

# What is a moderating variable and can you provide an example?

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April 26, 2024

## RECOMMENDED CITATION

stats writer (2024). *What is a moderating variable and can you provide an example?*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=139515>

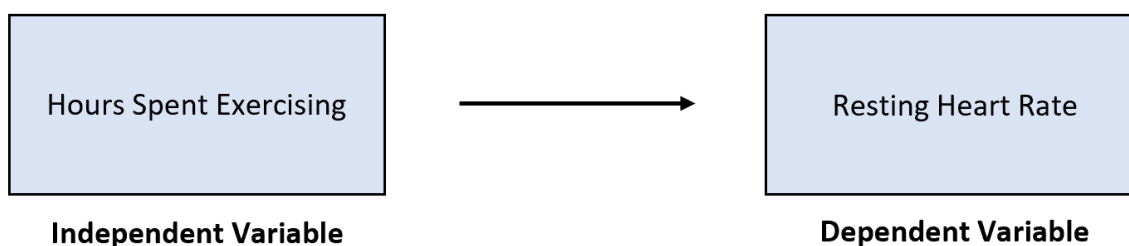
A moderating variable is a variable that affects the strength or direction of the relationship between two other variables. It can either enhance or weaken the relationship between the independent and dependent variables. For example, in a study investigating the relationship between exercise and mental health, age could be a moderating variable. Younger individuals may experience a stronger positive relationship between exercise and mental health, while older individuals may not see as significant of an impact. In this case, age is moderating the relationship between exercise and mental health.

## What is a Moderating Variable? Definition & Example

**A moderating variable is a type of variable that affects the relationship between a and an .**

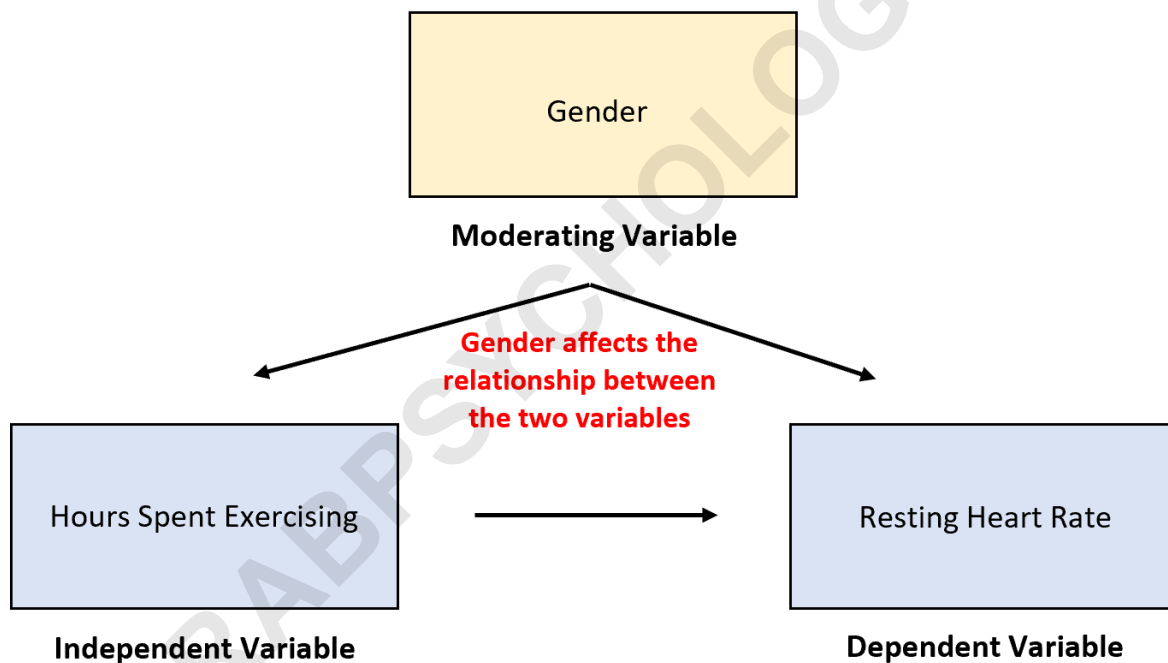
**When performing , we're often interested in understanding how changes in an independent variable affect a dependent variable. However, sometimes a moderating variable can affect this relationship.**

**For example, suppose we want to fit a regression model in which we use the independent variable *hours spent exercising each week* to predict the dependent variable *resting heart rate*.**

