You Can’t Coach Speed!

By Alex Diaz-Clark

NFL Scouting Combine & NFL Draft

- NFL Combine drills:
  - 40-yard dash
  - Bench Press
  - Vertical Leap
  - Broad Jump
  - Shuttle Drill
  - 3 Cone Drill
- NFL Coaches and scouts evaluate players ahead of the Draft

- NFL Draft: teams take turn selecting players to join their team
- Players selected in the 1st round make a lot more money.
- “You can’t coach speed”

Research Hypothesis

Top-performers in the 40-yard dash are drafted in the 1st round at a higher rate than the top-performers in the other drills.

Samples

$$40yd\ dash\ top\ performers\ drafted\ in\ the\ 1st\ round \sim Binomial(n = 820, p_{40})$$

$$Bench\ press\ TPs\ drafted\ in\ the\ 1st\ round \sim Binomial(n = 672, p_{BP})$$

$$Vertical\ leap\ TPs\ drafted\ in\ the\ 1st\ round \sim Binomial(n = 732, p_{VL})$$

$$Broad\ jump\ TPs\ drafted\ in\ the\ 1st\ round \sim Binomial(n = 716, p_{BJ})$$

$$Shuttle\ drill\ TPs\ drafted\ in\ the\ 1st\ round \sim Binomial(n = 644, p_{Sh})$$

$$3Cone\ drill\ TPs\ drafted\ in\ the\ 1st\ round \sim Binomial(n = 598, p_{3C})$$

Frequentist Approach: Two-Sample Z-test

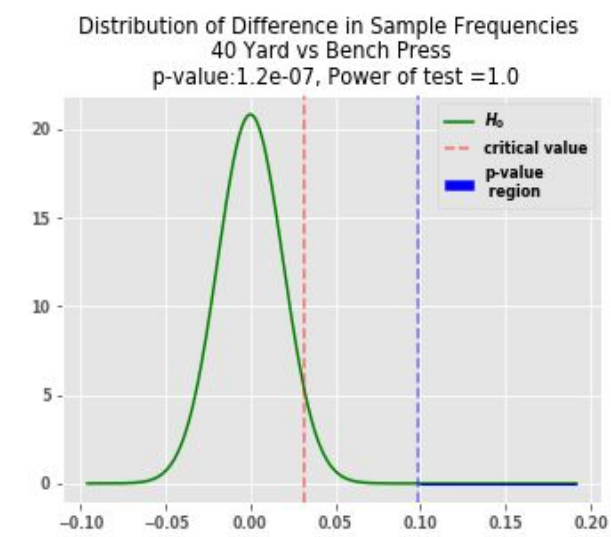
$$H_0 : p_{40} \leq p_{BP} \qquad H_A : p_{40} > p_{BP}$$

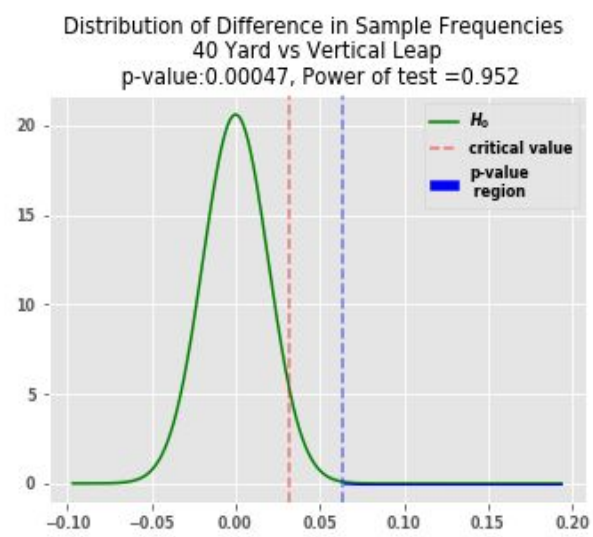
$$Binomial(n = 820, p_{40}) \approx Normal(820p_{40}, \sqrt{820p_{40}(1 - p_{40})})$$

