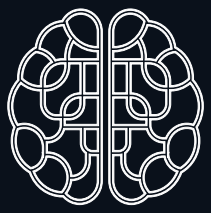
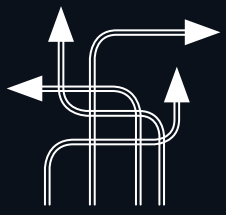


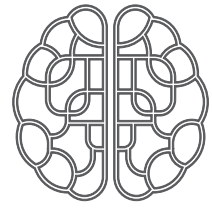


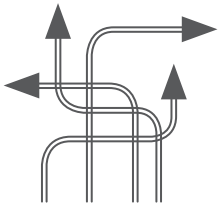
Players Making Decisions

Game Design Essentials and the Art of Understanding Your Players

ZACK HIWILLER

Players Making Decisions





Game Design Essentials and the Art of Understanding Your Players

ZACK HIWILLER

New Riders NRG

Players Making Decisions:
Game Design Essentials and the Art of Understanding Your Players
Zack Hiwiller

New Riders
www.newriders.com
To report errors, please send a note to errata@peachpit.com
New Riders is an imprint of Peachpit, a division of Pearson Education

Senior Editor: Karyn Johnson
Development Editor: Robyn G. Thomas
Production Editor: Danielle Foster
Copyeditor: Rebecca Rider
Proofreader: Patricia Pane
Compositor: Danielle Foster
Indexer: FireCrystal Communications
Interior Design: Danielle Foster
Cover Design: Mimi Heft, with Zack Hiwiller

ISBN-13: 978-0-134-39675-0
ISBN-10: 0-134-39675-8

9 8 7 6 5 4 3 2 1

Printed and bound in the United States of America

Dedication

To my grandmother, Betty Hiwiller (1927–2014), who always wanted me to be a writer. Yes, textbooks count, Grandma.

Acknowledgments

First, I would like to thank my wife, Gloriana, and my parents, Dan and Jan Hiwiller, for always tolerating me and encouraging me. Although the former would have been enough, the latter is greatly appreciated.

I would like to thank everyone who provided comments and support on early drafts. Many helped, but Mark Diehr, Matthew Gallant, and Scott Brodie did a yeoman's job on a short turnaround, even though they have extremely busy professional careers. If *Uncharted 4* is delayed, please do not blame me.

Everything that looks professional within is thanks to the wonderful team at Pearson including Robyn Thomas, Rebecca Rider, Danielle Foster, Patricia Pane, and Karyn Johnson.

I would like to use this space to thank Jesse Schell for convincing me game design could yield a career and be intellectually interesting. I'd like to thank Jon Dean, James Hawkins, and Jason Barnes for being early examples to me of what leadership looks like among game industry professionals. I would also like to thank all my friends and colleagues at Project Horseshoe, the best community of game designers in the world.

Finally, I cannot forget the dedicated staff and faculty of the Game Design program at Full Sail University who have helped me refine my approach to communicating the practice of game design, including, but not limited to, Ricardo Aguilo, Dax Gazaway, D'Juan Irvin, Christina Kadinger, Michael Lucas, Kingsley Montgomery, Andrew O'Connor, Mark Pursell, Brian Stabile, and Lee Wood.

About the Author

Zack Hiwiller is a game designer, educator, and writer who lives in Orlando, Florida. He is a department chair for the Game Design degree program at Full Sail University and does consultant work for many large and small companies. Previously, in addition to independent projects, he was a designer at Gameloft and Electronic Arts. He holds a Bachelor's degree in Information Systems from Carnegie Mellon University and a Master's degree in Modeling and Simulation from the University of Central Florida. His writings at hiwiller.com have been reposted by Kotaku, GameSetWatch, and other sites and have reached over 2 million readers. You have probably seen something of his reposted without attribution on sites like 9GAG, BuzzFeed, TheCHIVE, and others. Mark Zuckerberg used an image from one of his blog posts in his keynote at the 2011 F8 conference, and although he would have liked to have been cited, he actually thought it was pretty cool. In the fall months, he serves as an official for high school football games in central Florida.

Contents

Preface xii

Who Is This Book For? xv

How Is This Book Organized? xvi

PART 1 Getting Started 2

1 What Is a Game Designer? 4

Responsibilities of a Game Designer 5

Attributes of a Game Designer 8

Make Things 11

Cultivate Your Gardens 13

On Ontology and Dogma 15

Formalism 15

Summary 18

2 Problem Statements 19

Defining the Problem 20

Low-Hanging Fruit 22

Functional Fixedness 24

Brainstorming 25

Summary 27

3 Development Structures 28

Production Methodologies 29

Scope 35

Summary 37

4 Starting Practices 38

Analog Games 39

Theme and Mechanics 40

Next Steps 42

Designing for Others 42

Opening Questions 44

Summary 47

PART 2 Prototypes and Playtesting 48

5 Paper Prototyping Development Techniques 50
Software and Materials 51
Art 53
Cards 54
InDesign Data Merge 56
Summary 62

6 Playtesting 63
Playtesting Goals 64
Playtesting Benefits 65
Listening to Feedback 66
Finding Playtesters 70
Iterating 71
Summary 72

7 Playtesting Methods 73
The Testing Environment 74
Keep Playtesters Talking 74
A/B Testing 77
Self-Playtesting 77
Summary 79

8 Prototypes and Intellectual Property 80
Do I Need an NDA? 81
Ideas and Value 83
Summary 83

PART 3 Meaningful Decisions 84

9 Flow and the Fundamental Game Design Directive 86
Game Flow 87
Interest Curves 92
Learning Curves 97
Individual Differences 99
Summary 100

10 Decision-Making 101
Player Agency 102
Anatomy of a Choice 103
Less-Interesting Decision-Making 105

More-Interesting Decision-Making 110
Summary 116

11 Randomness 117
Completely Random Games 118
Completely Skill-Based Games 119
Fairness and Mitigating Randomness 120
Summary 123

12 Goals 124
How Players Determine Game Goals 125
Criteria for Goals 128
Solving Goal Problems 130
Summary 133

PART 4 Describing Game Elements 134

13 Mechanics, Dynamics, and Aesthetics (MDA) 136
What Are Games About? 137
MDA 138
More Dynamics 145
Summary 150

14 Milieu 151
What Is Milieu? 152
Polish 155
Player Types 156
Motivation 158
Milieu as Design Focus 161
Summary 162

15 Rules and Verbs 163
Rules 164
Qualities of Rules 165
Types of Rules 166
Verbs 167
Summary 169

16 Balance 170
Symmetry 171
Self-Balancing Mechanisms 172
Progression and Numeric Relationships 174

Balance Heuristics 181
Summary 182

17 Feedback Loops 183
Positive Feedback Loops 184
Negative Feedback Loops 185
Feedback Loops in Action 187
Fixing Problems 190
Summary 192

18 Puzzle Design 193
What Is a Puzzle? 194
Possibility Space 196
Breadcrumbs 197
Features of Ineffective Puzzles 200
Types of Puzzles 205
Other Puzzle Types 211
Summary 215

PART 5 Game Theory and Rational Decision-Making 216

19 Equilibria in Normal Form Games 218
The Prisoner's Dilemma 219
Solving Games Using Strict Dominance 220
Using (and Abusing) Dominance 223
Zero-Sum Games 226
Stag Hunt and Coordination 226
Determining Nash Equilibria in a Larger Matrix 228
Mixed Strategies 230
Stag Hunt Redux 233
Summary 234

20 Sequential and Iterated Games 235
Game Trees 236
Promises and Commitment Problems 240
Iterated Games 242
Experimenting with Strategies 243
Successful Strategies 244
Summary 246

21 Problems with Game Theory 247
Rational Actors 248
The Dollar Auction 249
The "Guess Two-Thirds" Game 250
Second-Price Auctions. 252
Summary 254

22 Marginal Decision Analysis 255
Marginal Nuggets 256
Balance on Margins 259
Summary 261

PART 6 Human Behavior in Games 262

23 Behaviorism and Schedules of Reinforcement 264
Operant Conditioning 265
Schedules of Reinforcement 266
Anticipation and Uncertainty 269
Ethical and Practical Concerns 273
Summary 274

24 Learning and Constructivism 275
Historic Approaches. 276
Novices and Experts 277
Cognitive Load 279
Expertise Reversal Effect 282
Split-Attention Effect 283
Tutorials and Learning Design 285
Summary 286

25 Motivation 287
Two Types of Motivation 288
What's the Problem with Rewards? 288
Self-Determination Theory and Challenges 290
Competition and Motivation 291
Personality 292
Other Motivation Effects 293
Summary 295

26 Human Decision-Making 296
Mental Shortcuts 297
Attribution Errors 297
Misunderstanding Randomness 299
Anchoring and Adjustment 302
Understanding Value in Uncertain Situations 304
Loss 307
Framing Decisions 308
Summary 310

27 Attention and Memory 311
Attention 312
Memory 317
Helping with Memory Limitations 318
Perception 319
Summary 323

PART 7 Game Design Tools 324

28 Documentation and Written Communication 326
The Game Design Document 327
The GDD Creation Process 331
References 336
Documentation for Tabletop Games 337
States and Flowcharts 338
Summary 342