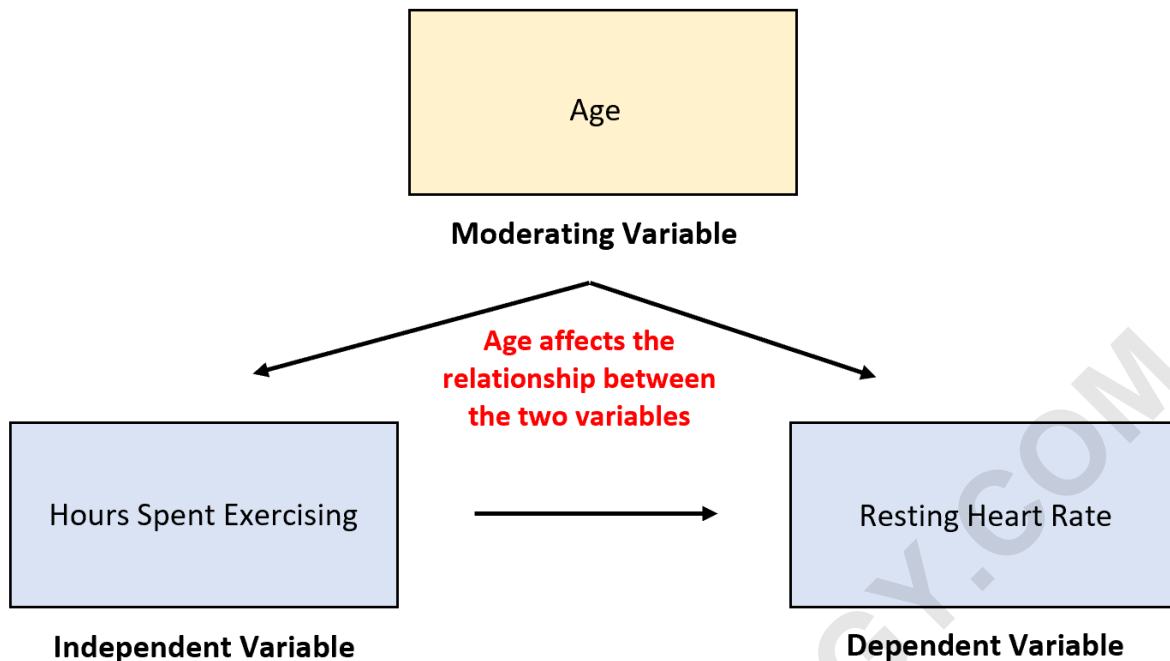


We suspect that more hours spent exercising is associated with a lower resting heart rate. However, this relationship could be affected by a moderating variable such as gender.

It's possible that each extra hour of exercise causes resting heart rate to drop more for men compared to women.



Another example of a moderating variable could be age. It's likely that each extra hour of exercise causes resting heart rate to drop more for younger people compared to older people.



### Properties of Moderating Variables

**Moderating variables have the following properties:**

**1. Moderating variables can be qualitative or quantitative.**

**are variables that take on names or labels. Examples include:**

**Gender (Male or Female) Education Level (High School Degree, Bachelor's Degree, Master's Degree, etc.) Marital Status (Single, Married, Divorced)**

**are variables that take on numerical values. Examples**

**include:**

## **Age Height Square Footage Population Size**

In the previous examples, gender was a qualitative variable that could affect the relationship between hours studied and resting heart rate while age was a quantitative variable that could potentially affect the relationship.

**Moderating variables can have the following effects:**

**Strengthen the relationship between two variables. Weaken the relationship between two variables. Negate the relationship between two variables.**

Depending on the situation, a moderating variable can *moderate* the relationship between two variables in many different ways.

**How to Test for Moderating Variables**

If  $X$  is an independent variable (sometimes called a "predictor" variable) and  $Y$  is a dependent variable (sometimes called a "response" variable), then we

could write a regression equation to describe the relationship between the two variables as follows:

$$Y = \beta_0 + \beta_1 X$$

If we suspect that some other variable,  $Z$ , is a moderator variable, then we could fit the following regression model:

$$Y = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 XZ$$

In this equation, the term  $XZ$  is known as an interaction term.

If the coefficient of  $XZ$  in the regression output is statistically significant, then this indicates that there is a significant interaction between  $X$  and  $Z$  and  $Z$  should be included in the regression model as a moderator variable.

We would write the final model as:

$$Y = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 XZ$$

If the  $p$ -value for the coefficient of  $XZ$  in the regression output is not statistically significant, then  $Z$  is not a

**moderator variable.**

**However it's possible that the coefficient for Z could still be statistically significant. In this case, we would simply include Z as another independent variable in the regression model.**

**We would then write the final model as:**

$$Y = \beta_0 + \beta_1 X + \beta_2 Z$$

**Introduction to Confounding Variables**