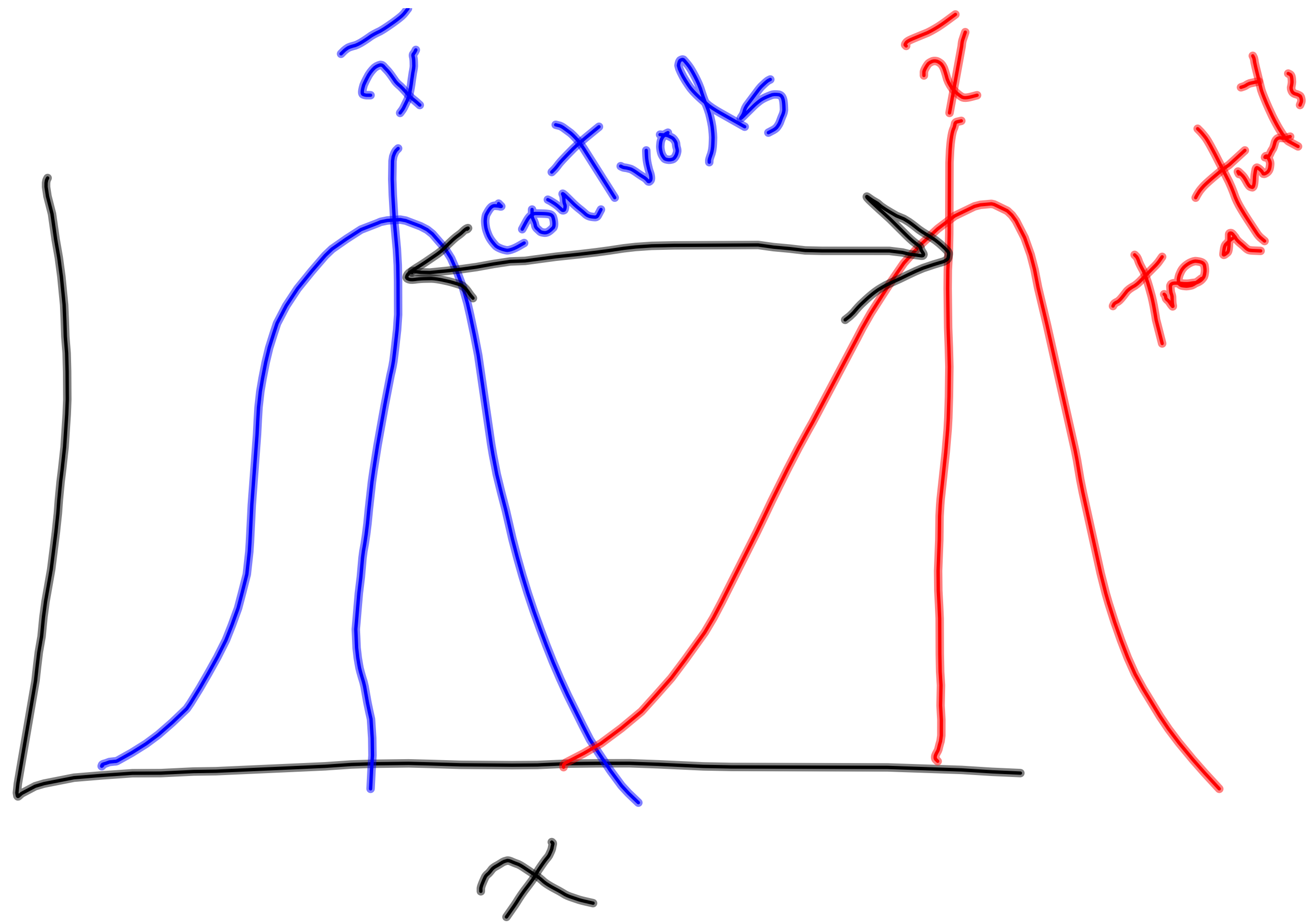
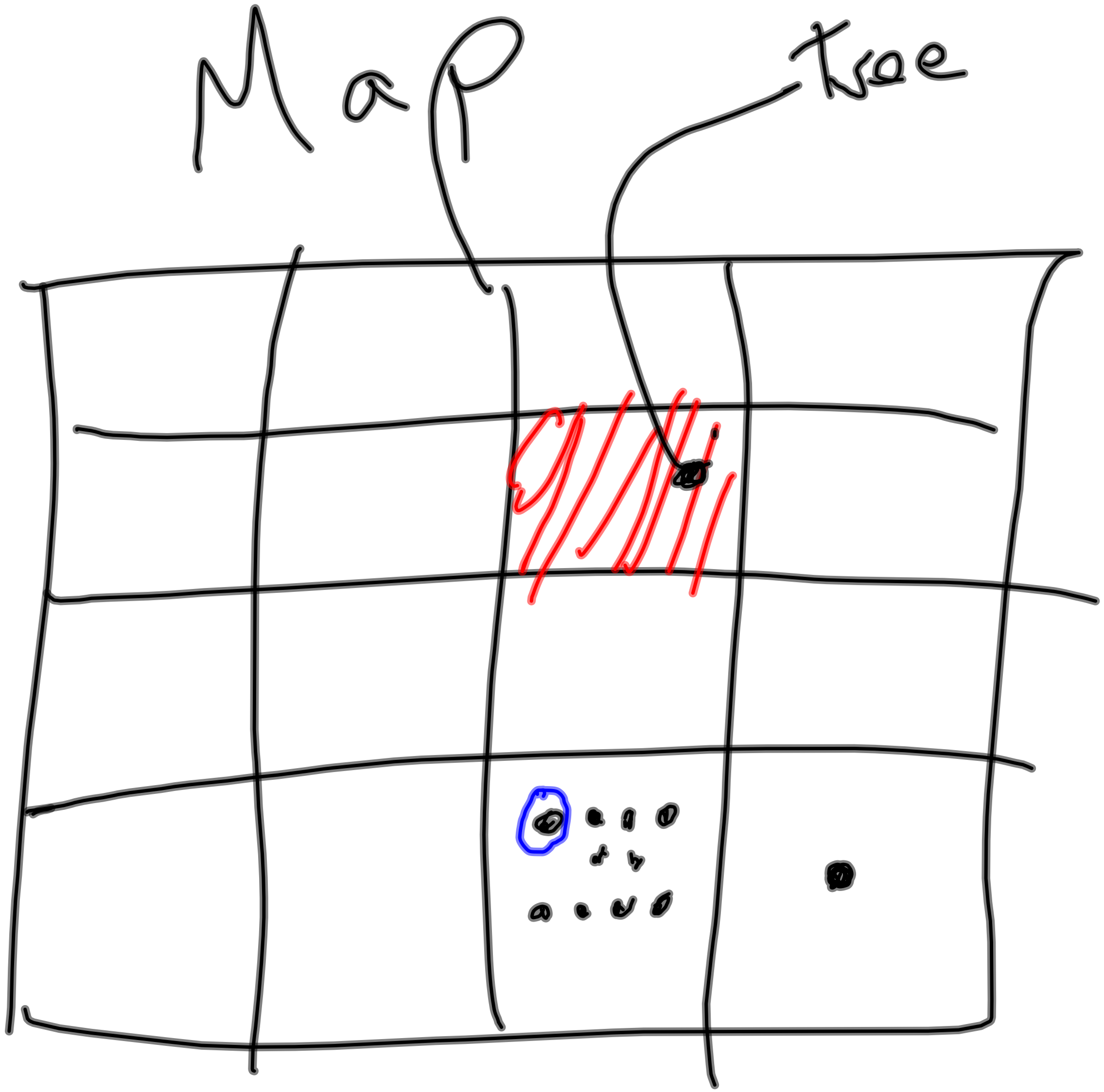