29 Probability 343
Probability Is Fancy Counting 344
Adding Die Rolls 350
Example: The H/T Game 353
Being Careful 355
Summary 360

30 Spreadsheets for Simulation 361
Why Use Spreadsheets? 362
Basics 362
Formulas 365
Goal Seek and Solver in Excel 376
One-Way Data Tables 382
Summary 384

31 Monte Carlo Simulation 385
Answering Design Questions 386
Hot Hand 388
Monty Hall 390
Once Around the Board 396
Martingale Betting 402
Summary 404

32 Presenting Ideas 405
The Thesis 406
Text on Slides 407
Data-Ink 409
Do Not Waste Time 411
Documentation 412
Acquiring Images 413
Example: State of Mobile Games 2014 415
Risk 418
Risk Analysis 419
Pitch Questions 421
Summary 423

PART 8 The Game Design Business 424

33 Profit, Loss, and Metrics 426
Profit and Loss 427
Metrics 429
Virality 431
Cash Flow 436
Summary 437

34 Sustainable Lifestyles 438
Life in AAA Digital Game Development 439
Life as an Independent Developer of Digital Games 441
Life in Tabletop Game Development 443
Market Luck 444
Summary 445

Conclusion 446

Ludography 450

Index 455

Preface

> "If you wish to make an apple pie from scratch, you must first invent the universe."
>
> —CARL SAGAN

This Carl Sagan quote from *Cosmos* intends to cheekily point out that even a simple object like an apple pie contains a multitude of layers, depending on your level of analysis. Although the baker feels that the apples, sugar, and flour are the fundamental building blocks of an apple pie, the physicist sees down to the atoms and fundamental particles that make up the pie itself. It is a profound and long-lasting quotation because of the disconnect that the listener experiences. Making an apple pie is prosaic. Inventing the universe is deity-level stuff.

Teaching game design offers a similar conundrum. Making games is fairly easy, as is apparent from looking at the number of available games. For example, when you look at the games available for just a single platform (iOS) in a single country (the US) at the time of this writing, you'll see that there are nearly 400,000 games available.[1] In addition, Over 110,000 analog games are listed in the BoardGameGeek.com database.[2] And, of course, the number of games children create every day on playgrounds all across the world is uncountable. With so many games coming out every day, games surely must be easy to make. As a result, teaching about games must be fairly straightforward and simple.

Unfortunately, that is not true.

The primary reason is that there is no reliable algorithm that we can use to create things as wildly disparate as *Chess*, *Grand Theft Auto V*, *Red Rover*, pole vaulting meets, and *Jeopardy!*. A cursory listing of the skills a game designer of any type will

1 App Store Metrics. (n.d.). Retrieved July 13, 2015, from http://www.pocketgamer.biz/metrics/app-store/app-count/.

2 BoardGameGeek. (n.d.). Retrieved July 13, 2015, from https://boardgamegeek.com/browse/boardgame.

find useful includes mathematics, psychology, computer programming, composition, rhetoric, drafting, architecture, art history, philosophy, economics, business, history, education, mythology, and animation. I stopped the list not because it was complete, but because I think the list—as incomplete as it is—makes the point that game design is remarkably multidisciplinary.

Because no algorithm exists, we have to attempt to shoehorn the facts and methods of a universe of disparate disciplines to make game design heuristics. Meanwhile, the impatient student just wants to make a simple apple pie.

When I first left the world of full-time development of video games to teach game design, I faced this very problem of distilling a vast universe down to a few salient points. I voraciously consumed every book I could find about design or game design and found that they largely talked about the process from a descriptive perspective. That was useful in some aspects, but not useful when I was looking to teach a prescriptive method. Most game design books were ludicrously padded with obvious statements that were not at all helpful to aspiring or professional designers. Some books, like Schell's *Art of Game Design* and Salen and Zimmerman's *Rules of Play* did a great job of merging descriptive and prescriptive insights from numerous areas of study and then backed up these anecdotes with external best practices.[3, 4] As my library expanded, I found more and more areas that I wanted to share with students, but unless I wanted to assign them hundreds of dollars worth of (sometimes overly academic, sometimes out-of-print) reading materials, I had no way to easily teach lessons that would have helped me professionally if someone had taught them to me in my apprentice years. This is the curse of a multidisciplinary field—the sources for insights are limitless, so collating knowledge into a curriculum eventually expands like a gas to fill whatever space you have.

I have created games professionally on over a dozen platforms. I have created large physical games for corporate retreats; I have created interactive books for tablets; and I have created free-to-play games in a brutally competitive market. These platforms seem like they share little in common. Some topics make sense only in terms of analog games, or single-player games, or multiplayer games. But some topics transcend platforms and are timeless. Less than ten years ago, mobile games had few established design patterns. Less than ten years ago, no digital social networks supported formal games. Less than thirty years ago, networked games in general were a quiet niche. What platforms will support the games ten years from now? Thirty years from now? What game design concepts

3 Schell, J. (2008). *The Art of Game Design: A Book of Lenses*. Amsterdam: Elsevier/Morgan Kaufmann.

4 Zimmerman, E., & Salen, K. (2003). *Rules of Play: Game Design Fundamentals*. Cambridge, Mass.: MIT Press.

will help support the game designers of the future? I cannot possibly claim to know the answer to those questions. But I can provide tools to support game designers today, and I can present them in the most evergreen way I know in order to sustain their relevance. In time, concepts in this book will be updated, expanded, or even retired as the industry gains greater understanding of how we game designers complete our magic.

Teaching has been incredibly challenging and rewarding. Just as my career in game design stemmed from a need to constantly learn about as many things as possible, my teaching career has reflected that as well. Research is enlightening, but it is students who provide me with unparalleled perspective into how to explain what game design actually is and how to do it well. This book is another well-disguised ploy for me to learn more, to pull insights from multiple disciplines, and to share new ideas with others.

Thank you for the opportunity,

—Zack Hiwiller
November 2015

Who Is This Book For?

This book is for those who are interested in what elements are involved in the design of games. Its purpose is to introduce the knowledge areas that are most helpful for understanding game design. This book is not a manual on how to design a game. There is no such book possible. Neither is it a book that claims to let one in on all the "secrets" of successful game design. Anyone promising that should not be trusted. Nor is this a book to teach a specific programming language or scripting toolset. Those books can be incredibly useful, but go obsolete quickly. This book focuses on concepts that can be used to help you understand the design of any type of game—analog or digital.

How Is This Book Organized?

This book is split into eight sections, each of which covers a topic I feel is essential to being a game designer—no matter the platform—and is not completely obvious to new designers:

- Part 1,"Getting Started," is about how to start from nothing. Although some games are iterations of previous games, most start with just the seed of an idea. What should that seed look like? What are some prerequisite elements that will help you organize your ideas into an actionable project?
- Part 2, "Prototypes and Playtesting," talks about how to plan and test your game before it is a final product. There is a pervasive myth among novice designers that games are largely birthed finished from idea to product, with only moderate tweaking along the way. This section sets out to debunk that myth and provide designers with the tools and inspiration required to make quick, testable versions of their games.
- Part 3, "Meaningful Decisions," covers one of the most interesting topics in games: decision-making. It is incontrovertible that interactivity is one of the keystone characteristics of games. Interactivity means that the players make some decisions that the game reacts to. How do designers present these decisions? What makes for interesting decision-making?
- Part 4, "Describing Game Elements," covers a number of topics concerning the different elements of games and different considerations thereof. There is little uniformity when talking with designers and academics about how game elements should be classified or applied, so this section takes a cross-section of the most pragmatic approaches for actually designing games.
- Part 5, "Game Theory and Rational Decision-Making," considers how players should behave were they to act rationally. By examining game decisions from this perspective, designers can remove elements that should be consistently never chosen. This leaves players with decisions between possibly interesting options.

- Part 6, "Human Behavior in Games," eschews the convenient fable of the rational player and looks to the realm of psychology to try to understand how real human players actually act. If games are truly about decision-making, then the whole branch of study spun off from psychology and economics that explores how humans actually make decisions is relevant to game design.
- Part 7, "Game Design Tools," considers the different tools designers use to document, analyze, and communicate ideas, such as the universally misunderstood game design document (GDD).
- Part 8, "The Game Design Business," considers the craft of game design as it relates to business. The old joke that is appropriated for nearly every industry is this: "How do you make a small fortune in the games business? Start with a large fortune." If a designer's craft is done for more than just a hobby, she must understand the requirements of the business aspects of game design.

4 Starting Practices

Be great in act as you have been in thought.

—JEAN PAUL

If I can relate only one lesson in this book, it's that the way to become a game designer is not found in the pages of any book, no matter how well-written. The key to becoming a game designer is simply to make games.

When asked about their game ideas, students often answer with riffs on their favorite large AAA games. Their ideas are often about making the next *Skyrim*. That is taking an overly large bite. They subtly ignore the massive complexity of these games, which often have development teams that number in the hundreds.

Making games is a complex affair. Even comparatively simple mobile games can be really complex. Rami Ishmail, cofounder of award-winning developer Vlambeer, is no stranger to complexity: "Even the simplest of games is really complex. When you're starting out you can't see that yet. That's why you need to start simple."[1]

1 Ismail, R. (2015, March 17). Twitter Feed. Retrieved March 18, 2015, from https://twitter.com/tha_rami/status/578004339362430976.

