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Introduction to Mediation, Moderation, and Conditional Process Analysis

A Regression-Based Approach

Andrew F. Hayes

"Mediation and moderation are two of the most widely used statistical tools in the social sciences. Students and experienced researchers have been waiting for a clear, engaging, and comprehensive book on these topics for years, but the wait has been worth it—this book is an absolute winner. With his usual clarity, Hayes has written what will become the default resource on mediation and moderation for many years to come."

—**Andy Field, PhD**, School of Psychology, University of Sussex, United Kingdom

"Hayes provides an accessible, thorough introduction to the analysis of models containing mediators, moderators, or both. The text is easy to follow and written at a level appropriate for an introductory graduate course on mediation and moderation analysis. The book is also an extremely useful resource for applied researchers interested in analyzing conditional process models. One strength is the inclusion of numerous examples using real data, with step-by-step instructions for analysis of the data and interpretation of the results. This book's largest contribution to the field is its replacement of the confusing terminology of mediated moderation and moderated mediation with the clearer and broader term *conditional process model*."

—**Matthew Fritz, PhD**, Department of Educational Psychology, University of Nebraska-Lincoln

"A welcome contribution. This book's accessible language and diverse set of examples will appeal to a wide variety of substantive researchers looking to explore how or why, and under what conditions, relationships among variables exist. Hayes has a unique ability to effectively communicate technical material to nontechnical audiences. He facilitates application of several cutting-edge statistical models by providing practical, well-oiled machinery for conducting the analyses in practice. I can use this book to enhance my graduate-level mediation class by extending the course to include more coverage on differentiating mediation versus moderation and on conditional process models that simultaneously evaluate both effects together."

—**Amanda Jane Fairchild, PhD**, Department of Psychology, University of South Carolina

"This decidedly readable, informative book is perfectly suited for a range of audiences, from the novice graduate student not quite ready for SEM to the advanced statistics instructor. Even the seasoned quantitative methodologist will benefit from Hayes's years of accumulated wisdom as he expertly navigates this burgeoning—and at times inconsistent—literature. This book is particularly well suited for graduate-level courses. Hayes brings conditional process analysis to life with such passion that even the most 'stat-o-phobic' will become convinced that they too can master SPSS (or SAS) process. The thoughtful use of real-life examples, accompanied by SPSS and SAS syntax and output, makes the book highly accessible."

—**Shelley Brown, PhD**, Department of Psychology, Carleton University, Canada

Explaining the fundamentals of mediation and moderation analysis, this engaging book also shows how to integrate the two using an innovative strategy known as conditional process analysis. Procedures are described for testing hypotheses about the mechanisms by which causal effects operate, the conditions under which they occur, and the moderation of mechanisms. Relying on the principles of ordinary least squares regression, Andrew Hayes carefully explains the estimation and interpretation of direct and indirect effects, probing and visualization of interactions, and testing of questions about moderated mediation. Examples using data from published studies illustrate how to conduct and report the analyses described in the book. Of special value, the book introduces and documents PROCESS, a macro for SPSS and SAS that does all the computations described in the book. The author's website (www.afhayes.com) offers free downloads of PROCESS plus data files for the book's examples.

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The PROCESS macro for SPSS and SAS



Take a workshop from Andrew F. Hayes on the use of PROCESS. Currently scheduled workshops that are open to the public can be found below



Interactions in Linear Regression Analysis. This is a two-day course on the estimation and interpretation of interactions in least squares regression analysis, with a focus on the use of PROCESS. This course is being offered in Philadelphia on May 13-14, 2016 through Statistical Horizons. Details and enrollment information are available [here](#).



Mediation, Moderation, and Conditional Process Analysis. This is a two-day introductory-level course on moderation and mediation analysis with an emphasis on the use of PROCESS. The course will be held at the **Queensland University of Technology** in Brisbane, Australia, June 6-7, 2016 and is offered through Statistical Horizons. Seats will be very limited. Details and enrollment information will be available on the [Statistical Horizons](#) page when registration opens.



Mediation, Moderation and Conditional Process Analysis. This course emphasizes the use of OLS regression and PROCESS is being offered through the Global School in Empirical Research Methods in St. Gallen, Switzerland, June 20-24th, 2016. Go to the [GSERM page](#) for details, tuition, and enrollment information. NOTE: This course covers less material than does the five-day course in Chicago. The course at GSERM meets 9.30 to 15.00 each day, whereas the course in Chicago meets 9.00 to 17.00 each day. The five-day course at GSERM is comparable to a three-day course through Statistical Horizons. Here is the [syllabus](#) for the GSERM course.



Mediation, Moderation, and Conditional Process Analysis. This is a five-day course that emphasizes the use of OLS regression and PROCESS and is being offered in Chicago on July 11-15, 2016, through Statistical Horizons. Details and enrollment information will be available on the [Statistical Horizons](#) page when registration opens. Here is the [syllabus](#) for the course.

