confidence interval (for a mean)

- what is a confidence interval?
- conditions
- finding & interpreting

Duke UNIVERSITY

Dr. Mine Çetinkaya-Rundel
Duke University

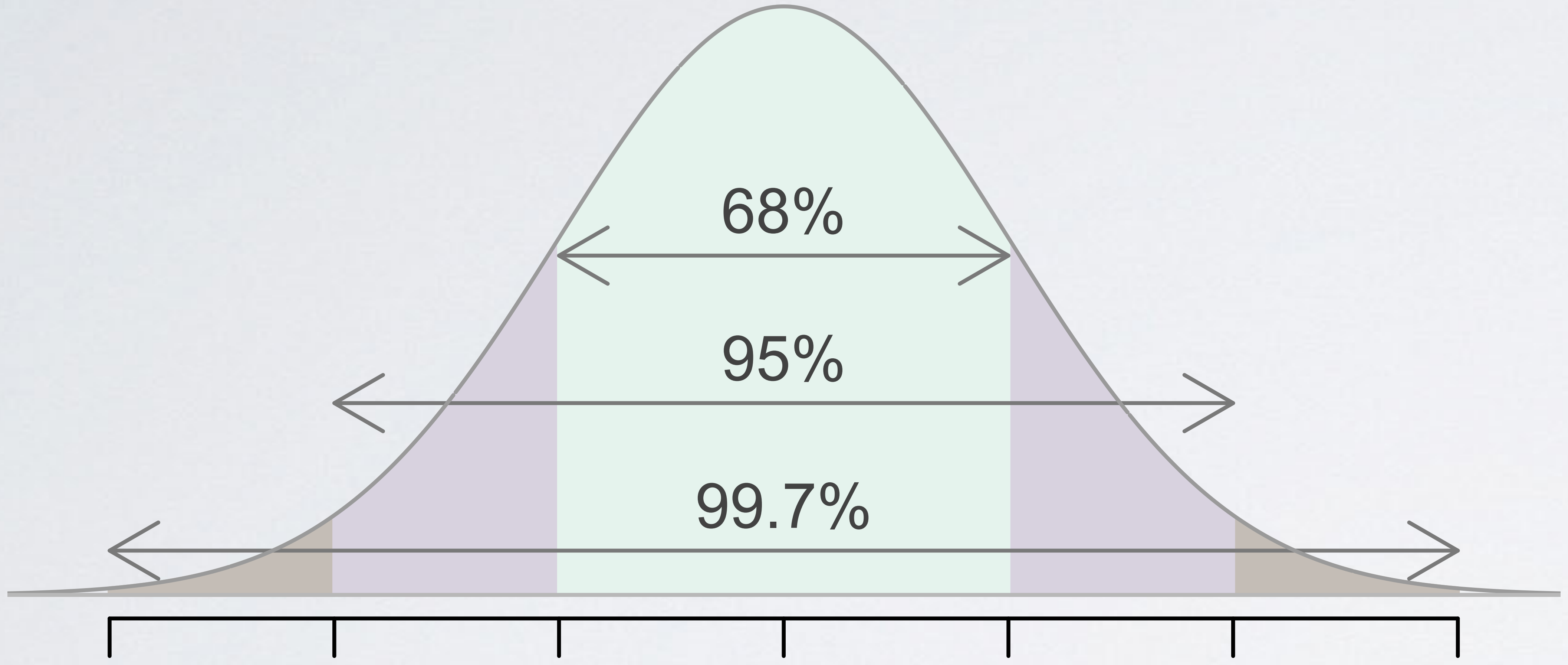
A plausible range of values for the population parameter is called a confidence interval.

- If we report a point estimate, we probably won't hit the exact population parameter.
- If we report a range of plausible values we have a good shot at capturing the parameter.

Central Limit Theorem (CLT):

$$\bar{x} \sim N\left(mean = \mu, SE = \frac{\sigma}{\sqrt{n}}\right)$$

$\vdash\!\!-\!\!-\!\!-\;\bar{x}\;-\!\!-\!\!-\!\!\dashv$



approximate 95% CI: $\bar{x} \pm \boxed{2SE}$

margin of error (ME)

practice

One of the earliest examples of behavioral asymmetry is a preference in humans for turning the head to the right, rather than to the left, during the final weeks of gestation and for the first 6 months after birth. This is thought to influence subsequent development of perceptual and motor preferences. A study of 124 couples found that 64.5% turned their heads to the right when kissing. The standard error associated with this estimate is roughly 4%. Which of the below is **false**?

✔ (a) A higher sample size would yield a lower standard error.

✔ (b) The margin of error for a 95% CI for the percentage of kissers who turn their heads to the right is roughly 8%.

x (c) The 95% CI for the percentage of kissers who turn their heads to the right is roughly 64.5% ± 4%.

✔ (d) The 99.7% CI for the percentage of kissers who turn their heads to the right is roughly 64.5% ± 12%.

Study reference: Gunturkun, O. (2003) Adult persistence of head-turning asymmetry. Nature. Vol 421.

The Kiss: http://en.wikipedia.org/wiki/File:Gustav_Klimt_016.jpg

Confidence interval for a population mean: Computed as the sample mean plus/minus a margin of error (critical value corresponding to the middle XX% of the normal distribution times the standard error of the sampling distribution).

