Contents

Part I	Introduction	1
1	Why Behavioral Mathematics? Games and Choices	3 4
	Going Beyond Looks	10
2	Observing the World Identifying Factors Finding Hidden Factors Quantifying Observations Needing More Than Observations	 15 16 22 24 28
3	Converting Behaviors to Algorithms Using Numbers to Select Using Numbers to Define Using Algorithms to Construct Numbers	29303337
Part II	Decision Theory	43
4	Defining Decision Theory Normative Decision Theory Descriptive Decision Theory The Best of Both Worlds	45 45 48 51
5	Game Theory Starting Simple Matching Pennies Prisoner's Dilemma	55 56 57 61

	Asymmetric Games Cutting the Cake Ultimatum Game Dictator Game Trust Game	69 70 72 75 76
6	Rational vs. Irrational Behavior	79
	Perfect Rationality	80
	The Pirate Game	80
	Superrationality	85
	Guess Two-Thirds of the Average Game	87
	Bounded Rationality	96
	Misusing Irrelevant Information	97
	Ignoring Relevant Information	100
	Rational Ignorance	105
	The Cost of Information	105
	The Cost of Calculation	107
	Combining It All	109
7	The Concept of Utility	111
-	Decisions under Risk	112
	Pascal's Wager	113
	No Pain, No Gain	115
	Utility of Money	121
	Value vs. Utility	121
	Utility vs. Risk	123
	Utility of Time	140
	Production over Time	141
	Distance over Time	145
	Changes in Utility over Time	150
	Our Utility of Utility	165

xii

	8	Marginal Utility	167
		Value vs. Utility vs. Marginal Utility	168
		Changes in Marginal Utility	169
	•	Decreasing Marginal Utility	170
		Increasing Marginal Utility	177
		Marginal Risk vs. Marginal Reward	181
		Defining Thresholds	187
		Multiple Utility Thresholds	188
		The Utility of Marginal Utility	194
	9	Relative Utility	195
		Hedonic Calculus	196
		Multi-Attribute Utility Theory	198
		Inconsistencies	205
		Problems with Perception	206
		Problems with Categorization	207
		Problems with Understanding	207
		Apparent Contradictions	210
		Giffen Goods	210
		Moral Dilemmas	219
		The Relative Benefit of Relative Utilities	225
Pa	rt III	Mathematical Modeling	227
	10	Mathematical Functions	229
		Simple Linear Functions	229
		Ouadratic Functions	231
		Shifting the Ouadratic	231
		Tilting the Parabola	233
		Reshaping the Parabola	234
		Sigmoid Functions	236
		The Logistic Function	236
		The Logit Function	239
		Ad Hoc Functions	240

xiv Contents

11	Probability Distributions	241
	Identifying Population Features	242
	Segmenting the Population	244
	Analyzing a Single Segment	247
	Uniform Distributions	248
	Normal (Gaussian) Distributions	250
	Properties of Normal Distributions	250
	Generating Normal Distributions	254
	Triangular Distributions	269
	Simplified Normal Distributions	269
	Parametric Building	270
	Uneven Distributions	272
	Parabolic Distributions	274
	Poisson Distributions	276
	Distributing the Distributions	279
	Problems with Categorization limit of all o zeo) add	
12	Response Curves	285
	Constructing Response Curves	286
	Building Buckets	289
	Retrieving a Result	294
	Converting Functions to Response Curves	296
	Simple 1-to-1 Mappings	296
	Advanced 1-to-1 Mappings	297
	Converting Distributions to Response Curves	303
	Data Structure	304
	Entering Data	304
	Selecting a Result	308
	Adjusting Data	311
	Search Optimization	314
	Hand-Crafted Response Curves	316
	Dynamic Response Curves	317
	The Logit Exercise	

13	Factor Weighting		319
	Scaling Considerations		319
	Imposing Artificial Limits		319
101 401	Absolute vs. Relative Weights	A Hybrid Approx	322
	Granularity		325
	Weighting a Single Criterion		329
	Concrete Numbers		329
	Abstract Ratings		329
	Combining Multiple Criteria		331
	Normalizing		331
	Weighted Sums		339
	Layered Weighting Models		341
	Constructing a Layer		342
	Propagation of Change		345
	Compartmentalized Confidence		346
	Everything Is Relative		348
Part IV	Behavioral Algorithms		349
14	Modeling Individual Decisions		351
	Defining Decision		351
	Deciding What to Decide		353
	Analyzing a Single Option		355
	Identifying Factors		356
	Identifying Relationships		375
	Building Connections		379
	Scoring the Option		382
	Comparing Options		385
	Selecting an Option		386
	Testing the Algorithm		387
	Summarizing the Decision Process		392

xvi	Contents
	15

15	Changing a Decision	395
	Monitoring a Decision	396
	Time Frames	396
	A Hybrid Approach	401
	Perseverance and Decision Momentum	405
	Ignoring Futility	408
	Building Decision Momentum	409
	Our Final Decision on Changing Decisions	415
16	Variation in Choice	417
	Reasons for Variation	418
	Variation between Actors	419
	Variation by a Single Actor	420
	Embracing Randomness	422
	Selecting from Multiple Choices	424
	Random from Top <i>n</i> Choices	425
	Weighted Random from Top n Choices	430
	Weighted Random from All Choices	441
	Scores and Weights	444
	Epilogue	447
	Index	451
	Building Connections Protocol Stand	