

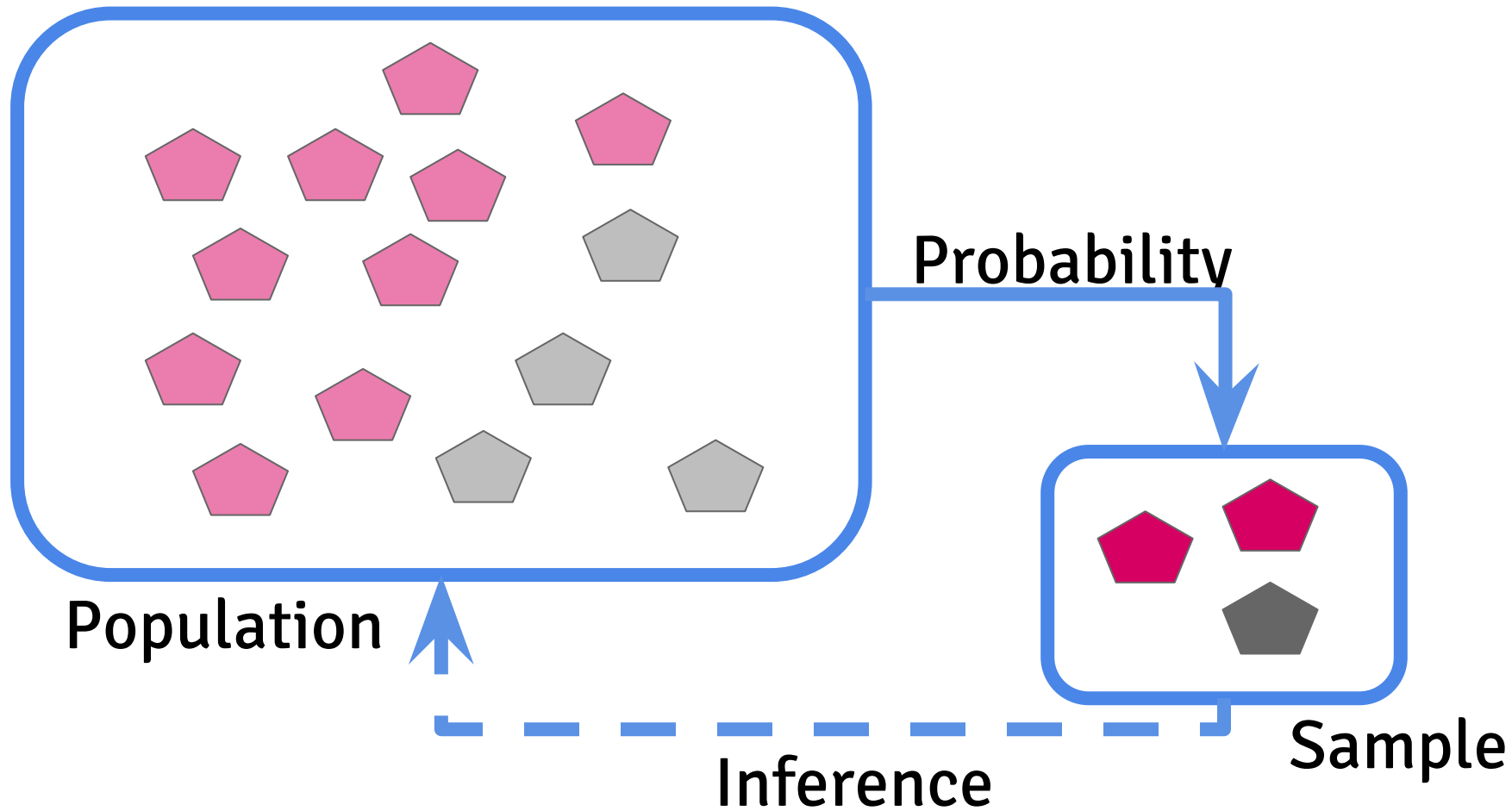
Inference

Jeff Leek