Analog Games

Many aspiring game designers do not even consider analog games such as board or card games. Fewer still consider role-playing and storytelling games or sports. Yes, even sports have designers! Games are such a broad medium that limiting yourself to just large, complex games for specialized game consoles is narrow-minded and will lead to only a narrow understanding of the craft. Analog games in particular are a great place to start your design practice because of how analog games typically expose all the inner workings of the game to the player. You may lack exposure to some of these games, so in **TABLE 4.1**, I have provided a list of some analog games—board games, card games, role-playing games (RPGs), and sports games—along with their level of complexity.

▶ **NOTE** Complexity can be measured by various metrics. For the purposes of this table, I used only an imprecise measurement of the length of the rules.

TABLE 4.1 Example Analog Games and Complexity Levels

Game Type	Simple	Medium	Complex
Board Game	*Loopin' Louie* *Can't Stop*	*Ticket to Ride* *Pandemic: The Cure*	*Power Grid* *Dead of Winter*
Card Game	*Love Letter* *The Other Hat Trick*	*San Juan* Dominion	*Race for the Galaxy* *Magic: The Gathering*
RPG	*A Penny For My Thoughts* *Fiasco*	*A Quiet Year* *Microscope*	*Dungeon & Dragons* *Pathfinder*
Sports	Four Square Darts	Badminton Dodgeball	Football (American) Roller Derby

It's important to note that board, card, RPG, and sports are not the only categories of nondigital games. So many examples fit these categories that it makes them salient choices to study. Games are incredibly diverse if you take the time to look. What labels categorize fantasy baseball, *I Love Bees*, Mafia/Werewolf games, or the activities involved in the Jejune Institute?

▶ **NOTE** For an entertaining explanation of the Jejune Institute see the film: The Institute [Motion picture]. (2013). Gravitas Ventures.

To illustrate what I mean by complexity, let me give you an example. I once created a 15-card analog game for a game design contest. I really enjoyed the experience, so I thought I would make a digital version in Unity, which is a popular game engine for digital-game development. What took me only an evening to design, assemble, and test as an analog game took weeks to fully implement digitally. I had so many contingencies I needed to address. Although bugs or vagueness can be reasoned out in a card game, a digital program needs to be explicitly told how to handle all contingencies. Changes are more robustly handled by humans who are OK with ambiguity; programs need clarity.

Another reason to start your game design experience by making analog games is that analog games tend to expose all their workings to the players. Digital games, on the other hand, often hide their mechanisms from both players and designers—they hide their mechanisms from players behind code and from designers by abstracting the game's workings. For instance, in an RPG, you may notice that players have difficulty rolling die to get a certain number, and thus they allow an attack, twice in a row. In an analog game, the reasons should be easy to track down: The players are doing the math themselves, so the inputs and outputs are clear. In a digital game, these calculations are obscured in code somewhere. When you get clear feedback, it allows for quick iteration. However, when you are making digital games, it's often the case that you can't even find out where a problem is hiding!

In the book, *Tabletop: Analog Game Design*, famed designer Greg Costikyan writes: "As many game studies programs have discovered, tabletop games are particularly useful in the study of game design, because their systems are exposed to the player, not hidden in code. It's easy to misunderstand the essential nature of a digital game, if you focus on graphics or narrative without appreciating the way in which system shapes the experience."[2]

Always err on the side of simplicity. With this rule in mind, it makes sense to start by developing board or card games.

Theme and Mechanics

When you are creating games, but most saliently, when you are designing board and card games, it's important to decide whether to focus first on theme or mechanics. By *mechanics*, I mean the rules and procedures of the game. In *7 Wonders*, the main mechanic is clearly drafting cards. In *Terror in Meeple City*, the main mechanisms are flicking, dropping, and blowing on game pieces. *Theme*, in this instance, is the overarching setting or antecedent elements that relate to the game's mechanisms. In *7 Wonders*, the theme is building ancient civilizations. In *Terror in Meeple City*, the theme is monsters destroying metropolitan areas.

If the game's problem statement focuses on thematic concerns, then the game might be too concerned with keeping consistency in that theme at the expense of fun. For instance, if *7 Wonders* was truly interested in taking the theme of building a civilization

2 Costikyan, G. (2011). *Tabletop: Analog Game Design*. Pittsburgh, PA: ETC Press.

seriously, then some mechanics should manage population, taxation, and land usage. However, additional mechanics about these things would slow the game down and distract from the game's actual problem statement, which focuses on a seven-player drafting experience.

Likewise, if a game's problem statement suggests mechanics, then parts of the game may not make sense in terms of the game's theme. The point of theme is to make the game understandable.

I was once working on a game where players shuffled passengers around an airport. It was an area control game, so it was important to move passengers at the right time to the right spots. Yet playtesters balked at ever moving passengers: "Why would they get on a different flight than the one they came to the airport for?" The mechanics made perfect sense in terms of game operation, but they did not interact well with the theme. Many European board games are criticized for being games about mechanics with a theme "pasted on." This criticism comes only if the game's theme does not assist players in understanding the mechanics and world of the game. For instance, *Dominion* could easily be about any number of themes; this game is about building a deck of cards, and what names the cards have hardly matter. Similarly, the theme of *Chess* does not matter. Trying to "paste on" a theme beyond basic notions of warfare is distracting and not helpful to players.

The proper way to start your design of an analog game is by seeing which way the problem statement points. Some great games have been designed with theme first and some with mechanics first. The two cited examples, *7 Wonders* and *Terror in Meeple City*, come from the same designer (Antoine Bauza) and are clearly mechanically focused and thematically focused in their problem statements, respectively. *7 Wonders*' problem statement asks, "What if a game played well with seven players?"[3] *Terror in Meeple City*'s design started with the intention to make a board game to match the thematic elements of the classic arcade game *Rampage*.

By having a poignant problem statement, you eliminate the need to ask the question of whether the designer should start with theme or with mechanics. The problem statement itself will dictate the direction in which to start. A problem statement is just a guide to help direct your efforts. If the development warrants it, you may change the problem statement. To return to Antoine Bauza's work, his *Spiel des Jahres* winning

3 Bauza, A. (2010). "Game Designer Diary: The Genesis of *7 Wonders*, Part 1." Retrieved March 19, 2015, from http://us.asmodee.com/ressources/articles/game-designer-diary-the-genesis-of-7-wonders-part-1.php.

game *Hanabi* is a cooperative imperfect information game about collectively creating a fireworks show. However, it was made from the pieces of another game he designed, *Ikebana*, which was a competitive set-collecting game about arranging flowers that played wholly differently. You never know what direction your ideas and testing will take you, but it is good to have a destination in mind.

Next Steps

The next step is to come up with basic rules. If your problem statement suggests mechanics, this should be easy. If your problem statement suggests theme, then you may want to consider what mechanics may match that theme. It's not important that you get the rules right on your first try, because everything is on the table as far as change goes. In fact, the first version of *7 Wonders* was not about card drafting at all.

Write these rules down on paper or in a digital document, but go only so far as to make a playable game. Do not worry much about the edge cases or complicated matters—the key is to have enough rules to make a playable game. The goal is to build your first prototype.

This prototype is likely to have breakable systems, unnecessary materials, ambiguities, and imbalances. You will have plenty of time to iron these out through playtesting and revision. The key of the first prototype is to get a feel for the game.

The first time that you play your new game, you are quite likely to identify many areas in which the game needs to improve. Perhaps there are not enough interesting decisions for players. Perhaps the rules are unclear about edge conditions. Perhaps the game always plays out in one particular way. Perhaps real players do not do what you expect. These are all areas I'll cover in upcoming sections and chapters, but to apply any of these lessons to your game, you must first have a game on which to test them.

Designing for Others

The 18-to-35-year-old male demographic really, *really* loves first-person shooters. Most students I teach in game design classes are 18-to-35-year-old males. Most pitches that I receive in assignments are for first-person shooters. This is natural. Many game designers want to learn about game design because they want to make games like those that they themselves have enjoyed. Game design can be a long, tedious process. Is it not better to go through all that work for an idea that you love instead of one you don't have a passion for?

If the answer is yes, who is left to make the *SpongeBob* games? They do not hire 8- to 12-year-olds to make games for the 8-to-12-year-old demographic. In fact, much of the industry is making games that do not serve the "core" demographic of 18-to-35-year-old men. It is a gift to be working on games for a living, but it is an extra-rare gift to be working on games that you like for a living. This can be a double-edged sword. Sometimes working on a genre you like can sour you on the genre entirely. For example, I worked on AAA sports games from 2004 to 2009, a genre I really liked. I have not bought a sports simulation game since I left that job. I just played them too much in my day-to-day life, so the magic behind them was lost.

Another issue that arises when you work on the types of games that you already enjoy is that you may find yourself stuck remaking the things that you already enjoy instead of pushing the envelope to make something new and exciting.

