Today, we are going to learn how to use JASP to compare group means.

You already know how to do this for simple datasets:

- one group mean against a hypothesized population mean: *single sample t-test*
- two means from paired samples (e.g., pretest-postest): *paired samples t-test*
- two means from independent groups: *independent samples t-test*

We'll talk about how to do these in JASP, and we'll also learn how to compare 3 or more group means using *analysis of variance* (ANOVA)

Before we can use JASP, we need to remember how hypothesis testing work:

1. define a null hypothesis $\mathcal{H}_0$ and an alternative hypothesis $\mathcal{H}_1$
    - these hypotheses are *models* of the potential data we could observe
2. observe data
3. assume the null $\mathcal{H}_0$ is true, and calculate the probability that you could have observed that data (or more extreme)
    - requires computing a *test statistic* (e.g., the t-score)
    - this probability of observing this test statistic under $\mathcal{H}_0$ is called the p-value.
4. if p is small ($p < 0.05$), then our data is rare – that is, quite unlikely to happen if $\mathcal{H}_0$ were true.
    - then, we *reject* $\mathcal{H}_0$, leaving (indirect) support for $\mathcal{H}_1$.

Let's illustrate doing hypothesis tests in JASP with a dataset. On Canvas, you can download the file `sternberg.csv` and open it in JASP.

Sternberg (1966) examined how people recall things from short term memory. On a screen, he briefly presented a set of 1, 3, or 5 digits. Shortly after this presentation, be presented a single test digit on the screen and ask subjects to push YES if the test digit had been included in the original set, and NO if the test digit was not included in the original set.

Variables in `sternberg.csv`:

- `nstim`: number of stimuli (digits) presented (1,3,5)
- `yesno`: 1 = YES, 2 = NO
- `RT`: response time in milliseconds

Research question 1: Is there a significant difference in mean RTs for trials where the test digit was in the original comparison set (i.e., YES responses) compared to trials where the test digit was *not* in the original comparison set (i.e., NO responses)?

1. identify test to use
    - two means from independent samples, so /independent samples t-test
2. define parameters and write down hypotheses
    - μ_1 = pop mean RT for YES responses
    - μ_2 = pop mean RT for NO responses
    - $\mathcal{H}_0 : \mu_1 = \mu_2$
    - $\mathcal{H}_1 : \mu_1 \neq \mu_2$
3. perform test in JASP
4. interpret p-value and make conclusion about research question.

Research question 2: Is there a significant difference in mean RTs among trials with 1, 3, or 5 numbers in the original comparison set?

Here, you'll notice that we now have THREE groups to compare. A t-test won't work for this.

However, another technique will work fine – it is called *analysis of variance*, or ANOVA for short.

- basically, it works by comparing the variance *between* groups to the variance *within* groups, and computes something called an F statistic. You can read the details in Chapter 12 of *Learning Statistics with JASP*

1. Identify test to use
    - since 3 or more means, we use ANOVA
2. define parameters and write down hypotheses
    - μ_1 = pop mean RT for displays with 1 number
    - μ_2 = pop mean RT for displays with 3 numbers
    - μ_3 = pop mean RT for displays with 5 numbers
    - $\mathcal{H}_0 : \mu_1 = \mu_2 = \mu_3$
    - $\mathcal{H}_1$: not all μ's are equal (i.e., there are differences among the population means)
3. perform test in JASP
4. interpret p-value and make conclusion about research question.