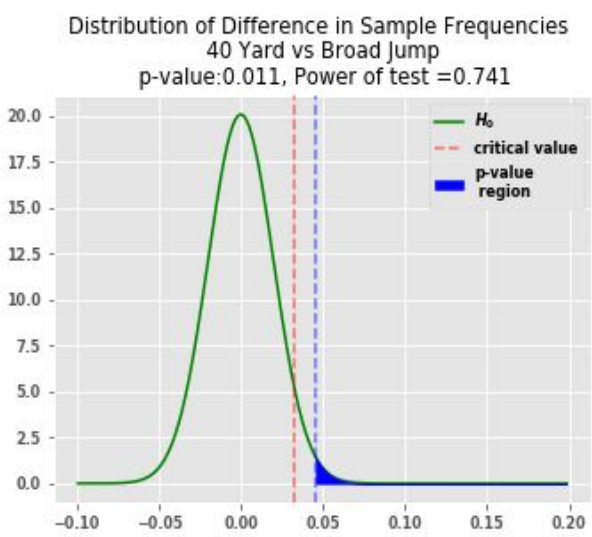
$$Frequency\ that\ 40yd\ TPs\ are\ drafted\ in\ the\ 1st\ round \sim Normal(p_{40}, \sqrt{\frac{p_{40}(1 - p_{40})}{820}})$$

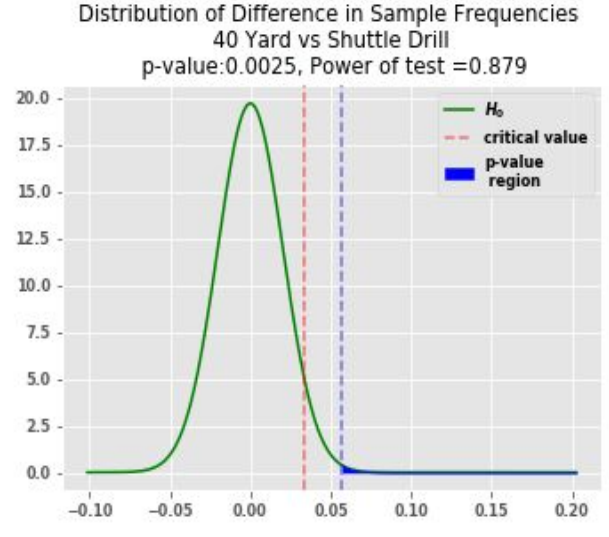
$$H_0 : p_{40} = p_{BP} = p \qquad p = \frac{820p_{40} + 672p_{BP}}{820 + 672}$$

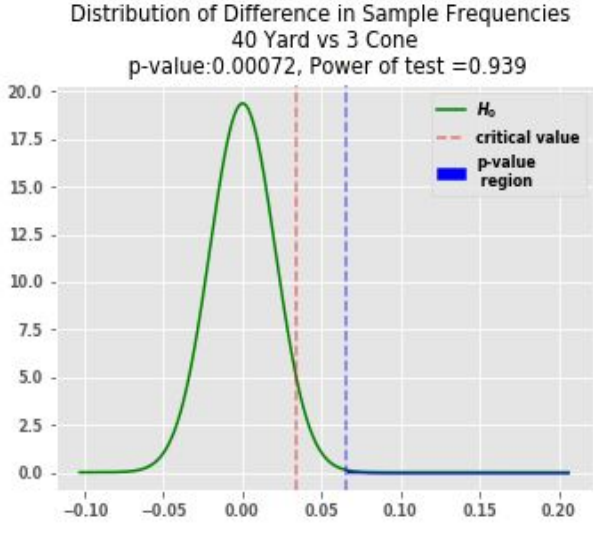
$$Diff\ in\ sample\ freq\ between\ 40yd\ and\ bench\ press \sim Normal(0, \sqrt{\frac{(820 + 672)p(1 - p)}{820 * 672}})$$











$\alpha = 0.05$

Able to reject the null hypothesis with 95% confidence in all 5 cases!