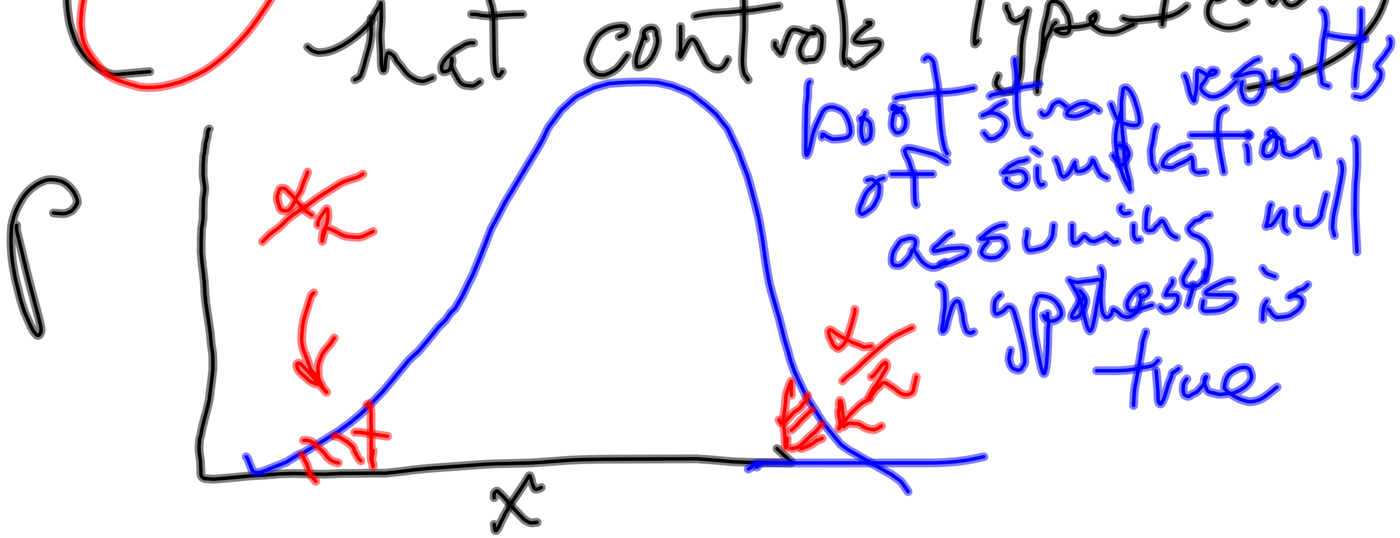