Read some reviews of Statistical Horizons workshops offered by Andrew Hayes [here](#), [here](#), [here](#), and [here](#).

Mediation, Moderation, and Conditional Process Analysis

Five-day course offered through

Statistical Horizons

www.statisticalhorizons.com

The Gleacher Center, Chicago, IL

11-15 July 2016

Instructor: Andrew F. Hayes

Statistical mediation and moderation analyses are among the most widely used data analysis techniques in social science, health, and business fields. Mediation analysis is used to test hypotheses about various intervening mechanisms by which causal effects operate. Moderation analysis is used to examine and explore questions about the contingencies or conditions of an effect, also called “interaction.” Increasingly, moderation and mediation are being integrated analytically in the form of what has become known as “conditional process analysis,” used when the goal is to understand the contingencies or conditions under which mechanisms operate. An understanding of the fundamentals of mediation and moderation analysis is in the job description of almost any empirical scholar. In this course, you will learn about the underlying principles and the practical applications of these methods using ordinary least squares (OLS) regression analysis and the PROCESS macro for SPSS and SAS invented by the course instructor.

Course objectives. By the end of this course, you will...

- be able to statistically partition one variable’s effect on another into its primary pathways of influence, direct and indirect.
- understand historical and modern approaches to inference about indirect effects
- know how to test competing theories of mechanisms statistically through the comparison of indirect effects in models with multiple mediators
- acquire an understanding of how to build flexibility into a regression model that allows a variable’s effect to be a function of another variable in a model.
- understand how scaling of variables influence parameter estimates and their interpretation.
- have the ability to visualize and probe interactions in regression models.
- have learned how to integrate models involving moderation and mediation into a conditional process model.
- have learned how to estimate the contingencies of mechanisms through the computation and inference about conditional indirect effects.
- know how to determine whether a mechanism is dependent on a moderator variable.
- be able to apply the methods discussed in this course using readily-available statistical software
- be in a position to talk and write in an informed way about the mechanisms and contingencies of causal effects.

Course audience: Researchers in any field, including psychology, sociology, education, business, human development, political science, public health, communication, and others who want to learn how to apply moderation and mediation analysis in their research.

Course prerequisites. Participants should have a basic working knowledge of the principles and practice of multiple regression and elementary statistical inference. No knowledge of matrix algebra

is required or assumed, nor is matrix algebra ever used in the course. Some familiarity with the use of SPSS or SAS is assumed.

Topics covered:

- Path analysis: Direct, indirect, and total effects in mediation models.
- Estimation and inference about indirect effects in single mediator models.
- Multiple mediator models (parallel and serial).
- Mediation analysis with a multicategorical independent variable.
- Mediation analysis in the two-condition within-subject design
- Estimation of moderation and conditional effects.
- Probing and visualizing interactions.
- Multicategorical moderators and independent variables in moderation analysis.
- The effects of variable scaling and model parameterization on interpretation.
- Conditional Process Analysis (also known as “moderated mediation”)
- Quantification of and inference about conditional indirect effects.
- Testing a moderated mediation hypothesis and comparing conditional indirect effects
- Moderation in serial mediation models

Computing technology. Computer applications will focus on the use of ordinary least squares regression and the PROCESS macro for SPSS and SAS developed by the instructor that makes the analyses described in this class much easier than they otherwise would be. When appropriate, some Mplus code will be provided for those interested, but structural equation modeling will not be the emphasis of this course. Because this is a hands-on course, students are strongly encouraged to bring their own laptops (Mac or Windows) with a recent version of SPSS Statistics (version 19 or later) or SAS (release 9.2 or later) installed. SPSS users should ensure their installed copy is patched to its latest release. SAS users should ensure that the IML product is part of the installation. Students should have good familiarity with the basics of ordinary least squares regression (although a brief overview of OLS regression will be the first topic of the course), as well as the use of SPSS or SAS. Students are also encouraged to bring your own data to apply what you’ve learned. R and STATA users can benefit from the course content, but PROCESS makes these analyses much easier and is not available for R or STATA.

Recommended book. This course is a companion to the instructor’s book *Introduction to Mediation, Moderation, and Conditional Process Analysis*, published by The Guilford Press. The content of the course overlaps the book to some extent, but many of the examples are different, and this course includes quite a bit of material not in the first edition of the book. A copy of the book is not required to benefit from the course, but it could be helpful to reinforce understanding.

What is not covered. As an introductory-level course, we focus primarily on research designs that are experimental or cross-sectional in nature with continuous outcomes. We do not cover complex models involving dichotomous outcomes, latent variables, nested data (i.e., multilevel models), or the use of structural equation modeling (though some Mplus code will be provided for those interested, to illustrate the similarity between SEM and regression approaches). Some treatment of “repeated measures” designs with no more than two repeated measurements is covered, but we do not address latent growth modeling or complex longitudinal data problems.

Tuition and enrollment. See www.statisticalhorizons.com