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## Introduction to Mediation, Moderation, and Conditional Process Analysis

*SECOND EDITION*

*A Regression-Based Approach*

**Andrew F. Hayes**

"This book provides clear instruction that is accessible to graduate students while also useful to seasoned researchers looking to expand their skills for more complex regression-based analyses. The second edition provides increased clarity in interpreting PROCESS output and documents PROCESS v3, which allows for great flexibility in analyzing models. Other useful developments in the second edition include chapters on multicategorical variables, incorporation of the index of moderated mediation, and the appendix of instructions on how to customize PROCESS for models not covered by the templates. Hayes's approach is cutting edge in both philosophy and pragmatics. I've used the first edition extensively as a course text as well as in my own research, and am excited to move to the second edition."

—**Elizabeth J. Kiel, PhD**, Department of Psychology, Miami University

"Using lucid prose and abundant, worked-through examples, Hayes walks readers through the promise and potential pitfalls of two of the most essential—yet convoluted—tasks in social science research. Novices will find this book to be a thorough, accessible description of ordinary least squares regression and a smart tutorial on mediation and moderation, but it is also much more. Any seasoned researcher who has slogged through the arcane computation and agonizing decision making related to the estimation and interpretation of direct and indirect effects, or the visualization and presentation of interactions, will find this volume (with the accompanying PROCESS macro) to be a veritable Swiss Army knife, and will return to it time and time again."

—**Jeffrey G. Parker, PhD**, Department of Psychology, University of Alabama

"This text is a wonderful combination of traditional mediation and moderation using regression and extensions into more complex variations. Coverage is clear and thorough—perfect for intermediate to advanced regression learners. Updates in the second edition include a new chapter with answers to many very important and common questions, which will be extremely helpful to learners. I can't wait to use this second edition with my students."

—**Jocelyn H. Bolin, PhD**, Department of Educational Psychology, Ball State University

"This second edition is a welcome addition to advanced regression books that can be used in doctoral courses in the social sciences or by social science researchers. Hayes maintains his usual level of clarity while adding coverage of such important topics as multicategorical variables for mediation, moderation, and conditional process models. Enhanced presentation of tabular materials, coupled with new plots, add to the reader's understanding of analyses. Incorporation of R syntax at points in the book is great, as many researchers turn to R for its open access and improved graphics capabilities. I loved the first edition for my first-year doctoral course, and will use the second edition in its place."

—**Ramona L. Paetzold, DBA**, Department of Management, Texas A&M University

"Since I began using the first edition of this text in my graduate statistics classes in 2014, the number of theses and dissertations that include mediation and/or moderation analysis in our department has increased dramatically. Valuable new material in the second edition includes 13 new models, including models with categorical variables and models with both parallel and serial mediation, as well as the recently developed index of moderated mediation. My copy of the first edition is filled with my annotations on the examples of PROCESS output—in the second edition, Hayes has provided useful annotations of his own. I highly recommend this book for statistics classes that include OLS mediation and moderation. It is also a terrific resource for researchers wishing to keep up with advances in moderation and mediation analysis."

—**Karl L. Wuensch, PhD**, Department of Psychology, East Carolina University

Lauded for its easy-to-understand, conversational discussion of the fundamentals of mediation, moderation, and conditional process analysis, this book has been fully revised with 50% new content, including sections on working with multicategorical antecedent variables, the use of PROCESS version 3 for SPSS and SAS for model estimation, and annotated PROCESS v3 outputs. Using the principles of ordinary least squares regression, Andrew F. Hayes carefully explains procedures for testing hypotheses about the conditions under and the mechanisms by which causal effects operate, as well as the moderation of such mechanisms. Hayes shows how to estimate and

interpret direct, indirect, and conditional effects; probe and visualize interactions; test questions about moderated mediation; and report different types of analyses. Data for all the examples are available on the companion website ([www.afhayes.com](http://www.afhayes.com)), along with links to download PROCESS.

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The model templates diagramming each model number can be found in Appendix A of the **second edition** of *Introduction to Mediation, Moderation, and Conditional Process Analysis*. The templates for PROCESS v3 are different than those used in PROCESS v2, reflecting differences in the labeling of moderators in version 3, the elimination of some models, and the addition of some new models that combine parallel and serial mediation as well as models of moderated serial mediation.