x̄
controls
x̄
treatments
x


Map
tree

Type I Error

Mistakenly rejecting a null hypothesis that actually is true

(α is the mechanism that controls Type I error)



Type II Error

Mistakenly Failing to reject a null hypothesis that actually is False. ("Power" = 1 − "II")

Depends on: α what is true

specify magnitude of the actual non-zero "effect" or "difference"

Logic

1. Americans are ~~not~~ members of Congress — wrong — a probably not

   $p(C \mid A) = 10^{-6}$

2. This man is a member of Congress

   $p(A)$

   $p(\theta)$

3. Therefore This man is probably not American — wrong

   $p(A \mid C)$

   θ "data"

Rare disease: Frequency of $\frac{1}{1{,}000{,}000}$ $\quad p(+_d) = \frac{1}{1{,}000{,}000}$

Diagnostic test for the disease: "99% accurate"

.01 probability of false positive $\quad p(+_t | -_d) = .01$

.01 probability of false negative $\quad p(-_t | +_d) = .01$

$$p(+_d | +_t) = \frac{10^{-6} \times (1 - .01)}{10^{-6} \times (1 - .01) + (1 - 10^{-6}) \times .01}$$

$$\frac{10^{-6}}{10^{-2}}$$

$$= \frac{10^{-6}}{10^{-2}} = \frac{10^{2}\,10^{-6}}{10^{2}\,10^{-2}} = \frac{10^{-4}}{1}$$

$$= 0.0001$$

.01 %

Before test .0000001

After .0001

x "data"

θ "parameter"

$p(\theta)$ unconditioned by data, "original frequency"

$p(\theta | x)$ conclusion we are looking for

$p(x | \theta)$ "bootstrap results"

posterior distribution

prior

likelihood

$$p(\theta \mid x) = \frac{p(\theta)\, p(x \mid \theta)}{\sum_{\theta} p(\theta)\, p(x \mid \theta)}$$

$$p(+_d \mid +_t) = \frac{p(+_d)\, p(+_t \mid +_d)}{p(+_d)\, p(+_t \mid +_d) + p(-_d)\, p(+_t \mid -_d)}$$