

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

A Regression-Based Approach

THIRD EDITION

Andrew F. Hayes

Series Editor's Note by Todd D. Little

THE GUILFORD PRESS
New York London

Contents

Preface	viii
 Part I. Fundamentals	
1 Introduction	3
1.1 A Scientist in Training / 3	
1.2 Questions of Whether, If, How, and When / 5	
1.3 Conditional Process Analysis / 9	
1.4 Correlation, Causality, and Statistical Modeling / 15	
1.5 Statistical and Conceptual Diagrams, and Antecedent and Consequent Variables / 19	
1.6 Statistical Software / 22	
1.7 Overview of This Book / 24	
1.8 Chapter Summary / 27	
 2 Fundamentals of Linear Regression Analysis	 29
2.1 Correlation and Prediction / 30	
2.2 The Simple Linear Regression Model / 35	
2.3 Alternative Explanations for Association / 46	
2.4 Multiple Linear Regression / 49	
2.5 Measures of Model Fit / 56	
2.6 Statistical Inference / 58	
2.7 Multicategorical Antecedent Variables / 67	
2.8 Assumptions for Interpretation and Statistical Inference / 70	
2.9 Chapter Summary / 75	
 Part II. Mediation Analysis	
 3 The Simple Mediation Model	 79
3.1 The Simple Mediation Model / 80	
3.2 Estimation of the Direct, Indirect, and Total Effects of X / 84	
3.3 Example with Dichotomous X: The Influence of Presumed Media Influence / 88	

3.4	Statistical Inference / 95	
3.5	An Example with Continuous X: Economic Stress among Small-Business Owners / T10 ¹	
3.6	Chapter Summary / 117	
4	Causal Steps, Scaling, Confounding, and Causal Order	119
4.1	What about Baron and Kenny? / 119	
4.2	Confounding and Causal Order / 128	
4.3	Effect Scaling / 139	
4.4	Multiple Xs or Ys: Analyze Separately or Simultaneously? / 151	
4.5	Chapter Summary / 156	
5	More Than One Mediator	159
5.1	The Parallel Multiple Mediator Model / 161	
5.2	Example Using the Presumed Media Influence Study / 166	
5.3	Statistical Inference / 173	
5.4	The Serial Multiple Mediator Model / 180	
5.5	Models with Parallel and Serial Mediation Properties / 194	
5.6	Complementarity and Competition among Mediators / 197	
5.7	Chapter Summary / 200	
6	Mediation Analysis with a Multicategorical Antecedent	201
6.1	Relative Total, Direct, and Indirect Effects / 203	
6.2	An Example: Sex Discrimination in the Workplace / 209	
6.3	Using a Different Group Coding System / 219	
6.4	Some Miscellaneous Issues / 226	
6.5	Chapter Summary / 230	
Part III. Moderation Analysis		
7	Fundamentals of Moderation Analysis	233
7.1	Conditional and Unconditional Effects / 237	
7.2	An Example: Climate Change Disasters and Humanitarianism / 245	
7.3	Visualizing Moderation / 258	
7.4	Probing an Interaction / 263	
7.5	The Difference between Testing for Moderation and Probing It / 275	
7.6	Artificial Categorization and Subgroups Analysis / 278	
7.7	Chapter Summary / 281	

8	Extending the Fundamental Principles of Moderation Analysis	283
8.1	Moderation with a Dichotomous Moderator /	284
8.2	Interaction between Two Quantitative Variables /	293
8.3	Hierarchical versus Simultaneous Entry /	306
8.4	The Equivalence between Moderated Regression Analysis and a 2x2 Factorial ANOVA /	308
8.5	Chapter Summary/	317
9	Some Myths and Additional Extensions of Moderation Analysis	319
9.1	Truths and Myths about Mean-Centering /	320
9.2	The Estimation and Interpretation of Standardized Regression Coefficients in a Moderation Analysis /	329
9.3	A Caution on Manual Centering and Standardization /	335
9.4	More Than One Moderator /	336
9.5	Comparing Conditional Effects /	358
9.6	Chapter Summary /	363
10	Multicategorical Focal Antecedents and Moderators	365
10.1	Moderation of the Effect of a Multicategorical Antecedent Variable /	366
10.2	An Example from the Sex Discrimination in the Workplace Study /	370
10.3	Visualizing the Model /	378
10.4	Probing the Interaction /	383
10.5	When the Moderator Is Multicategorical /	396
10.6	Using a Different Coding System /	404
10.7	Chapter Summary /	405
 Part IV. Conditional Process Analysis		
11	Fundamentals of Conditional Process Analysis	409
11.1	Examples of Conditional Process Models in the Literature /	413
11.2	Conditional Direct and Indirect Effects /	417
11.3	Example: Hiding Your Feelings from Your Work Team /	422
11.4	Estimation of a Conditional Process Model Using PROCESS /	430
11.5	Quantifying and Visualizing (Conditional) Indirect and Direct Effects /	433
11.6	Statistical Inference /	439
11.7	Chapter Summary /	450
12	Further Examples of Conditional Process Analysis	451
12.1	Revisiting the Disaster Framing Study /	452

- 12.2 Moderation of the Direct and Indirect Effects in a Conditional Process Model / 460
- 12.3 Statistical Inference./474
- 12.4 Mediated Moderation /481
- 12.5 Chapter Summary / 489

13 Conditional Process Analysis with a Multicategorical Antecedent 491

- 13.1 Revisiting Sexual Discrimination
in the Workplace /492
- 13.2 Looking at the Components of the Indirect Effect of X / 502
- 13.3 Relative Conditional Indirect Effects / 510
- 13.4 Testing and Probing Moderation of Mediation / 513
- 13.5 Relative Conditional Direct Effects / 517
- 13.6 Putting It All Together / 523
- 13.7 Further Extensions and Complexities /524
- 13.8 Chapter Summary / 525

Part V. Miscellanea

14 Miscellaneous Topics and Some Frequently Asked Questions 529

- 14.1 A Strategy for Approaching a Conditional Process Analysis / 531
- 14.2 How Do I Write about This? / 537
- 14.3 Power and Sample Size Determination / 549
- 14.4 Should I Use Structural Equation Modeling Instead of Regression Analysis? / 552
- 14.5 The Pitfalls of Subgroups Analysis / 556
- 14.6 Can a Variable Simultaneously Mediate and Moderate Another Variable's Effect? / 561
- 14.7 Interaction between X and M in Mediation Analysis / 565
- 14.8 Repeated Measures Designs / 568
- 14.9 . Dichotomous, Ordinal, Count, and Survival Outcomes / 572
- 14.10 Chapter Summary /573

Appendices

A Using PROCESS	579
B Constructing and Customizing Models in PROCESS	651
References	671
Author Index	705
Subject Index	716
About the Author	732

The companion website (www.afhayes.com) provides data for all the examples, plus the free PROCESS download.