

What is the definition of Three-Way ANOVA and can you provide an example?

Authored by
stats writer

June 27, 2024

RECOMMENDED CITATION

stats writer (2024). *What is the definition of Three-Way ANOVA and can you provide an example?*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=155387>

Three-Way ANOVA (Analysis of Variance) is a statistical method used to analyze the effects of three independent variables on a continuous dependent variable. It is a form of multiple regression analysis that allows for the examination of interactions between the three independent variables. This type of ANOVA is often used in research studies to determine the significance of three or more factors on a particular outcome. For example, a researcher may use Three-Way ANOVA to analyze the effects of gender, age, and income on job satisfaction among employees.

Three-Way ANOVA: Definition & Example

A three-way ANOVA is used to determine how three different factors affect some response variable.

Three-way ANOVAs are less common than a (with only one factor) or (with only two factors) but they are still used in a variety of fields.

Whenever we perform a three-way ANOVA, we're interested in whether there is a statistically significant relationship between each factor and the response variable along with whether there are any interaction effects between the factors.

This tutorial shares several scenarios in which you might use a three-way ANOVA along with an example of how to perform one.

When to Use a Three-Way ANOVA

Here are a few scenarios where you may use a three-way ANOVA:

Scenario 1: Botany

A botanist may want to determine how (1) sunlight exposure, (2) watering frequency, and (3) fertilizer type affect plant growth.

In this scenario, she could perform a three-way ANOVA since there are three factors and one response variable.

Scenario 2: Retail

An executive at a retail store may want to determine how (1) day of the week, (2) store location, and (3) advertising campaigns affect total sales.

In this scenario, he could perform a three-way ANOVA since there are three factors and one response variable.

Scenario 3: Medical

A doctor may want to determine how (1) gender, (2) diet, and (3) exercise habits affect weight.

In this scenario, she could perform a three-way ANOVA

since there are three factors and one response variable.

Three-Way ANOVA: Example

Suppose a researcher wants to determine if training program, gender, and athletic division affect jumping height.

1. Training program (program 1 vs. program 2)
2. Gender (male vs. female)
3. Athletic Division (division I vs. division II)

The one response variable will be jumping height.

Suppose he collects this data on 40 individuals:

Individual	Program	Gender	Division	Height
1	1	Male	I	7
2	1	Male	I	7
3	1	Male	I	8
...
39	2	Female	II	2
40	2	Female	II	1

He then uses statistical software to perform a three-way ANOVA and receives the following output:

Source	df	SS	MS	F	P-value
Program	1	36.1	36.1	65.636	0.000000298
Gender	1	67.6	67.6	122.909	0.000000171
Division	1	19.6	19.6	35.363	0.0000119
Program*Gender	1	0.0	0.0	0.000	1.000
Program*Division	1	0.4	0.4	0.727	0.400
Gender*Division	1	0.1	0.1	0.182	0.673
Program*Gender*Division	1	0.1	0.1	0.182	0.673
Residuals	32	17.6	0.55		

The P-value column shows the p-value for each individual factor and the interactions between the factors.

From the output we can see that none of the interactions between the three factors were statistically significant.

We can also see that each of the three factors (Program, Gender, and Division) were statistically significant.

In conclusion, we would state that training program, gender, and division are all significant predictors of the jumping height increase among players.

We would also state that there are no significant interaction effects between these three factors.

Note: In practice, we would also calculate the mean jumping height for each program, gender, and division so that we could determine which of each factor are associated with increased jumping height.

The following tutorials explain how to perform a three-way ANOVA in R and Python:

ARABPSYCHOLOGY.COM