The point, however, is that if you are working on a game and you plan on selling 100,000 copies of it, it is quite likely that all 100,000 of those copies will be bought by someone other than you. So you need to be able to step into someone else's shoes to deliver an experience that they will enjoy. And it can be really difficult when what those people enjoy differs from what you enjoy. Yet this is the norm and not the exception. Most designers are designing for people vastly different than themselves. Legendary MUD designer Richard Bartle says, "Designers don't create virtual worlds that they, personally, wish to play; they create virtual worlds that *people* wish to play."[4]

However, some design breakthroughs can be made by considering first how other people react to different elements of games. Independent designer Zach Gage made the hit game *SpellTower* because he did not like the mobile word games that existed and he wanted to make one that would challenge him to understand their appeal.[5] His outside view on the genre allowed him to make an acclaimed and popular title, one that he would not have made if he only made games he enjoyed. The same is true for Michael Brough, who made *Corrypt*. He did not like puzzle-style games, so he made one that was excellent as a puzzle-style game but (because he was not beholden to the norms of the genre) one that also subverted the genre effectively.

4 Bateman, C. (2009). *Beyond Game Design: Nine Steps Toward Creating Better Videogames*. Boston, MA: Cengage Learning.

5 Kohler, C. (2012, December 17). "Game Designer Stands at Rowdy Intersection of Entertainment and Art | WIRED." Retrieved April 1, 2015, from www.wired.com/2012/12/worlds-most-wired-zach-gage.

It's easy to say that you should just leave everything to playtesting and that your target audience will direct you on what to make. This is tempting, but also quite dangerous. Playtesters cannot help until they have something to test, which means you must make something with them in mind. Additionally, playtesters reject new ideas as confusing if they are not familiar with them. Sometimes you have to warm them up to a new idea before they embrace it. Also, playtesting is expensive in terms of time. You cannot bring in playtesters every day to make every little decision, nor can you spend the engineering time to A/B test every possible decision. At the end of the day, the designer needs to have an innate understanding of what he is trying to do.

Opening Questions

As an exercise, you can go through a number of key questions about your game to get a good sense of where to begin. These questions are just to help you get started. Most of them will be obsolete by the time you make changes to your first prototype. It is usually a bad idea to keep any of these answers locked down and written in stone:

- *What is your problem statement?*
- *How many players will there be?*
- *What is the object of the game for each player? What are their short-term goals?*
- *Do players work together or alone? Who is their adversary: the game, other players, or something else?*
- *Do you have any key rules in mind?*
- *What resources do the players manage?*
- *What do players do? What decisions do they face?*
- *What information is public, hidden to particular players, or hidden to all players?*
- *What hinders players? What are the trade-offs?*
- *How does the game end? Are there winning conditions?*
- *Explain a turn or two (or equivalent time period) of the game.*

After answering these questions, you can make an attempt to write down the rules for the game.

To use the example of the airport game I mentioned above, earlier in my career, I had a period of about a year when I had to fly somewhere about every month. One evening, I was in New York while a huge blizzard was approaching. It was hammering the Midwest and the flight network was already suffering from delays. As I sat awaiting the fate of my flight, I could feel the tension in the room rise as flight after flight was delayed and announced over the loudspeaker. Periodically, it would be announced that a flight was changing gates. I watched as dozens of stressed travelers grabbed all their belongings and rushed off in unison to another part of the terminal. This happened a half-dozen times as I sat and watched. Having nothing better to do, I started to brainstorm an idea for a board game where passengers rushed through an airport. Here is what I came up with when I worked through the previous checklist of questions:

- *What is your problem statement?*

  What would a board game be like where you had to shuffle weary and stressed passengers through an airport?

- *How many players will there be?*

  I'm going to guess 3 to 5 players. I imagine it will be similar to a Eurogame like *Ticket to Ride*, and those games generally have 3 to 5 players.

- *What is the object of the game for each player? What are their short-term goals?*

  Each player tries to score victory points by getting as many passengers onto correct flights as possible.

- *Do players work together or alone? Who is their adversary: the game, other players, or something else?*

  Players work alone, trying to achieve the best score. Players can out-position other players' passengers to score.

- *Do you have any key rules in mind?*

  Passengers have to make it through security before they can move freely through the airport. Players should be able to move their passengers all at once. When a flight fills up, it leaves, kind of like the boats in *Puerto Rico*. Flights will change gates often.

- *What resources do the players manage?*

  Players will manage the passengers on the board. I want this game to be as minimally random as possible, so no cards or dice.

- *What do players do? What decisions do they face?*

  Players get one action on their turn. They can move people through security, move passengers to gates, or move passengers into club lounges.

- *What information is public, hidden to particular players, or hidden to all players?*

  All information is public. The flight board will show the order of flights.

- *What hinders players? What are the trade-offs?*

  Players hinder players because there will not be enough room on each flight for all passengers. Players must choose to spend their action on getting more passengers, placing them effectively, or changing the flight board.

- *How does the game end? Are there winning conditions?*

  When all the flights are gone from the flight board, the game is over. The player with the most points wins.

- *Explain a turn or two (or equivalent time period) of the game.*

  Each player gets one main action. They choose from a menu of actions. A player may choose to put passengers through security, move their cleared passengers, or move a passenger into a club lounge.

The descriptions from these questions are not enough to write the rules of the game. There is still a lot of work to do. However, it does help to frame the ideas that are nascent. From this, I could start a sketch of what the actual rules look like. Once I have something that can direct play, I could craft a prototype to test where my idea of the rules are broken, fun, or both.

If you do not have answers to all these questions, it's OK. You can still attempt to build a prototype at this point. Playtesting suggests answers. Some of the best games were started by having a broad problem statement that could be built into a functional toy that suggested directions for further development.

Summary

- Analog games such as board and card games offer the interactivity that makes games compelling in a medium that offers easier prototyping and development than digital games.
- A fertile place to start from when considering a game's problem statement is to examine whether you want to start building around a theme or around specific mechanics.
- It is important to try and understand the positive qualities of games you do not like along with the negative qualities of games you do like. You will rarely be making games for an audience that directly aligns with your tastes.
- Whether you start with theme or mechanics, you need to start by determining some basic rules for your game in order to be able to create something that is testable. A great backstory is fine, but it does not help to create something testable.
- By going through a battery of generalized opening questions, you can begin to narrow down your idea into a form that will allow you to construct a prototype that you can use to run playtests.

Index

7 Wonders, 40–41, 42

A

AAA studios, 37, 90, 439
Aarseth, Espen, 17
A/B testing, 77, 79
abilities, player, 88
Abt, Clark, 16
accessibility, 320
accommodation, 276
ActionScript, 324
Adams, Ernest, 16
Addiction by Design (Schüll), 273
addictions, game, 273
Adobe
  Flash, 324
  Illustrator, 51
  InDesign, 52, 56–60
  Photoshop, 52, 54, 56
Advantage/Disadvantage system, 392–396
adventure games, 24, 193
aesthetics, 135, 138, 150, 151, 291
agency, player, 102, 122, 123
agile software development, 32, 37, 125
agreeableness, 158, 160
Agricola, 120–122
airport game, 41, 45
Alan Wake, 133
Alexander, Christopher, 12
algebraic puzzles, 213
"Almost there" phenomenon, 270
alpha state, 30
Alvedon, E.M., 16
Amazon, 294
analog games, 39–40, 41, 49, 155, 169, 443
analytics packages, 434–435
anchoring, 302–303
anchors, spreadsheet, 373–375
animations, 410, 411
anticipation, 269–271
anxiety, player, 88
App Annie, 427
AppData, 427
appendices, 336
Apple
  App Store, 427, 443, 444
  Numbers, 325, 365
  Pages, 52
Applied Imagination (Osborn), 25
arcade games, 102
Ariely, Dan, 309
Aristotelian structure, 94–95
Arkham Horror, 181
ARPPU/ARPU, 429–430
Art & Fear (Bayles/Orland), 11–12
Art of Game Design (Schell), 72, 92, 129, 316, 336
artifacts, presentation, 412–413
artificial brains, 263
artwork, 29, 53–54, 413
Assassin's Creed games, 284–285
assimilation, 276
asymmetrical games, 171
attention, 311–316, 323
attribution errors, 297–299, 310
auctions, 173–174, 249–250, 252–253
autonomy, 290, 295, 440
autotelic motivation, 288
Avery labels, 52
awards, 164, 270, 272, 289
Axelrod, Robert, 243–245

B

Baccarat, 118, 344, 346–347
Backgammon, 167
backwards induction, 236–237, 238–239, 241, 246, 268
Baddeley, A.D., 318–319
balance, 170–182
  defined, 170
  heuristics, 181
  on margins, 259–261
  self-balancing mechanisms, 172–174, 182
  testing for, 181, 182
  vs. symmetry, 171–172, 182
Baltimore Marathon, 270
Banjo Kazooie, 420, 421
Bartle, Richard, 8, 43, 156–157, 162
baseball games, 167, 184
battle games, 145–146
Bauza, Antoine, 41