Many of the features available in the syntax version of PROCESS v3 are not available in the dialog box. These include:

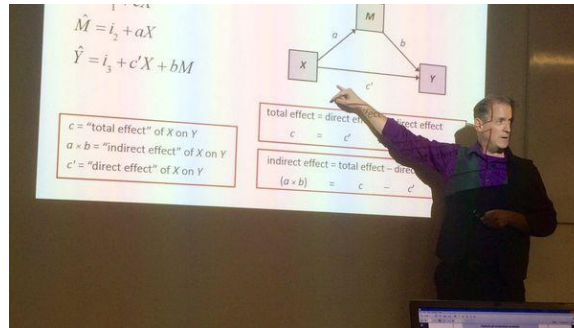
- Seeding the random number generator.
- Linear contrasts of specific indirect effects in multiple mediator models.
- Comparing two conditional effects in moderation models with more than one moderator.
- Customizing and editing models.
- Custom assignment of covariates to equations.
- User-defined coding of multicategorical independent variables and moderators.
- User-defined values for conditioning the estimates of effects on moderator values.
- Production of standard errors and confidence intervals of estimates of outcome variables derived from a model equation.

Many questions you may have about PROCESS are answered on the FAQ page at [processmacro.org](http://processmacro.org)

### Some important changes to PROCESS implemented in version 3:

- Dichotomous Y not allowed in version 3.
- X, W, and Z can be multicategorical for all models PROCESS can estimate.
- Only percentile bootstrap confidence intervals are available.
- Bootstrap confidence intervals are available for all model coefficients.
- Probing of interactions involving continuous moderators defaults to the 16<sup>th</sup>, 50<sup>th</sup>, and 84<sup>th</sup> percentiles of the moderator distribution.
- Interactions can be probed and data generated for visualization for any interaction in a model, regardless of where that interaction appears in the model.
- Models can be created from scratch and numbered models can be edited.
- Preprogrammed moderated serial mediation and “Parallel-serial” multiple mediator models.
- Simple implementation of a “slope difference test” for comparing conditional effects in multiple moderator models.
- Heteroscedasticity-consistent inference using the HC0, HC1, HC2, HC3, and HC4 regression coefficient covariance matrix estimators.

For more information on the use of PROCESS, see the documentation (Appendices A and B) in the second edition of *Introduction to Mediation, Moderation, and Conditional Process Analysis*.



**Take a course taught by Andrew F. Hayes on the use of PROCESS at one of these locations and dates in 2018:**

Atlanta, Georgia, 3 March 2018

**Understanding PROCESS v3: New Features, Building, and Editing Models.** This 2-hour workshop will take place at the convention of the Society for Personality and Social Psychology. The workshop is free but requires registration with the conference, which is not. A book signing with Andrew Hayes will occur prior to the workshop at the Guilford Press booth.

GSERM, University of St. Gallen, Switzerland, 11-22 June 2018

**Mediation, Moderation, and Conditional Process Analysis I.** This 5-day course is offered by the Global School in Empirical Research Methods. It will be taught 11-15 June 2018 and includes about 22 hours of instructional time, with a focus on the use of PROCESS. Details and enrollment information are available at [gserm.ch](http://gserm.ch)

**Mediation, Moderation, and Conditional Process Analysis II.** This 5-day course builds on the material offered in the first course taught a week prior. This course, which includes about 22 hours of in-class instructional time, is also offered by the Global School in Empirical Research Methods on 18-22 June 2018. Like the first course, it emphasizes the use of PROCESS for SPSS and SAS. Details and enrollment information are available at [gserm.ch](http://gserm.ch)

Statistical Horizons, Chicago Illinois, USA, 16-20 July 2018

**Mediation, Moderation, and Conditional Process Analysis .** This 5-day course is offered by Statistical Horizons and will emphasize the use of PROCESS for SPSS and SAS. It will take place at the Gleacher Center in downtown Chicago and includes about 32 hours of in-class instructional time. Details and enrollment information are available at [www.statisticalhorizons.com](http://www.statisticalhorizons.com)

If you would like to inquire about scheduling a private workshop at your institution, send an email to [workshop@processmacro.org](mailto:workshop@processmacro.org)