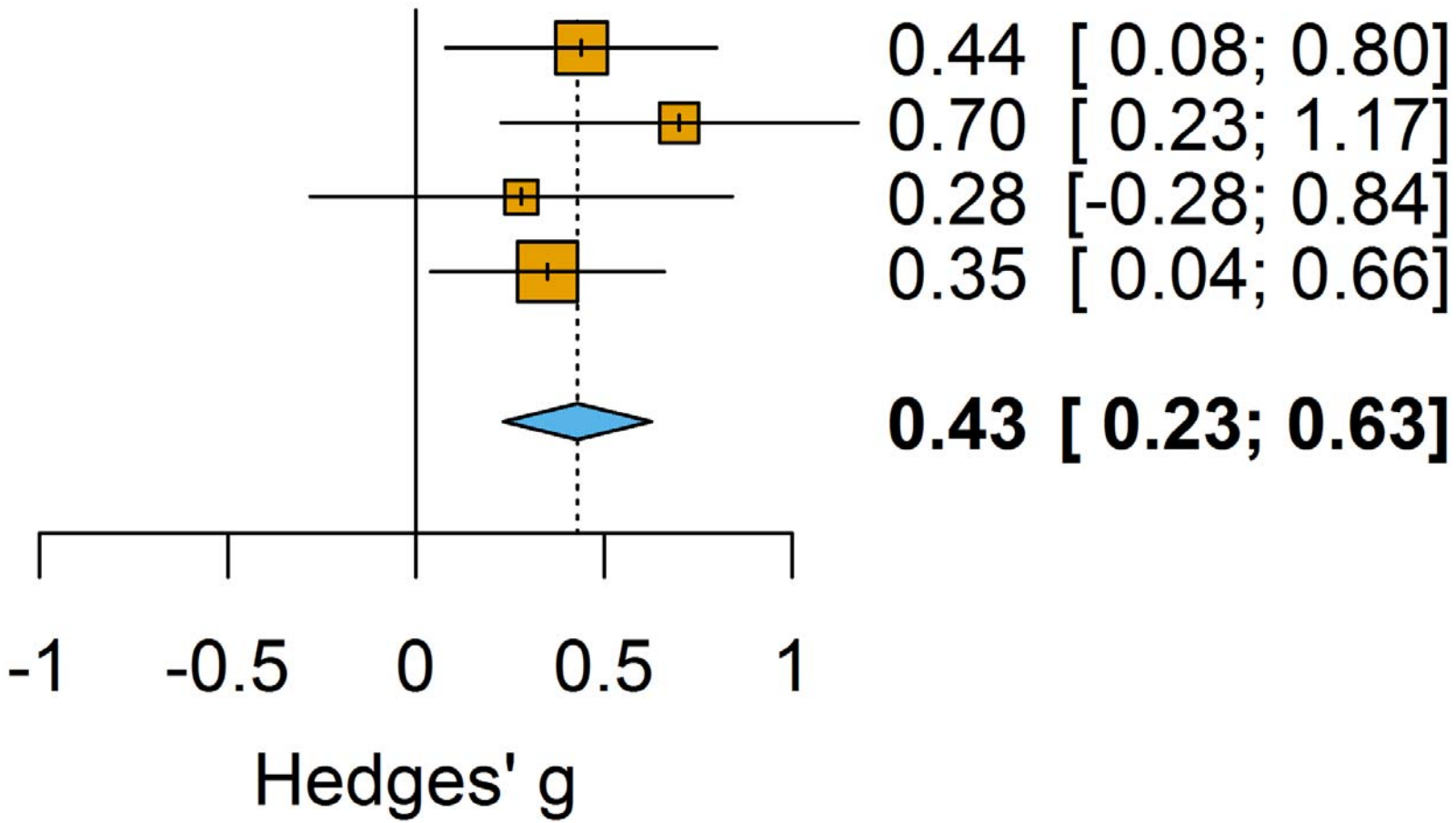

Cohens d, 95% CI
1.0
0.5
0.0
-0.5
-1.0
100
200
300
400
500
sample size

It's **not** true that 95% of future estimates will fall in **a single** 95% CI.

Capture percentage:
A single 95% CI captures the true value 84.3% of time.