Bayles, David, 11–12
Behaviorism, 265, 273
behaviorists, 274, 276, 288
Bernoulli, Daniel and Nicolas, 305
beta state, 30
Beyond Game Design (Bartle), 157
bias
  confirmation, 64, 67–69, 72, 444
  self-serving, 298–299
Big Five personality traits, 292–293
"Billion Dollar Bracket" promotion, 302
Bingo, 84
black boxes, 273, 276
Blackjack, 109, 118–119, 339, 341
blind decisions, 105–106
blind playtests, 337–338
board games, 31–32, 33, 39, 78, 139, 453–454
BoardGameGeek, 84
"Book It!" program, 289, 290
Boolean functions, 372
boredom, player, 84, 86, 88, 90, 94
boy-girl problem, 355–358
Braid, 21, 133, 278–279, 280
brain mapping, 263
Brain Rules (Medina), 321
brainstorming, 25–26, 27, 29
breadcrumbs, 197–200, 215
Brough, Michael, 43
brute-force puzzles, 202
Buffet, Warren, 302
bugs, 30, 34, 325
Bungie, 90, 272
button mashing, 146–148
Buzz!, 186

C

Cacoo, 325
Cage, David, 21
Caillois, Roger, 15, 118, 287
Cain, Susan, 13
Calc, OpenOffice, 325
Calleja, Gordon, 17
camping, 146
Canabalt, 441
Candy Land, 84, 118
Can't Stop, 149–150
car-buying decisions, 307
card games, 22, 39, 54–56, 78, 453–454
card sleeves, 53
Carroll, Lewis, 206–207
cash flow, 436–437
casino games, 118, 267
Cavanaugh, Terry, 203
Caverna, 70
cells, spreadsheet, 362
challenge levels, 88, 99, 159
chance, games of, 118, 184
cheating-student's game tree, 238–239
Checkers, 194
Chen, Jenova, 87
Chess, 41, 103–104, 110, 119, 171, 277–279
chickens-and-pigs story, 32
children's games, 84, 118, 157
choice. *See also* decision-making
  anatomy of, 103–105
  calculating expected value for, 114–115
  offering overabundance of, 112–113
  risk-reward, 113–114
  "take it or leave it," 107–108
Chrono Trigger, 154
chunks, information, 277, 317, 318, 323
churn, 434
Civilization, 85, 120, 190
Civilization Revolution, 301
CLANG, 418–421
Clash of Clans, 273
classical conditioning, 265
climbing the pyramid, 33–34
cognitive load, 279–281, 286
coin pushers, 271–272
coin-flip games, 305, 344–345, 353–355
coin-flip trials, 299–300
coin-toss game, 114–115
coin-toss study, 298
Colbert Report, The, 68
colorblindness, 319–320
Columbine Massacre game, 153–154
columns, spreadsheet, 362
comma-separated value (CSV) files, 56, 57, 60
commercials, 319
commitment problems, 237, 240–241
communication channels, game development, 327
competition, 291–292
complexity, design, 331, 332, 342
complexity levels, 39
compound events, 301–302
computer-controlled players, 102
conditional probability, 347–350, 356, 360
conditioned reflex, 265
confirmation bias, 64, 67–69, 72, 444
conscientiousness, 158, 160
constitutive rules, 166
constructivism, 126, 276–277, 280, 281, 286
context-sensitive directions, 285, 286
continuous reinforcement, 266
contract game tree, 241
contract work, 441
contracts, 83
conversion rate, 429
Cook, Dan, 425
cooperative behaviors, 245, 246
Cops and Robbers, 165–166
Corrypt, 43
Costikyan, Greg, 40, 135
costs
  balancing with quality and features, 35–36
  estimating, 427–429
  including fudge factor in, 36–37
  user acquisition, 428–429
counters, 53
CPU players, 102
Craigslist, 82
"crazy" ideas, 25
creative endeavors, 11–13, 14, 20
critical path puzzles, 211–212
criticism, 9, 25, 66–67, 448
crossword puzzles, 199
Croteam, 295
crunch, 439, 445
Csikszentmihalyi, Mihaly, 87, 288
CSV (comma-separated value) files, 56, 57, 60
cue cards, 409
curves
  interest, 92–96, 98, 100
  learning, 97–99, 100
cutting mats, 52
Cyberspace conference, 143

D

daily active users (DAU), 434
Dali, Salvador, 17
damage rates, 181
Danesi, Marcel, 194, 195, 205
Dark Souls, 171, 290, 447
Dartmouth/Princeton football game, 298–299
Darts, 119
Data Merge, InDesign, 56–60
data tables, one-way, 382–384
databases, 362–364
data-ink, 409–411, 417
DAU (daily active users), 434
De Koven, Bernie, 120
Dead of Winter, 70, 155
Dead Rising, 335, 447
deadlock, 220

Deathcam, 65
deception puzzles, 210
decision-making, 101–116
  anatomy of choice in, 103–104
  and anchoring, 302–303
  attribution errors, 297–299
  blind, 105–106
  and expected value, 114–115, 116, 304–307
  framing decisions, 308–309
  informed, 106
  and loss, 307–308
  marginal analysis of, 255–261
  meaningless/misleading, 108–109, 148
  mental shortcuts, 297
  obvious, 107–108
  and player agency, 102
  providing for meaningful, 84–85, 101
  and randomness, 299–302
  risk-reward options, 113–114
  role of game goals in, 124
  trade-offs, 110–113, 116
  understanding, 255
decoupled rewards, 192
decreasing marginal utility, 256–259, 261
deduction puzzles, 205–206
Demeter, Steve, 441
demographics, game design, 42–44, 87, 128
descriptive systems, 140
Desert Bus, 129
design goals, 5, 7
design risks, 419, 420
Destiny, 272, 273
development risks, 419–420
development structures, 28–37
DeviantArt image searches, 53
dice, 53, 350–352
Dice Tower, 443
Diehr, Mark, 283
difficulty adjustments, 89
DigiOrange labels, 52
digital games
  leveraging data from, 286
  list of, 450–453
  rules for, 169
  tools for designing, 324
digital prototypes, 48, 49, 50
diminishing marginal utility, 305
disabled players, 320
disjoint events, probability of, 345
dispositional factors, 297–298, 310
Divekick, 24
Dixit, 53
Docs, Google, 52, 333
documentation, 326–342
  flowcharts, 338–342
  game design document, 327–336
  importance of, 326
  misconceptions about, 328–330
  for presentations, 412–413
  purpose of, 342
  steps for creating, 331–336
  for tabletop games, 337–338
  tools for creating, 325
  using references in, 336
dollar auction, 249–250
dominance
  strict, 220–223, 234
  using/abusing, 223–226
Dominion, 41, 111, 122, 189
Donkey Kong, 113–114
dopamine, 263
double-cross, 240
drafting, 120, 123
Dragon's Lair, 168
drawing programs, 51
Drèze, Xavier, 270
drop rates, 115
Duncker, Karl, 24
Dungeons & Dragons, 350, 392–396
Dutch auctions, 173
Dwarf Fortress, 98
Dyer, Geoff, 14
dynamics, 135, 138, 145–150, 151

E

eBay, 82, 174, 253, 267
economic trade-offs, 259–261
edge cases, 335–336, 404
edutainment, 275
Eigen, Manfred, 66, 155, 177, 343
eight-ball pool, 187
Elance, 82
Elder Scrolls, 191, 284
Electronic Arts, 20, 324, 405
elevator pitch, 406
ELO rating system, 119, 171
emotion, 319
endowment effect, 307, 310
engagement, player, 92, 272
English auctions, 173
engrams, 272, 273
equilibrium
  defined, 218
  mixed strategy, 225, 230–233
  Nash, 227, 228–229
  Pareto optimal, 220, 239
  using induction to solve for, 249
ESCALATION strategy, 243, 244
European-style games, 119, 120
evaluation apprehension, 26
Excel
  basics, 362–364
  common errors, 372–373
  doing simulation in, 382–384
  formulas, 365
  functions, 178, 366–372
  Goal Seek feature, 376–377, 384
  one-way data tables, 382–384
  purpose of, 52, 325, 361
  Solver, 376, 377–381, 384
excitement, player, 92
expected value, 114–115, 116, 304–307
experience points (XP), 148, 178–180, 191, 293, 305, 373
experience tables, 178–180
experimentation loops, 126, 127, 128, 133
expert players, 277–279, 282
expertise reversal effect, 282–283, 286
exponential relationship, 177
external motivators, 289
extinction, 267, 274
extreme behaviors, 181, 182
extrinsic breadcrumbs, 197–198
extrinsic motivation, 288, 289, 295
extroversion, 158, 160
eye-tracking study, 321

