Example: High P-value but False Null Hypothesis

Standard gravity

- Near the surface of the Earth, objects accelerate at

  $g = 9.80665\ m/s^2$

- Suppose we measure the acceleration several times, and get the measurements

  $10.2, 9.5, 10.5, 9.0, 10.9, 10.2$

- Null Hypothesis
  - $g = 10.0$

```
> measurements = c(10.2, 9.5, 10.5, 9.0,
10.9, 10.2)
> t.test(measurements, mu=10.0)

One Sample t-test

data:  measurements
t = 0.1777, df = 5, p-value = 0.8659
```

- Is the Null Hypothesis true?
  - NO! Actually, $g = 9.80665\ m/s^2$
- We can play this game even with the hypothesis that $g = 9.80666\ m/s^2$
  - Hard to reject!
- Typically, the Null Hypothesis is of the form

$$\mu_x = \mu_y$$

- What we actually mean is $\mu_x \approx \mu_y$
  - If can't reject $\mu_x = \mu_y$, we also can't reject $\mu_x \approx \mu_y$ (Why?)
  - If we reject $\mu_x = \mu_y$, we should also look at our estimate for $\mu_x - \mu_y$ -- maybe it's so small we achieved nothing