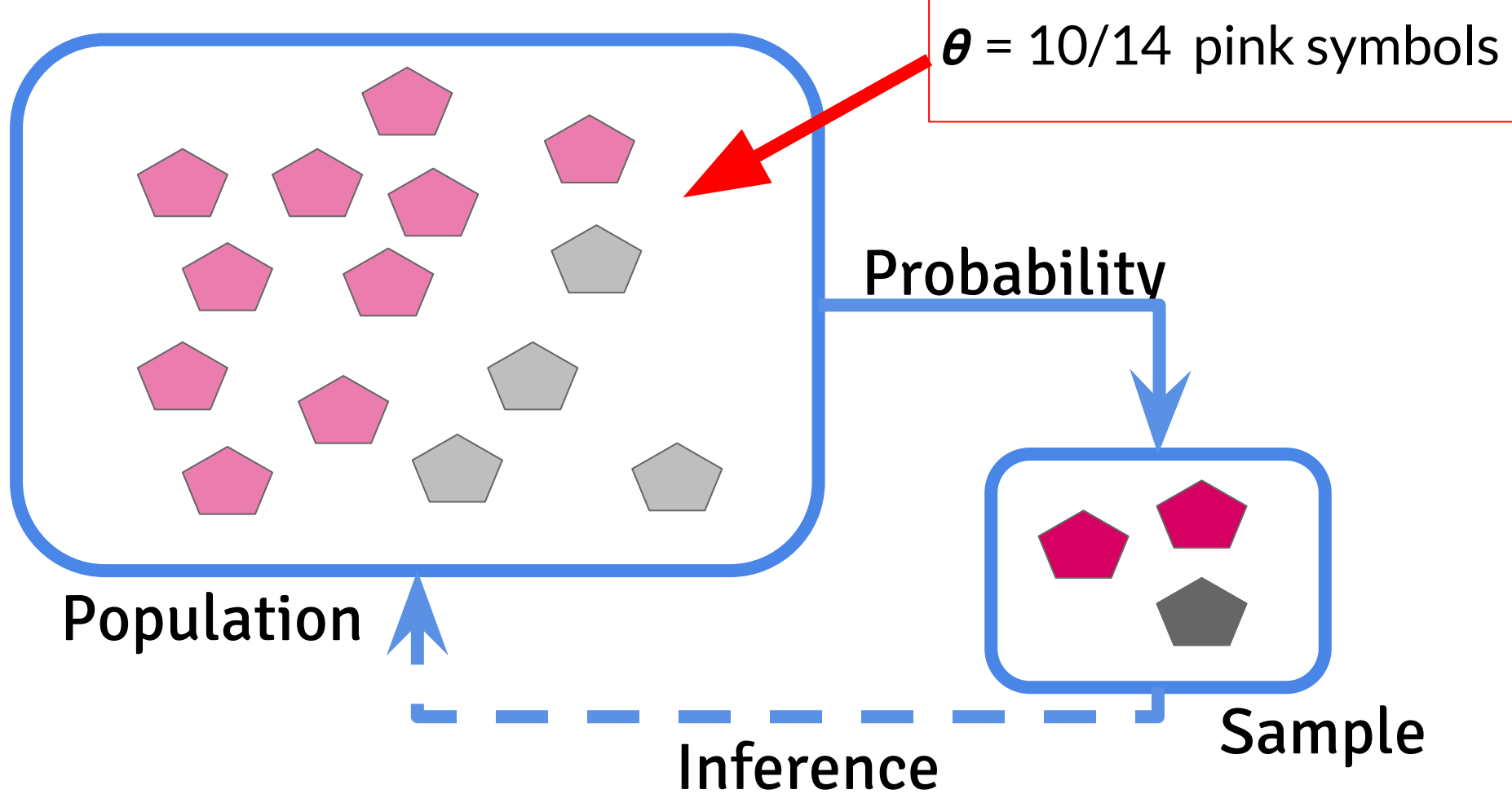
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