F

F2P (free-to-play) games, 429–430, 437
Facebook
  farming game, 178–180
  Mafia Wars, 184
Family Feud, 258–259, 260
FAQ document, 336
FarmVille, 138, 154, 191, 293, 307
fear of critique, 66–67
features
  balancing quality, cost, and, 35–36
  describing game, 135
  limiting number of, 342
feedback, playtester, 66–69, 72
feedback loops, 183–192
  and camping, 146
  defined, 183
  fixing problems, 190–192
  in H/T game, 355
  methods for creating, 187–190
  negative, 185–187, 188–189
  positive, 5, 146, 184–185, 187–188
Fibonacci Sequence, 176–177
fighting games, 24, 146–147
Final Fantasy games, 153, 154

finishing phase, 34
Fire and Dice, 257–258
first impressions, 323
first-person shooters, 42, 49, 75, 146
Five Domains of Play, 158–159
fixed-interval schedule, 266, 267, 269
fixed-ratio schedule, 266, 267, 269
Flappy Bird, 441, 444
Flash, Adobe, 324
flat relationship, 175
flight-simulator games, 282
flow, 87–92, 97, 100
flowcharts, 31, 338–342, 399, 400, 404
fMRI (functional Magnetic Resonance Imaging), 263
football games, 5, 108–109, 127, 185, 298–300, 304
Ford, Henry, 439–440
formula errors, 372–373
formula operators, 365, 366
formulas, spreadsheet, 365–375
framing decisions, 308–309
Franusic, Joël, 11
Frazetta, Frank, 17
freeimages.com, 413
free-to-play (F2P) games, 429–430, 437
frequent buyer cards, 270
frustration, player, 88, 90, 92, 94
FTL, 122
fudge factors, 36–37
Fullerton, Tracy, 6
fun
  book about theory of, 99
  elusive nature of, 31, 273
  as games' primary goal, 288–289
  tracking/measuring, 94
  types of, 138
functional fixedness, 24, 27
functional Magnetic Resonance Imaging (fMRI), 263
functions, spreadsheet, 366–372, 384
fungible goods, 260, 261

G

Gage, Zach, 43
Gaiman, Neil, 76
Gamasutra, 273
Gamasutra.com, 65
gambler's fallacy, 300, 301
gambling, 273, 402–404
game balance. *See* balance
game design. *See also* game development
  achieving perfection in, 13
  for analog *vs*. digital games, 39–40
  avoidable dangers in, 447–449
  avoiding low-hanging fruit in, 22–24
  business issues, 425–445
  characteristics of good, 6
  commonly held heuristics, 91–92
  demographic considerations, 42–44, 87, 128
  documents, 7, 29, 33, 326–342
  eliciting flow state in, 87–92
  ethical/practical concerns, 273
  focusing on theme *vs*. mechanics, 40–42
  fundamental directive, 91
  gender considerations, 128, 291
  iterative nature of, 6, 71–72
  knowledge/skills required for, 3, 7, 38, 364
  and memory limitations, 318–319
  mindsets, 10
  opening questions, 44–46
  and player motivations, 161
  playtesting (*See* playtesting)
  quantity *vs*. quality in, 11–12, 25
  role of psychology in, 262–263
  science of, 71
  as subset of game studies, 15
  tools, 3, 324–325
  unified vocabulary for, 135
  vs. game theory, 217
  vs. other design processes, 7, 31
game design document (GDD), 327–342
  editing, 335
  importance of, 327
  misconceptions about, 328–330
  purpose of, 329, 342
  steps for creating, 331–336
  for tabletop games, 337–338
  templates for, 330
  updating, 329–330, 342
  using references in, 336
  and waterfall method, 29
Game Design Workshop (Fullerton), 6
game designer(s), 4–18
  attributes of successful, 7, 8–10, 344
  common stereotype of, 7
  key to becoming, 38
  responsibilities of, 5–7, 326
  sharing ideas with other, 80–83
  tools for, 324–325
  vs. idea guys, 10
Game Developers Conference (GDC), 444
game development. *See also* game design
  communication lines, 327, 328
  complexity of, 28, 38
  lifestyles, 438–443
  role of playtesting in, 63
  systems approach to, 5
  team members, 327–328
  tediousness of, 6
game engines, 39, 154, 263
Game Feel (Swink), 155
game flow, 87–92, 100
game goals. *See* goals
Game Outcomes Project, 32, 439–441
game publishers, 83
game states, 338–342
game studies, 15–16, 217
game studios, 439
game theory
  and dollar auctions, 249–250
  and "guess two-thirds" game, 250–252
  and homework-assignments problem, 268
  and *Prisoner's Dilemma*, 219–220
  problems with, 247–254
  purpose of, 254
  and rational actors, 248–249
  and second-price auctions, 252–253
  usefulness of, 218, 247
  vs. game design, 217
game trees, 236–241, 246, 304, 306–307
game-icons.net, 54
GameMaker, 3
gameplay, 78
GameRankings.com, 363
games
  careers in, 438
  combining best practices from other, 13–14
  complexity of, 38
  defining, 15–18
  describing elements of, 135, 137–150
  designing (*See* game design)
  developing problem statements for, 19–27
  essential features of, 15
  establishing design goals for, 5
  explaining to players, 163, 164, 167–168, 169
  how players determine goals for, 125–128
  human behavior in, 262–263
  as interactive systems, 5
  key questions to answer about, 44–46
  as learning devices, 13–14, 275
  making money from, 425
  making *vs*. playing, 8, 13
  measuring complexity of, 39
  normal form description of, 218

pitching, 421–422
playtesting (*See* playtesting)
protecting, 80–83
random, 118–119
risks in, 419
role of decision-making in, 84–85
rules for (*See* rules)
skill-based, 119
why humans play, 287
games education, 262–263
game-sale estimates, 427
gamification, 288, 289
Garfield, Richard, 65
Gazaway, Dax, 23
GDD. *See* game design document
Gee, James Paul, 9
gender differences, 128, 291, 319–320
Genocide Tetris, 152–153
geometry problems, 283–284
Gestalt grouping, 322
Giant Bomb website, 214
Giger, H.R., 17
Glass, Ira, 12
glass beads, 53
Go, 137
Goal Seek feature, Excel, 376–377, 384
goal-gradient effect, 269–270, 274, 293–294, 295
goals, 124–133
allowing players to set, 129, 130
for *Braid*, 133
confusing strategies with, 133
criteria for, 128–130, 132
for *Heavy Rain*, 132
helping players understand, 129
how players determine, 125–128
for *Minesweeper*, 126–128
for playtesting, 64
for *Project Gotham Racing*, 132
providing players with clear, 91, 133
for *SimCity*, 125–126
solving goal problems, 130–133
types of, 130–131
Godden, D.R., 318–319
Godin, Seth, 407
gold state, 30
Gone Home, 17
Good Player Award, 289, 290
Google
Docs, 52, 333
eye-tracking study, 321
image searches, 53–54, 413
Play, 427
Sheets, 52, 325, 361, 365
GoPets, 157
graphs, 407
griefers, 130
GRIM TRIGGER strategy, 243, 244–245
grinding, 148
GROFMAN strategy, 243
"guess two-thirds" game, 250–252
Guillotine, 109
guillotine cutters, 52
Guitar Hero, 133

H

Habbo Hotel, 140
Habitat, 143–144
Half-Life 2, 96
Half-Real (Juul), 164
Halo, 90, 282, 315
Hanabi, 42
handcuffing decisions, 109–110
Hansel and Gretel, 197
harmony, 159
Harry Potter series, 136
head-to-head games, 226
Hearts, 164, 166, 167
Heavy Rain, 21, 132, 137
help, onscreen, 286, 320–321
Hemingway, Ernest, 8
heuristics, 91–92, 181, 296, 297, 414
Hi-Ho! Cherry-O, 118
hints, 197–199, 320–321
histograms, 291–292
Hobson's Choice, 107–108
homework-assignments problem, 268
Homo Ludens (Huizinga), 287
hooks, 422, 434
HORSE, 165
hot-hand simulation, 388–390
H/T game, 353–355, 359
Huizinga, Johan, 287
Hull, Dr. Clark, 269–270
human decision-making, 296–309. *See also* decision-making
and anchoring, 302–303
attribution errors, 297–299
and expected value, 304–307
framing decisions, 308–309
and loss, 307–308
mental shortcuts, 297
and randomness, 299–302
human psychology, 262–263
Hunicke, Robin, 138

I

IBM, 74
iconography library, 54
idea generation, 333
idea guys, 10
ideas
building on, 25
encouraging "crazy," 25
presenting, 405–406
(*See also* presentations)
protecting, 80–83
testing, 31, 32
and value, 83
ideation, 29
IGDA Accessibility SIG, 320
Ikebana, 42
Illustrator, Adobe, 51
image searches, 53, 413
implementation phase, 33
implicit rules, 167
incorporation, 83
increasing marginal utility, 260–261
independent developers, 441–443
independent events, probability of, 346–347
InDesign, Adobe, 52, 56–60
induction, 242, 249–250, 254
inferential puzzles, 208–209
informed decisions, 106
Ingenious, 139
innovation/risk levels, 332
insurance game tree, 306
Interactive Fantasy, 135
interactive games, 84
interactive narratives, 21
interest curves, 92–96, 98, 100, 190
intransitive systems, 225
intrinsic breadcrumbs, 199
intrinsic motivation, 288, 289, 290, 295
iOS App Store, 443, 444
Ishmail, Rami, 38
Isner-Mahut tournament, 358–360
Iterated Elimination of Dominated Strategies, 221–223
iterated games, 242–245, 251
iterative processes, 31–32, 71–72

J-K

Japanese RPGs, 153
Jejeune Institute, 39
Jelly no Puzzle, 203–204
jigsaw puzzles, 213
Jira, 325
Jobs, Steve, 407
joint probability, 344–347, 360
juggling, 280–281
Juul, Jesper, 16, 356
Kahneman, Daniel, 307
Keynote, 406