Bayesian A/B Testing

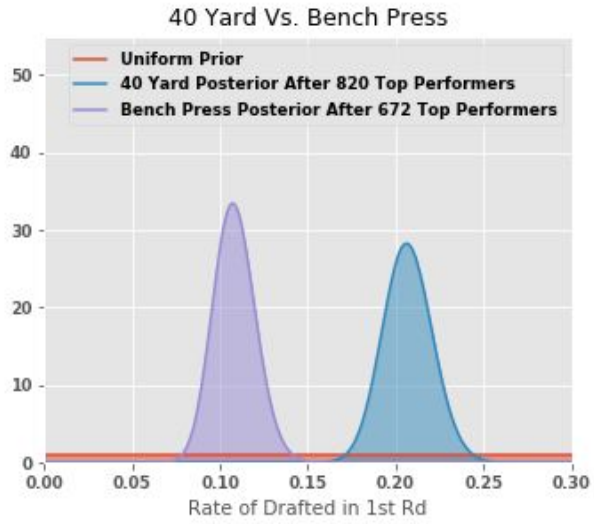
Frequentist: *P(Observed Data | Null Hypothesis)*

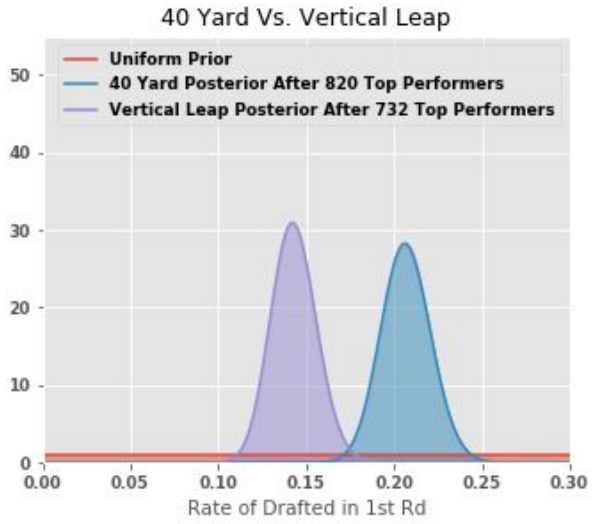
Bayesian: *P(Alternate Hypothesis | Observed Data)*

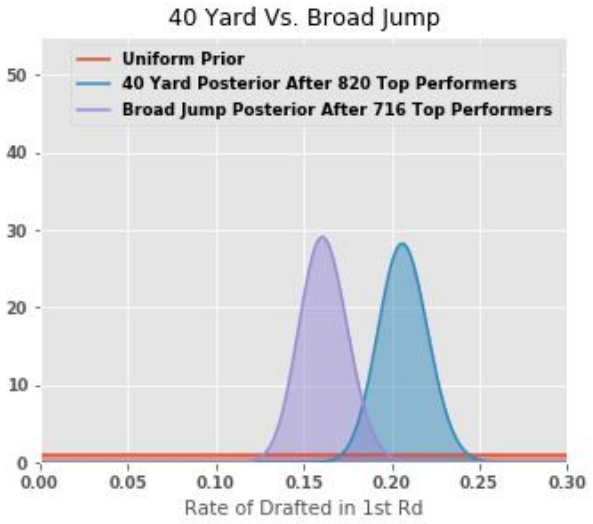
$$Prior = Beta(\alpha = 1, \beta = 1)$$

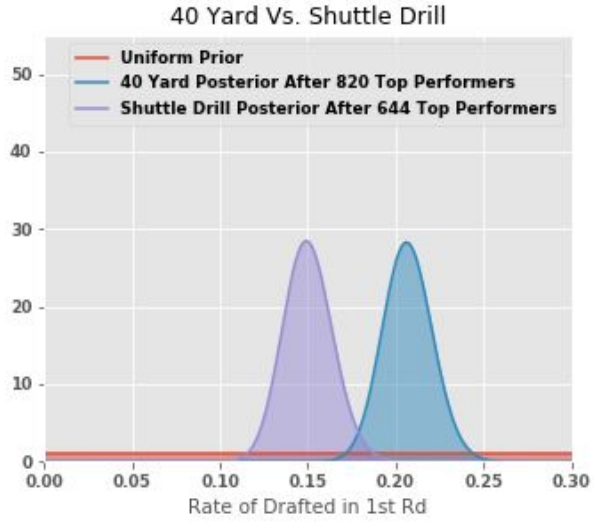
$$Posterior_{40} = Beta(\alpha = 170, \beta = 652)$$

