The Mathematics of Marriage Dynamic Nonlinear Models

John M. Gottman, James D. Murray, Catherine C. Swanson, Rebecca Tyson, and Kristin R. Swanson

A Bradford Book The MIT Press Cambridge, Massachusetts London, England

Contents

Preface		xi		
1	Wha	at Do We Mean by Theory?	1	
2	Wha	at Phenomena Are We Modeling?	5	
	2.1	Brief Review of Research on Marriage	6	
	2.2	The Problem of Power	28	
	2.3	Review of Gottman and Levenson	29	
	2.4	What Phenomenon Are We Modeling?	34	
	2.5	Two More Mysteries in Marital Research	34	
3	Nonlinear Dynamic Modeling			
	3.1	The General Systems Theory of von Bertalanffy	35	
	3.2	Two or more equations	36	
	3.3	Outline of the Subsequent Chapters	38	
4	Calculusthe Mathematics of Change			
	4.1	Dynamical Motion as Slope	42	
	4.2	The Concept of a Function	45	
	4.3	Limits	51	
	4.4	The Derivative Is a Limit	52	
	4.5	Common Derivatives in Functional Form	53	
	4.6	Rules for Differentiation	54	
	4.7	Integration—the Reverse of Differentiation	56	
	4.8	Maxima and Minima	56	
	4.9	Problem	58	
	4.10	Writing Differential Equations	59	
	4.11	Taylor's series	61	
5	Introduction to Dynamic Modeling			
	5.1	Philosophy of Modeling	65	
	5.2	A Bit of Dynamical Modeling History	68	

	5.3 One Equation: Malthus Revisited	69				
	Appendix 5.1: Stability Results	79				
6	Modeling Catastrophic Change 8	31				
	6.1 The Spruce Budworm Problem	82				
	6.2 Spruce Budworm Catastrophe	88				
	6.3 Examples of Catastrophic Change: Zeeman	89				
	6.4 Catastrophes in Perception	93				
	6.5 Chapter Summary	97				
	Appendix 6.1: Nondimensionalization	98				
7	Intuitive Discussion of Phase Space Plots	99				
	7.1 Phase Space Portrait	99				
	7.2 Force Field Portrait	00				
	7.3 Null Clines and Steady States	01				
	7.4 Chapter Summary	04				
	Appendix 7.1: Phase Plane Analysis	04				
8	Interacting Dvadic Systems 111					
-	8.1 A Linear Marriage Model: Romeo and Juliet	11				
	8.2 Predator and Prev (LotkaVolterra Equations)	13				
	8.3 Competition Models	19				
	8.4 Cooperation Models	$\frac{1}{22}$				
	8.5 Chapter Summary	${22}$				
	Appendix 8.1: Nonlinear Modeling Concepts	24				
9	Writing the Equations of Marriage 197					
	9.1 The Model 1	21 20				
	9.2 Estimating of Parameters	23 21				
	9.3 Finding Null Clines	95 95				
	9.4 Steady States and Stability	30 97				
	95 Catastrophes in this Model	31 11				
	Appendix Q 1: The Inertia Parameter	41				
	Appendix 0.2: Stability of Standy States	44				
	Appendix 9.2. Stability of Steady States	40				
		49				
1(Initial Results of Our Modeling	51				
	10.1 Power and Affect: Influence Functions	51				
	10.2 Mismatch Theory of Unstable Marriages	54				
	10.3 Set Points and Inertia	56				
	10.4 Validation of the Model Parameters	57				
	10.5 Discussion of Initial Modeling Results	60				
	10.6 Prospects for Extending the Model	62				

_
2
0
3
7
3
1
3
5
7
7
8
9
3
1
5
6
6
1
1
7