Kickstarter, 418, 420–421
Kim, Scott, 194–195
kingmaking, 146
King's Wise Men puzzle, 208–209
Kivetz, Ran, 270, 293
Knizia, Reiner, 139
Koster, Raph, 99, 152
Krebs, Valdis, 67
Kurzweil, Ray, 263

L

L.A. Noire, 322
labels, 52
Lando/Vader game tree, 240
law of large numbers, 77
Laws of the Game (Eigen), 66, 155, 177, 343
layout programs, 51–52
LCR, 84, 118
Le Havre, 175
League of Legends, 93, 127, 138, 281
Learn to Play (White), 285
learning curves, 97–99, 100
"learning design" principles, 285–286
learning devices, games as, 13–14, 281
LeBlanc, Marc, 138
Ledonne, Danny, 154
legal issues, 81, 83
Legend of Zelda, 24, 156
Lemarchand, Richard, 90
Lemonade Stand, 162
Lepper, Mark, 289
Let's Make a Deal, 113
levels, game, 89–90
lifestyles
  AAA digital game development, 439–441
  independent digital game development, 441–443
  tabletop game development, 443
linear inverse relationship, 175–176
linear relationship, 175
LinkedIn, 448
Loewenstein, George, 270
logos, 414
long-term goals, 131
long-term memory, 279–280
loops
  experimentation, 126, 127, 128, 133
  feedback (*See* feedback loops)
loss aversion, 307
losses, 307–308, 310
lottery game tree, 306
low-hanging-fruit exercise, 22–24, 83
LucasArts, 143
luck, market, 444
luck-based games, 123, 146
ludography, 450–454

M

Madden NFL Football, 20, 127, 330
Mafia Wars, 120–122
magazine subscriptions, 309
Magic: The Gathering
  Ancestral Recall card, 172
  card design, 54–55, 57, 61, 65
  card sleeves, 53
  chance of winning, 119
Major League Baseball, 184, 192
Man, Play, and Games (Caillois), 118, 287
man-hour estimates, 36–37
man-months, 428
manuals, user, 286
marathons, 270
marginal analysis, 255–261
marginal utility, 256–261, 305
margins, balance on, 259–261
Mario Kart 64, 185–186
market luck, 444
market risks, 419, 420
martingale betting, 402–404
Mass Effect, 137
massively multiplayer online games (MMOs), 144, 156, 330, 344, 422
massively multiplayer online role-playing games (MMORPGs), 129, 130
mastery, desire for, 290, 295
matchstick puzzle, 213
math formulas, 365–366
mathematical relationships, 174–180, 182
mathematics, 217
math-problems study, 323
matrices, 218, 220, 228–229, 236, 237
MAU (monthly active users), 434
Max Payne, 363
mazes, 202–203, 211
Mazza, Ray, 308
McDonalds pricing, 256–257
MDA, 136–150
  elements of, 138, 152
  examples, 140–144
  meaning of acronym, 135
  purpose of, 140, 150
  relationship among elements of, 139, 152
MDD (media design document), 29, 33
meaningful decisions, 84–85
meaningless decisions, 108–109, 148
mechanics. *See also* MDA
  defined, 40, 138
  design theory and, 137
  how players react to, 151
  progression, 174
  as rules, 163
  theme and, 40–42
media design document (MDD), 29, 33
Medina, John, 321
medium-term goals, 130–131
Mega Man 3, 106
MegaBoss problem, 300
Meier, Sid, 120, 301
memory
  games, 202
  limitations, 317–319
  psychology of, 279–280
  retention, 321, 323
mental shortcuts, 296–297
metrics, 429–437
Metroid Prime, 307
Microsoft
  Excel (*See* Excel)
  Project, 325
  user research, 90
  Word, 52, 325
milieu, 151–162
mindset, game design, 10
Minecraft, 71, 441, 447
Minesweeper, 126–128
minimum viable product (MVP), 37
mini-payoffs, 98
misdirection, attention, 313–315
misleading decisions, 108–109
mixed strategies, 225, 230–233
MMORPGs (massively multiplayer online role-playing games), 129, 130
MMOs (massively multiplayer online games), 144, 156, 330, 344, 422
mobile games industry presentation, 415–417
Moles, Abraham, 155
Mondrian, Piet, 17
Monopoly, 107, 110, 142, 166, 183, 396–401
Monte Carlo simulation
  answering design questions with, 386–388
  defined, 362, 385
  and one-way data tables, 384
  and random number generator, 368
monthly active users (MAU), 434
Monty Hall problem, 390–392

motivation, 287–295
competition and, 291–292
goal-gradient effect, 293–294
and personality, 158–161, 292–293
and scarcity, 294–295
types of, 288, 295
MUD, 156
multiplayer games, 78, 144, 145, 245. *See also* MMORPGs; MMOs
multitasking, 313, 323
Murphy, Stephen, 16
MVP (minimum viable product), 37
Mysterium, 53

N

narrative-based games, 85, 108, 111–112
NASCAR came, 128
Nash equilibrium, 227, 228–229
National Footbal League, 192
Nationwide ad, 319
NBA Live, 102
NBA Street, 102
NCAA Football 08, 185
NDAs (non-disclosure agreements), 80–83
near misses, 92
N-effect, 291–292
negative feedback loops, 185–187, 188–189, 355
neuroticism, 158, 160
Nicholls, John, 290
Nikoli, 199
Nim, 107
"noise" elements, 410–411
nondigital games, 39. *See also* analog games
non-disclosure agreements (NDAs), 80–83
normal form games, 218
normative systems, 140
note cards, 52
notes, presentation, 412, 417
Noun Project, 54
novelty, 129, 158, 422
novice players, 277–279, 282–283
Numbers, Apple, 325, 365
numeric relationships, 174–180
Nunes, Joseph C., 270

O

object of the game, 131
obvious decisions, 107–108
OCEAN personality traits, 158–161, 162, 293
"Once Around the Board" simulation, 396–401
One Pawn Army, 282–283
one-way data tables, 382–384
onscreen help, 286, 320–321
open ascending price auctions, 173
open descending price auctions, 173
openness to experience, 158, 159
OpenOffice Calc, 325
operant conditioning, 265, 273
operational rules, 166
operators, formula, 365, 366
opportunity cost, 111
Oregon Trail, 275
organizing elements, 318
Orland, Ted, 11–12
orphaned verbs, 169
Osborn, Alex, 25
Out There, 122
overdesigning, 331
overscoping problem, 35, 36
ownership rights, 83

P

Pages, Apple, 52
Pandemic, 171
paper prototypes, 50–62
artwork for, 53–54
for card games, 54–56
hardware for making, 52–53
materials used for, 49, 52–53
reducing time required to create, 56
software for making, 50, 51–52, 56–60
paper-folding problem, 302–303
paradoxes, 210
Pareto distributions, 430–431, 442, 445
Pareto optimal result, 220, 239
Pausch, Randy, 20
Pavlov, Ivan, 265–266, 269
payoffs
mini- *vs*. big, 98–99
in *Prisoner's Dilemma*, 219–220
Penn & Teller's Smoke & Mirrors, 129
perception, human, 319–323
perfect players, 262
perfection, 13
Perlenspiel, 3
persistence, 9
persistent-world games, 140
personality, five-factor model of, 158–161, 292–293
Persson, Markus, 441
Peterson, Paul, 109
philomathy, 9
Photoshop, Adobe, 52, 54, 56
physical games, 453–454
physical manipulation puzzles, 213–214
picas, 58
pictorial information, 321
pigs-and-chickens story, 32
pitch questions, 421–422
P&L (profit and loss statement), 426–429, 436, 437
platformers, 49, 278, 285, 338
Play, Five Domains of, 158–159
playcalling game tree, 304
player agency, 102, 122, 123
player types, 156–157
players
being advocate for, 6
classifying, 156–157
communicating with, 7
crafting meaningful decisions for, 84–85, 101
disabled, 320
how game goals are determined by, 125–128
individual differences among, 99–100
learning curves for, 97–99
mapping engagement of, 92–96, 100
motivations of, 161, 287–295
punishing, 308
understanding, 6, 287
playing games, 8, 13–14
playtesters
crediting, 70
finding, 70, 73
keeping them talking, 74–75
listening to feedback from, 66–69, 72
splitting into two groups, 77
warming up, 44
playtesting, 63–79
asking questions after, 76
avoiding bias in, 74, 79
benefits of, 65–66
best practices for, 73
blind, 337–338
defined, 63
environment for, 74
finding people for, 70, 73
goals of, 64–65, 74
good/bad techniques for, 79
listening to feedback from, 66–69, 72
methods, 73–79
purpose of, 48, 64, 72, 74, 91
self, 77–79
timing of, 49, 76
plot, 136, 150
Pokemon, 225, 228–229
polish, 155–156, 162