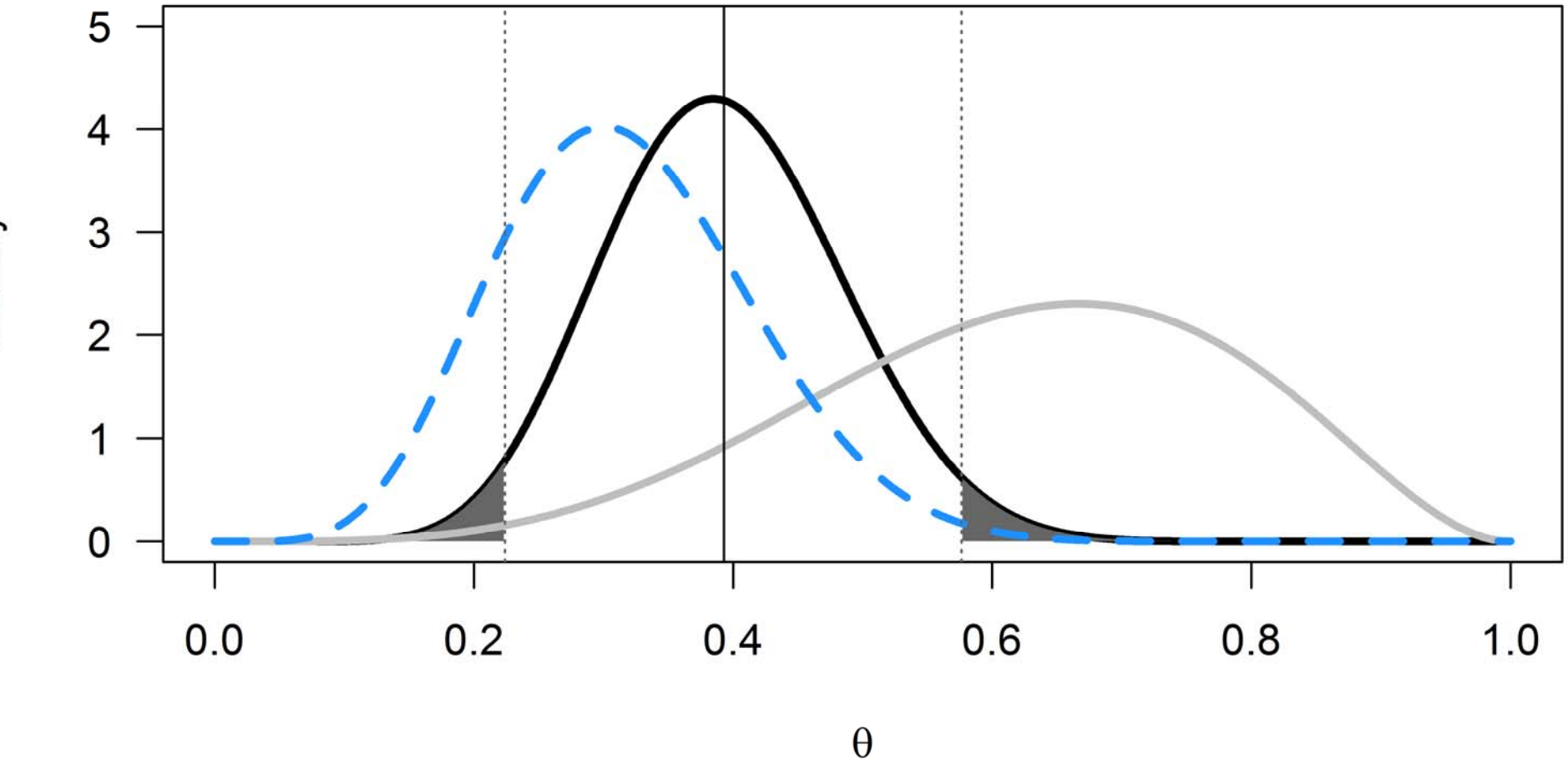
Cumming & Maillardet, 2006

Confidence intervals and *p*-values are directly related. If a 95% CI <> 0, $p < 0.05$


95%-CI
0.44 [0.08; 0.80]
0.70 [0.23; 1.17]
0.28 [-0.28; 0.84]
0.35 [0.04; 0.66]
0.43 [0.23; 0.63]
-1
-0.5
0
0.5
1
Hedges' g

In Bayesian statistics **credible intervals** or **highest density intervals** are used.

A 95% credible interval contains the values you find most **plausible**.


Mean posterior: 0.39 , 95% Credible Interval: 0.22 ; 0.58
5
4
3
2
1
0
0.0
0.2
0.4
0.6
0.8
1.0
θ

Confidence intervals communicate uncertainty, and some idea about what will happen in the future.