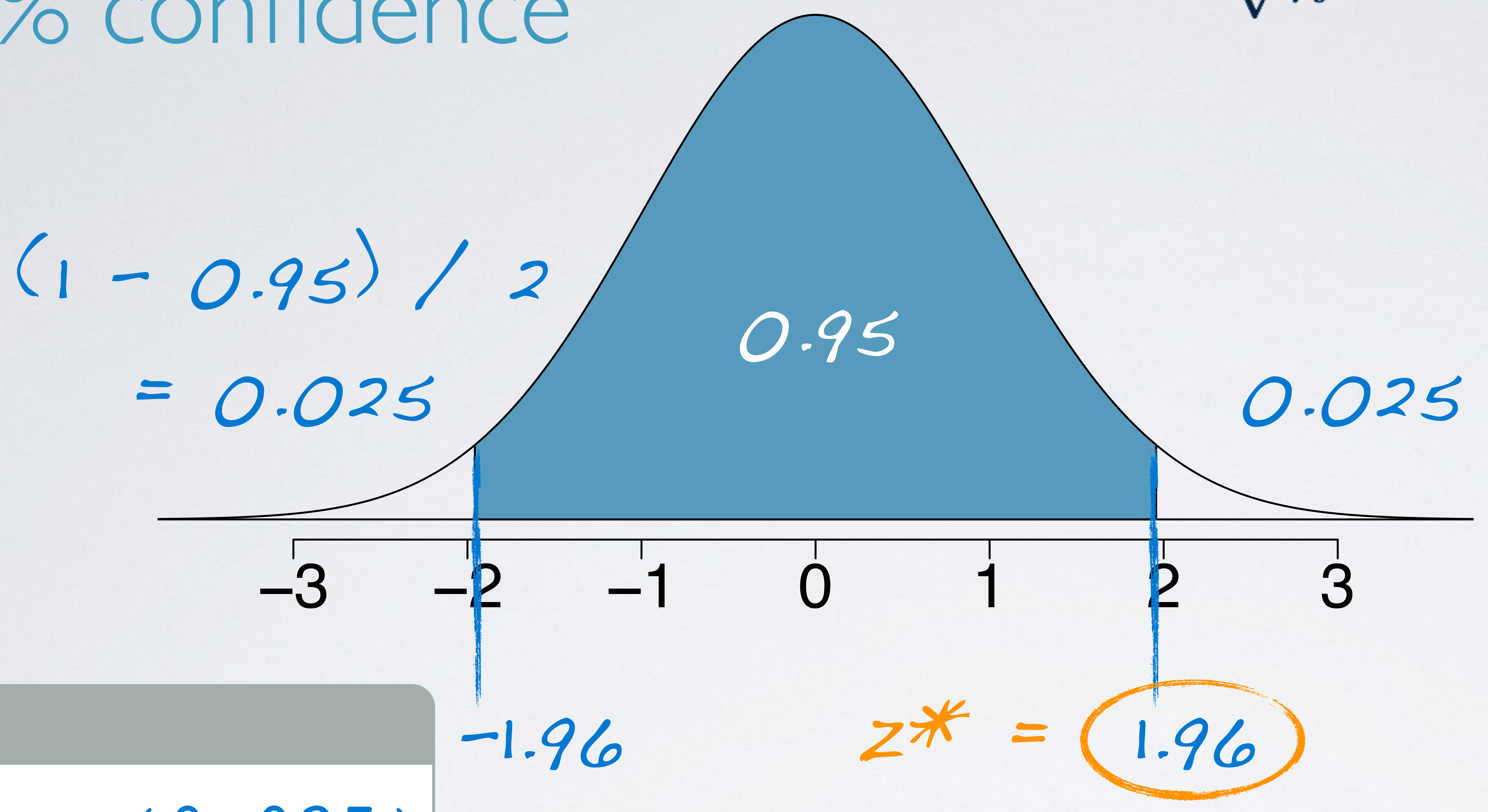
$$\bar{x} \pm z^\star \frac{s}{\sqrt{n}}$$

Conditions for this confidence interval:

1. ***Independence:*** Sampled observations must be independent.
   - random sample/assignment
   - if sampling without replacement, $n < 10\%$ of population
2. ***Sample size/skew:*** $n \geq 30$, larger if the population distribution is very skewed.

finding the critical value
95% confidence

$$\bar{x} \pm z^{\star} \frac{s}{\sqrt{n}}$$



R

```
> qnorm(0.025)
[1] -1.96
```

Second decimal place					
0.07	0.06	0.05	0.04	0.00	Z
0.0003	0.0003	0.0003	0.0003	0.0003	−3.4
0.0004	0.0004	0.0004	0.0004	0.0005	−3.3
0.0005	0.0006	0.0006	0.0006	0.0007	−3.2
0.0008	0.0008	0.0008	0.0008	0.0010	−3.1
0.0011	0.0011	0.0011	0.0012	0.0013	−3.0
0.0015	0.0015	0.0016	0.0016	0.0019	−2.9
0.0021	0.0021	0.0022	0.0023	0.0026	−2.8
0.0028	0.0029	0.0030	0.0031	0.0035	−2.7
0.0038	0.0039	0.0040	0.0041	0.0047	−2.6
0.0051	0.0052	0.0054	0.0055	0.0062	−2.5
0.0068	0.0069	0.0071	0.0073	0.0082	−2.4
0.0089	0.0091	0.0094	0.0096	0.0107	−2.3
0.0116	0.0119	0.0122	0.0125	0.0139	−2.2
0.0150	0.0154	0.0158	0.0162	0.0179	−2.1
0.0192	0.0197	0.0202	0.0207	0.0228	−2.0
0.0244	0.0250	0.0256	0.0262	0.0287	−1.9
0.0307	0.0314	0.0322	0.0329	0.0359	−1.8