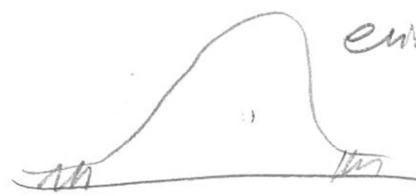
Lec 23 12/8/15 Rand 201

How do I pick H_0 & H_a? How does α play in

H_0: Green aliens do not exist

H_a: Green aliens do exist



α low → skeptic

α high → credulous (push over)

H_0: Green aliens exist

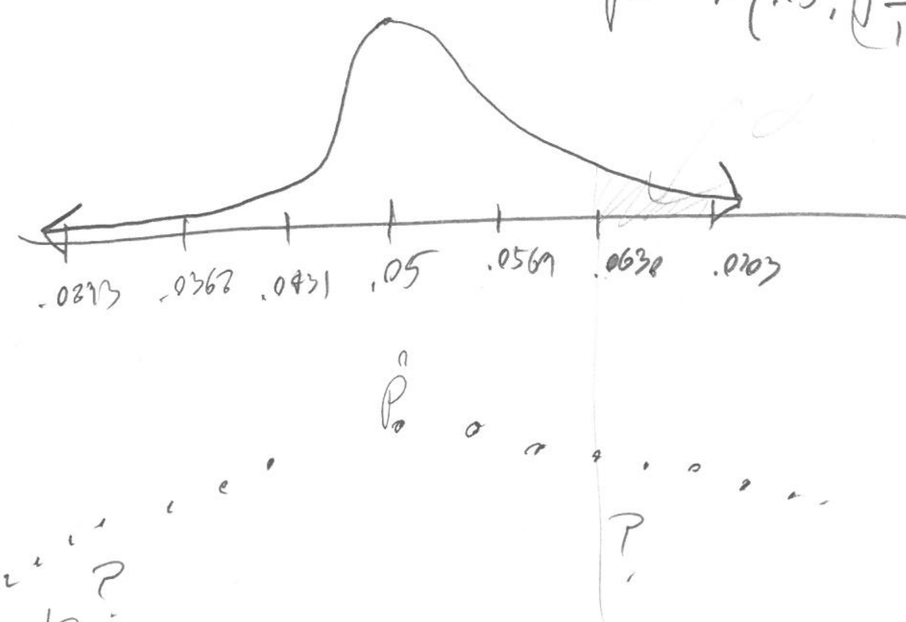
H_a: Green aliens don't exist

α low → dogmatic

α high →

Uber: if more than 5% of customers don't like a driver, driver is fired. After 1000 rides, Uber makes a decision:

$$\hat{p} \sim N\left(.05, \left(\sqrt{\frac{.05(.95)}{1000}}\right)^2\right) = N(0.05, .0069^2)$$



weird?
Bro do I care?

$H_0: p \leq 0.05$ (Null) ← default position

$H_a: p > 0.05$

let $\alpha = 2.5\% \Rightarrow Z_\alpha = 2$ ← why not $\frac{\alpha}{2}$?

One-sided

One-sided One-sample proportion test...
(Right-sided)

Rej. Region $= \left(-\infty, p + Z_\alpha\sqrt{\frac{p(1-p)}{n}}\right] = (-\infty, .0638]$

$\hat{p} \in$ Ret Region $\Rightarrow$ Retain H_0 $\Rightarrow$ Driver good $\Rightarrow$ doing fine

$\hat{p} \notin$ '' '' $\Rightarrow$ Reject H_0 $\Rightarrow$ Driver bad $\Rightarrow$ fire driver

$\alpha = 2.5\% =$ P(Type I error)

$=$ P(firing a good driver)

Decision

Truth		Retain H_0	Reject H_0
	H_0 true		Type I err
	H_0 false	Type II err	

Type II err $=$ P(keeping a bad driver)

Costs? Type II cost $>$ Type I cost

How to make P(Type II err) small? $n\uparrow$ $\alpha\uparrow$

\# complaints $= 71$

$\hat{p} = \frac{71}{1000} = .071 \notin$ Ret Region $\Rightarrow$ Fire driver

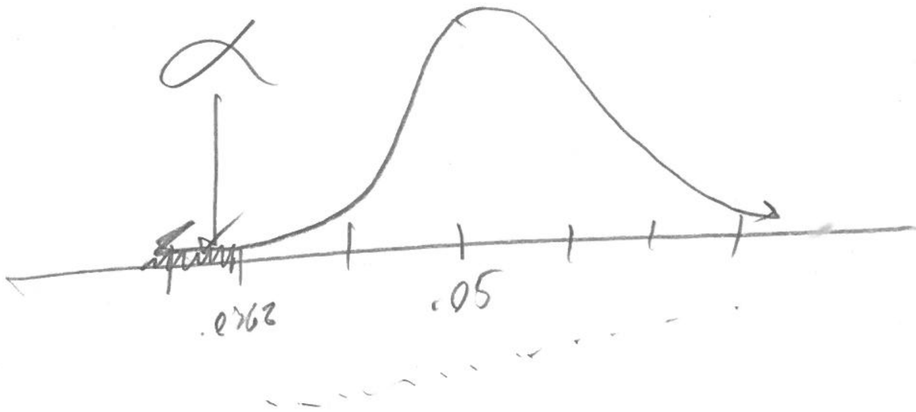
---

There is another way to do this...

$H_0: p \geq 0.05$ (bad driver)

$H_a: p < 0.05$ (good driver)

$\alpha = 2.5\%$



$$\text{Rej Region} = \left[p + z_\alpha \sqrt{\frac{p(1-p)}{n}}, \infty\right)$$

$$= [.0362, \infty)$$

		Decision	
		Retain	Reject
Truth	H_0 true		Type I
	H_0 false	Type II	

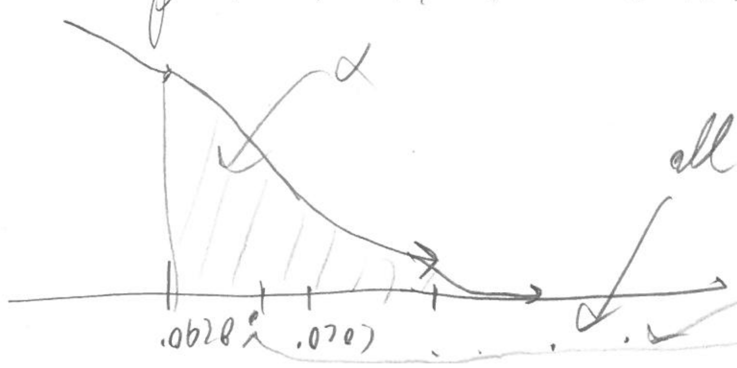
Type I err: keep a bad driver on the road

Type II err: fire a good driver

$$\alpha = P(\text{Type I err})$$

What's the problem with this???

Return to $\hat{p} = 0.071$ in test #1....



all these pts are rejections

but isn't this pt

"more" of a rejection than this pt

Fisher hated this... He didn't think clear-cut decisions should be separate

How to capture this?

$$p_{val} := P\left(\text{seeing data or more extreme} \mid H_0 \text{ true}\right)$$

$$= P\left(\hat{P} \geq \hat{p} \mid H_0\right)$$

$$= P\left(\hat{P} \geq .071 \mid p = 0.05\right)$$

$$= P\left(\frac{\hat{P} - 0.05}{.0069} \geq \frac{.071 - 0.05}{.0069}\right) = P\left(Z > 3.04\right) = .0012$$

$= 0.1\%$

$p_{val} < \alpha \Rightarrow$ Reject H_0

b/c 0.1% is super rare...