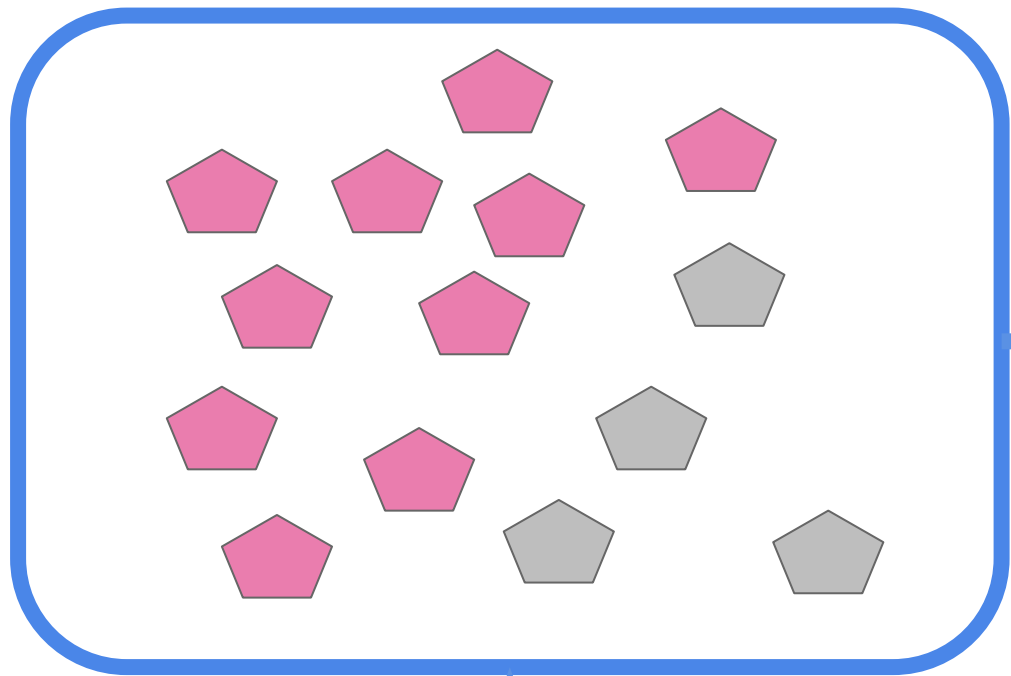
Central dogma of statistics



