What is the difference between One-Way ANOVA and Repeated Measures ANOVA?

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One-Way ANOVA and Repeated Measures ANOVA are two statistical tests commonly used in data analysis. While they both involve comparing means of different groups, they differ in their approach and application.

One-Way ANOVA is used to compare the means of three or more independent groups, where each group is measured only once. This test is useful in situations where the researcher wants to determine if there is a significant difference between multiple groups. It assumes that the groups are independent of each other and that the data is normally distributed.

On the other hand, Repeated Measures ANOVA is used to compare the means of three or more related groups, where each group is measured more than once. This test is appropriate for situations where the same group of participants is measured under different conditions or at different time points. It takes into account the within-subject variability and is more powerful than One-Way ANOVA in detecting significant differences.

In summary, the main difference between One-Way ANOVA and Repeated Measures ANOVA is the type of data they analyze. One-Way ANOVA is used for independent groups, while Repeated Measures ANOVA is used for related groups. It is important to choose the appropriate test based on the research question and type of data to obtain accurate and meaningful results.

One-Way ANOVA vs. Repeated Measures ANOVA: The Difference

Two types of ANOVA models that students often get confused between are the one-way ANOVA and the repeated measures one-way ANOVA.

Here's the simple difference:

A one-way ANOVA is used to determine whether or not there is a statistically significant difference between the means of three or more independent groups.

A repeated measures one-way ANOVA is used to determine whether or not there is a statistically significant difference between the means of three or more groups *in which the same subjects show up in each group*.

	One-Way ANOVA	Repeated Measures One-Way ANOVA
Variables	Used with one categorical predictor variable and one continuous response variable.	Used with one categorical predictor variable and one continuous response variable.
Subjects	Each subject only appears in **one group**.	Each subject appears in **each group**.

For example, suppose a professor wants to determine if three different studying techniques lead to different mean exam scores. To test this, he recruits 15 students and randomly assigns 5 students to use each studying technique for one week before the exam.

He could use a one-way ANOVA to test for differences between the group means since each student only appears in one group each.

One-Way ANOVA

Studying Technique 1	Studying Technique 2	Studying Technique 3
Student A Exam Score	Student F Exam Score	Student K Exam Score
Student B Exam Score	Student G Exam Score	Student L Exam Score
Student C Exam Score	Student H Exam Score	Student M Exam Score
Student D Exam Score	Student I Exam Score	Student N Exam Score
Student E Exam Score	Student J Exam Score	Student O Exam Score

However, suppose the professor recruits just 5 students and has each student use each studying technique during three different weeks to prepare for tests of equal difficulty.

In this scenario, he could use a repeated measures one-way ANOVA to test for differences between the group means since each student appears in each group.

Repeated Measures One-Way ANOVA

Studying Technique 1	Studying Technique 2	Studying Technique 3
Student A Exam Score #1	Student A Exam Score #2	Student A Exam Score #3
Student B Exam Score #1	Student B Exam Score #2	Student B Exam Score #3
Student C Exam Score #1	Student C Exam Score #2	Student C Exam Score #3
Student D Exam Score #1	Student D Exam Score #2	Student D Exam Score #3
Student E Exam Score #1	Student E Exam Score #2	Student E Exam Score #3

When to Use a Repeated Measures ANOVA

A repeated measures ANOVA is used in two specific

situations:

1. Measuring the mean scores of subjects during three or more time points. For example, you might want to measure the resting heart rate of subjects one month before they start a training program, once during the middle of the program, and one month after the program to see if there is a significant difference in mean resting heart rate across these three time points.

Subject	Resting Heart Rate 1 Month Before Training Program	Resting Heart Rate in Middle of Training Program	Resting Heart Rate 1 Month After Training Program
Michael	65	58	60
Dwight	55	48	49
Andy	58	55	55
Meredith	68	60	64
Angela	47	45	45

Since the heart rate of each subject is measured *repeatedly*, we can use a repeated measures ANOVA to determine if there is a significant difference in mean heart rate across these three time periods.

2. Measuring the mean scores of subjects under three different conditions. For example, you might have subjects watch three different movies and rate each one based on how much they enjoyed it.

Subject	Movie 1 Rating	Movie 2 Rating	Movie 3 Rating
Michael	88	84	92
Dwight	76	78	90
Andy	78	94	95
Meredith	80	83	88
Angela	82	90	99

Again, the same subjects show up in each group, so we need to use a repeated measures ANOVA to test for the difference in means across these three conditions.

Pros & Cons of the Repeated Measures ANOVA

A repeated measures one-way ANOVA offers the following pros over the ordinary one-way ANOVA:

1. It's faster and more cost-effective to recruit a small number of individuals to participate in a repeated measures one-way ANOVA since researchers can simply obtain data from the same individuals multiple times.

2. Researchers can attribute a portion of the variance in the data to the individuals themselves, which makes it easier to detect true differences that exist between the different treatments.

However, a repeated measures one-way ANOVA comes with the following cons:

1. If one individual drops out of the experiment, researchers lose out on more data compared to an ordinary one-way ANOVA.

2. There is the potential for individuals to suffer from - which refers to differences in participant behavior as a result of the order in which treatments are presented to them. For example, individuals may become tired or fatigued by time they experience the last treatment.