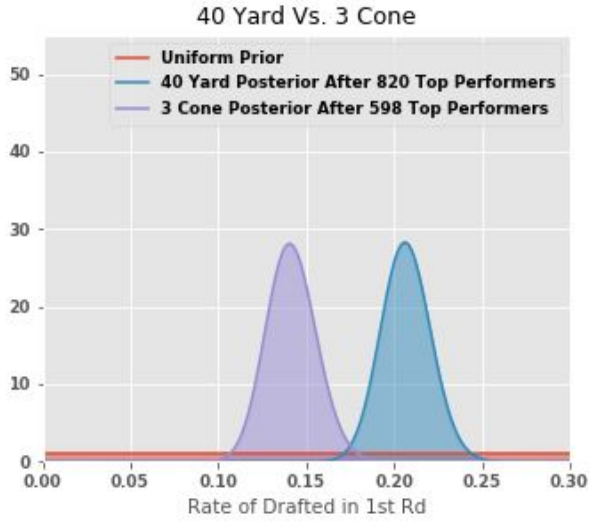
$$Posterior_{BP} = Beta(\alpha = 73, \beta = 601)$$



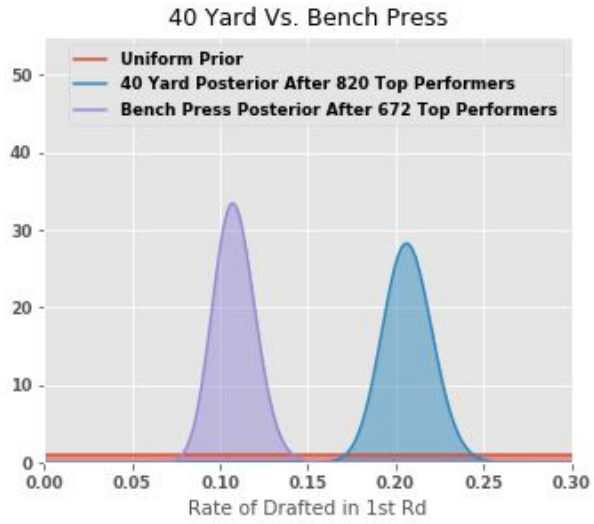


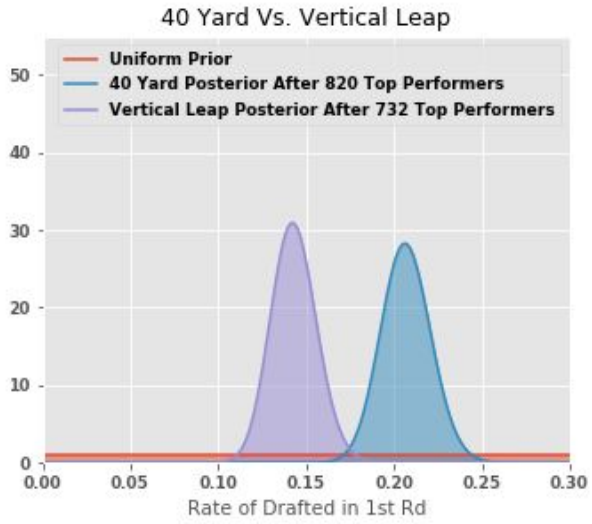


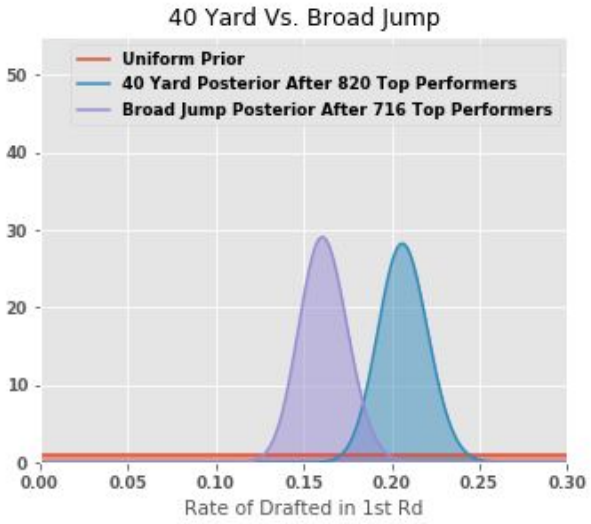


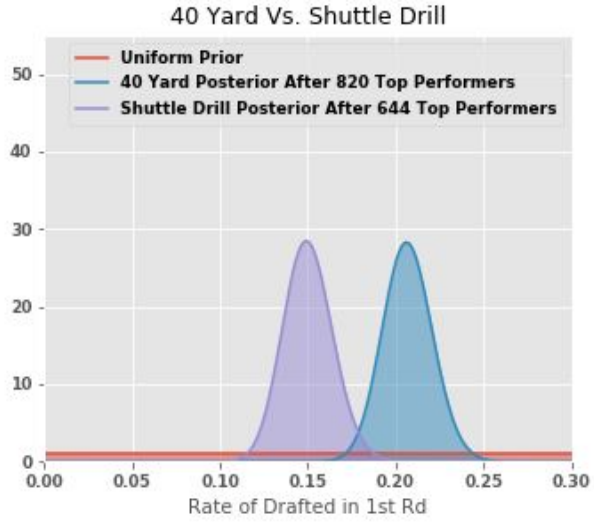


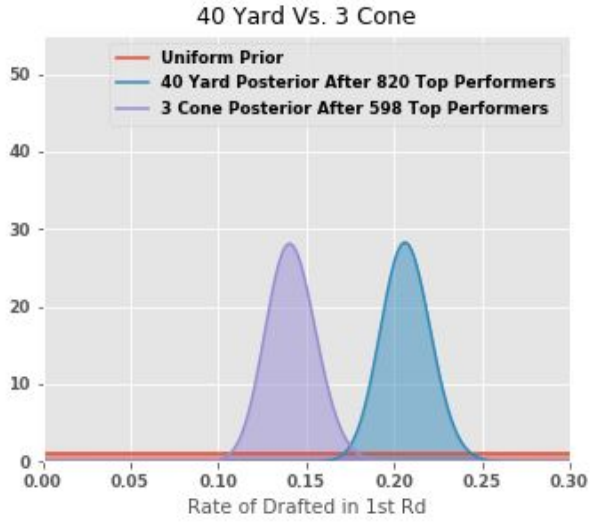
40-yard vs	# of times 40 > other	probability
Bench Press	10000/10000	1.0
Vertical Leap	9997/10000	.9997
Broad Jump	9883/10000	.9883
Shuttle Drill	9973/10000	.9973
3 Cone	9991/10000	.9991











40-yard vs	assumed diff	probability
Bench Press	0.067	.9561
Vertical Leap	0.031	.9553
Broad Jump	0.013	.9503
Shuttle Drill	0.024	.9516
3 Cone	0.032	.9515

Conclusions

Frequentist approach:

I was able to reject the statement that top performers in the 40-yard dash are not drafted in the 1st round at a higher rate than top performers in the other drills, and I was able to reject that statement with 95% confidence.

Bayesian approach:

There is a greater than 95% chance that top performers in the 40-yard dash are drafted in the 1st round at a rate that is:

- 6.7 percentage points higher than top performers in the bench press.
- 3.1 percentage points higher than top performers in the vertical leap.
- 1.3 percentage points higher than top performers in the broad jump.
- 2.4 percentage points higher than top performers in the shuttle drill.
- 3.2 percentage points higher than top performers in the 3-cone drill.