Parameters are characteristics of the population

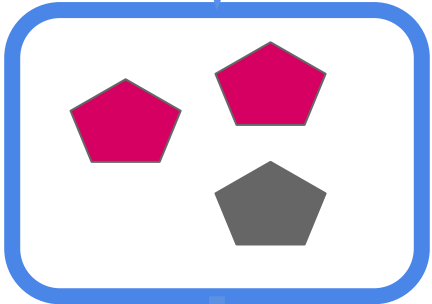


**We estimate population parameters
with the data**



$$\hat{\theta} = 2/3 \text{ pink symbols}$$

Probability



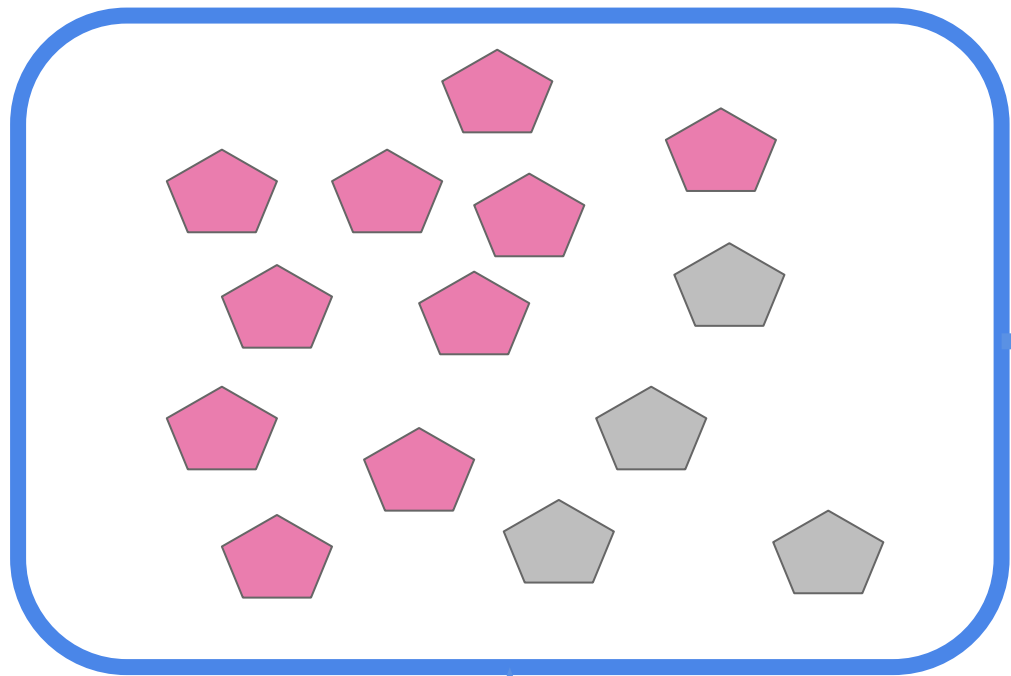
Population



Inference

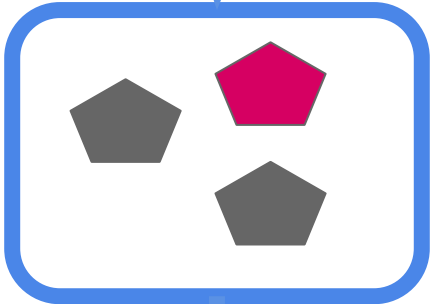
Sample

But in another sample we might get something different



$\hat{\theta} = 1/3$ pink symbols

Probability



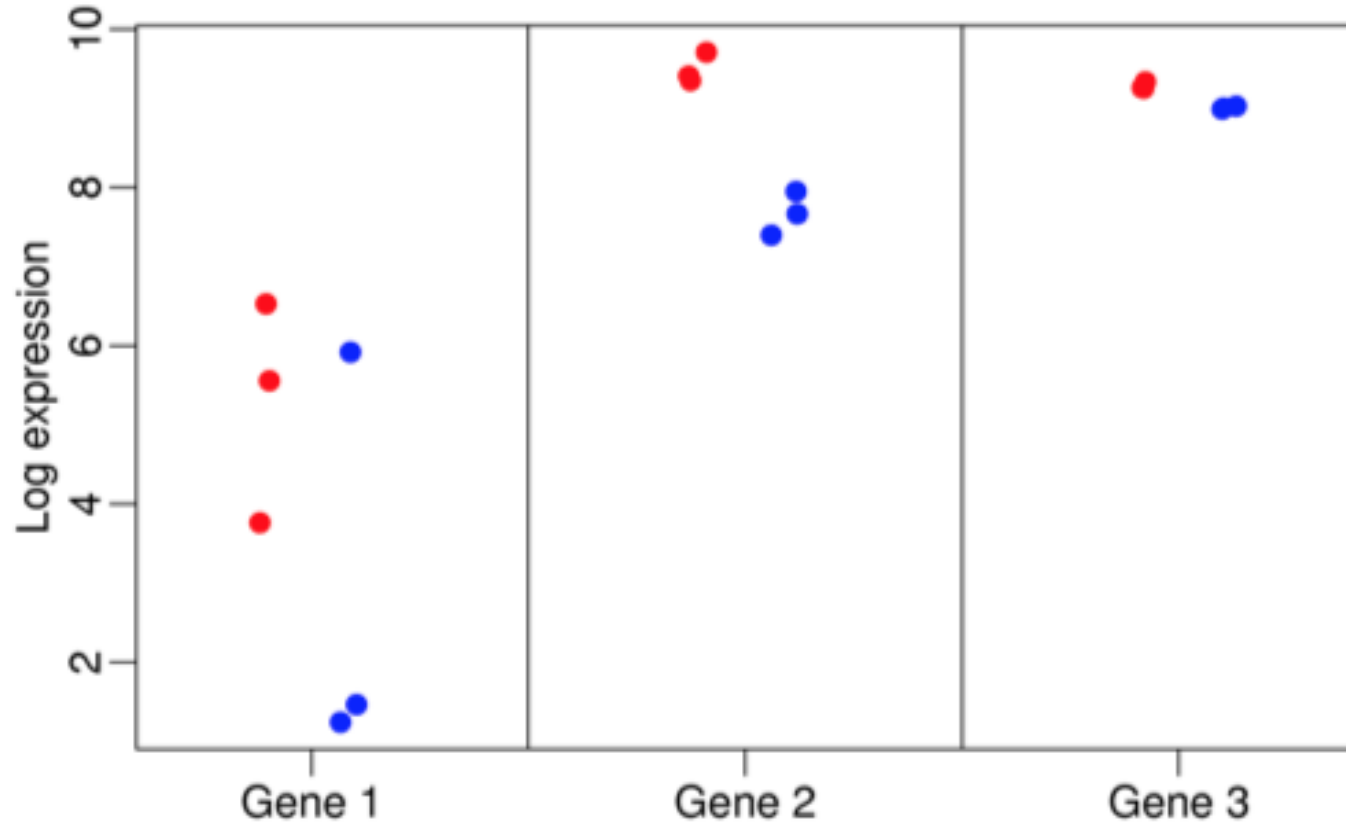
Population



Inference

Sample

