

**In a problem of estimation, we start with a knowledge of the mathematical form of the population sampled, but without knowledge of the values of one or more of the parameters which enter into this form ...**

**The *probability* of occurrence of our entire sample is therefore expressible as a function of these unknown parameters, and the *likelihood* is defined merely as a function of these parameters proportional to this probability.**

-Johnny Appleseed

# Probability vs Likelihood

---

- Probability and likelihood are mathematically similar, but differ in the choice of free parameters:

- (Normal) Probability Density Function

$$f(y | \mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(y - \mu)^2}{2\sigma^2}}$$

- (Normal) Likelihood Function

$$\mathcal{L}(\mu, \sigma^2 | y) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(y - \mu)^2}{2\sigma^2}}$$