Goal : what is population quantity and how certain are we?



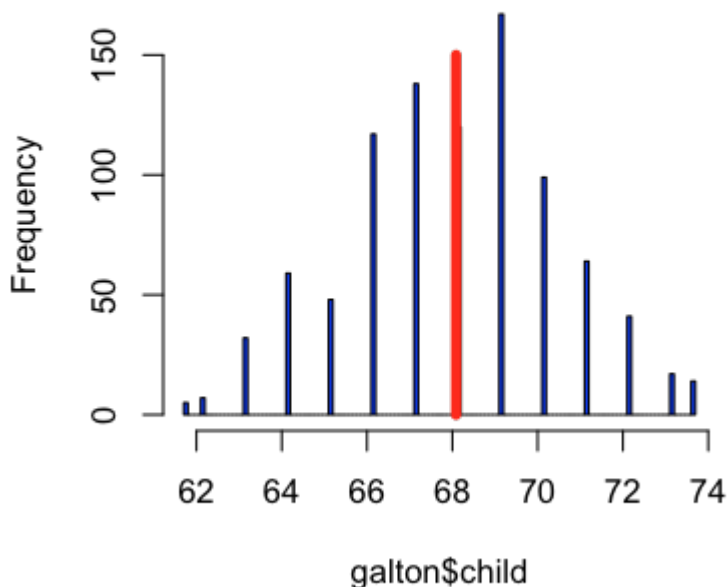
$$\bar{X} = \frac{1}{M} \sum_{i=1}^M X_i$$

$$s_x^2 = \frac{1}{M-1} \sum_{i=1}^M (X_i - \bar{X})^2$$

$$CI = \left(\bar{X} - c \frac{s_x}{\sqrt{n}}, \bar{X} + c \frac{s_x}{\sqrt{n}} \right)$$

$$\Pr(\theta \in CI) = f(c)$$

Histogram of galton\$child



Notes and further reading

- Inference is a whole class (no joke): <https://www.coursera.org/course/statinference>
- Basic thing to keep in mind is how do you
 - estimate
 - quantify uncertainty