Portal, 98, 167, 168, 193, 281, 290
positive feedback loops, 5, 146, 184–185, 187–188
possibility space, 196–197, 203–204, 215
postmortems, project, 65
post-reward resetting phenomenon, 271
PostScript picas, 58
poverty game, 161–162
Power Grid, 173, 174, 175
power inflation, 260
power law, 442
Powerball jackpot, 306
PowerPoint, 406, 407
Predictably Irrational (Ariely), 309
preproduction, 29
Presentation Zen (Reynolds), 412
presentations, 405–423
  acquiring images for, 413–415
  creating effective, 412–413
  cue cards for, 409
  documentation for, 412–413
  example, 415–417
  game pitch, 421–422
  minimizing text in, 407–409
 "noise" elements in, 410–411
  problem with most, 405–406
  reading, 406, 423
  recommended length for, 406–407
  removing non-data-ink from, 409–410
  team-based, 411
  thesis for, 406–407, 412
  time wasters in, 411
press-your-luck dynamic, 149–150
Prezi, 411
Price is Right, The, 85
pricing strategies, 173–174, 256–259, 309
primacy effect, 318
primary keys, 363–364
Princeton/Dartmouth football game, 298–299
printers, 52
Prisoner's Dilemma, 219–220, 226, 235, 242, 243, 245
prisoners-and-hats problem, 208–209
private notes, 412
prizes, 250, 270, 271, 291, 302, 306. *See also* rewards
probability, 343–360
  bomb story, 343
  and boy-girl problem, 355–358
  calculating with ELO rating, 119
  of compound events, 301–302
  conditional, 347–350, 356, 360
  of disjoint events, 345
  as fancy counting, 344–350
  and gambler's fallacy, 301
  H/T game example, 353–355, 359
  importance of, 360
  of independent events, 346–347
  and Isner-Mahut tournament, 358–360
  joint, 344–347, 360
  making assumptions about, 360
  with multiple die rolls, 350–352
  in skill-based games, 119
probability tree, 386
problem solvers, 277–279
problem statements, 19–27
  examples of, 20–22
  focusing on theme *vs.* mechanics in, 40–42
  purpose of, 19, 41
production blocking, 26
production costs, 428
production methodologies, 29–34
production phase, 30
productivity studies, 439–440, 445
Professor Layton series, 199–200
profit and loss statement (P&L), 426–429, 436, 437
progression mechanics, 174
Project, Microsoft, 325
Project Gotham Racing, 21, 132
Project Management Triangle, 35
project postmortems, 65
prototypes
  artwork for, 53–54
  building, 22, 42, 49
  changing, 48, 49
  defined, 31, 48, 72
  digital (*See* digital prototypes)
  evaluating, 32
  and intellectual property, 80–83
  methods for creating, 49
  paper (*See* paper prototypes)
  purpose of, 42, 48
prototyping, 29, 324
psychology
  in game design, 262–263
  of memory, 279–280
publishers, game, 83
Puerto Rico, 22
Punch a Bunch, 85
punishing failure, 188
puzzle breadcrumbs, 197–200
Puzzle Instinct (Danesi), 195, 205
puzzles, 193–215
  characteristics of, 194–195
  defined, 194–195
  features of ineffective, 200–205
  interest curves for, 95
  key to making effective, 195, 197
  playtesting, 201
  popularity of, 193
  possibility space for, 196–197, 203–204, 215
  types of, 205–214
pyramid metaphor, 33–34

Q-R

Quake II, 184
quality
  balancing features, cost, and, 35–36
  vs. quantity, 11–12, 25
Quantic Dream, 21
Quiet (Cain), 13
racing games, 21, 128, 132, 186
Rampage, 41
random games, 118–119
random number generator, 368–369, 384, 385
RANDOM strategy, 243
randomness, 117–123, 146, 299–302, 308
Rare Entertainment, 420
rational actors, 248–249, 254, 262
Realm of the Mad God, 140–141
real-time strategy games, 145
recency effect, 318
references, design document, 336, 342
reinforcement. *See* schedules of reinforcement
relatedness, desire for, 290, 295
relational puzzles, 207–208
repetition, 158, 311, 319, 394
requirements, gathering, 33
research, game design, 332–333
Resident Evil, 137, 155, 322
resource allocation, 35–36
retention, 321, 323, 432–434
"retro" game design, 447
revenue, calculating, 430
reward schedules, 266–269
rewards, 130, 150, 154, 164, 289–290. *See also* risk-reward choice
Reynolds, Gary, 412
riddles, 92, 200
Ridiculous Fishing, 441
Risk, 184
risk analysis, 419–421
risk study, 418
risk-averse people, 306, 310
risk/innovation levels, 332
risk-loving people, 306, 310
risk-neutral people, 306
risk-reward choice, 113–114, 116
river-crossing puzzle, 211–212

Rock, Paper, Scissors, 147–148, 225, 230–233
Rock Band, 85
role-playing games (RPGs), 266. *See also* MMORPGs
  balance on margins in, 260
  blind decisions in, 105
  creating design document for, 331–335
  examples of, 39
  expected value in, 115
  feedback loops in, 184
  fixing problems in, 190
  meaningless decisions in, 108
  milieu in, 153–154
  prototyping, 49
role-playing journal, 135
Roll Through the Ages, 175
Rollings, Andrew, 16
Room, The, 193
Rose, Mike, 273
Rousseau, Jean Jacques, 226
rows, spreadsheet, 362
royalty-free images, 62
RPG Maker engine, 154
RPGs. *See* role-playing games
Rubik's Cubes, 213
rule of thirds, 414
rulers, 52
rules, 163–169. *See also* mechanics
  establishing basic, 42, 44
  examples of, 138
  as part of pitch presentations, 422
  philosophical treatment of, 164
  qualities of, 165–166
  for tabletop games, 337–338
  types of, 166–167
  as way of explaining game, 164, 169
Rules of Play (Salen/Zimmerman), 71, 103, 165–167
runtime behaviors, 138

S

Sackson, Sid, 149
salary caps, 192
Salen, Katie, 16, 103, 165
Saltsman, Adam, 441
sampling distributions, 77, 404
San Juan, 22
satisfaction, player, 91
scaffolding, 281, 286
scarcity, 294–295
schedules of reinforcement, 264–274
  in coin pushers, 271–272
  in *Destiny,* 272
  ethical/practical concerns, 273
  and goal-gradient effect, 293
  purpose of, 264
  research on, 265–266
  role of anticipation in, 269–271
  types of, 266–269
Schell, Jesse, 16, 72, 92, 129, 316, 336
Schüll, Natasha Dow, 273
scientific method, 125
scissors, 52
scope
  playtesting, 64
  project, 35–37
Scrum, 32
second-price auctions, 174, 252–253
self-balancing mechanisms, 172–174, 182
self-determination theory, 290–291, 295
self-healing mats, 52
self-playtesting, 77–79
self-serving bias, 298–299
sequential games, 236–239, 246
set-theoretical puzzles, 206–207
Settlers of Catan, 78, 119, 189
Shadow of the Colossus, 24, 86, 90
shadow of the future, 245, 246
Sheets, Google, 52, 325, 361, 365
shooter games, 108. *See also* first-person shooters
shortcuts, mental, 296–297
short-term goals, 130
short-term memory, 317
Sibelius, Jean, 448
SimCity, 10, 102, 125–126
Simonton, Dean Keith, 20
simplicity, design, 331
simulations
  in Excel, 382–384
  hot-hand, 388–390
  martingale betting, 402–404
  Monte Carlo (*See* Monte Carlo simulation)
  Monty Hall problem, 390–392
"Once Around the Board," 396–401
  player agency in, 102
  super-attack, 386–388
situational factors, 297–298, 310
skill levels, player, 88
skill-based games, 119, 123
Skinner, B.F., 265, 276, 288
Skinner box, 265–266, 274
Sky Parlor Studios, 434
Skyrim, 38, 156, 284–285
Slack, 325
slide decks, 406, 412–413
slideware, 406, 407, 412
slot machines, 267, 273
Smoke & Mirrors, Penn & Teller's, 129
Snakes and Ladders, 84, 118
sniping software, 253
social anxiety, 26
social games, 128
social loafing, 26
Socratic questioning, 75–76
software development
  life cycle, 28, 29
  models, 29–31
Solis, Daniel, 109
Solver, Excel, 376, 377–381, 384
Space Invaders, 137
SpaceChem, 291–292
spatial manipulation puzzles, 213–214
specification, 29
Spector, Warren, 201
SpellTower, 43
Spent, 161–162
Spiel des Jahres, 41–42, 122
split-attention effect, 283–284, 286
SpongeBob games, 43
sports games, 39, 43, 171, 184
spreadsheet software, 52, 56, 325, 361, 365. *See also* Excel
spreadsheets, 361–384
  for Advantage/Disadvantage system, 392–396
  anchors in, 373–375
  for card games, 55–56
  common errors in, 372–373
  for experience tables, 178–180
  formulas in, 365–375
  functions in, 366–372
  for hot-hand simulation, 388–390
  for martingale betting, 402–404
  for *Monopoly* simulation, 396–401
  for Monty Hall problem, 390–392
  nomenclature, 362–364
  profit and loss, 427
  purpose of, 361, 362, 384
  for super-attack simulation, 386–388
  tools for creating, 361 (*See also* spreadsheet software)
St. Petersburg Paradox, 305
staff costs, 428
Stag Hunt, 226–227, 228, 233, 236–237
Stanley Parable, The, 316
states, game, 338–342
statistical functions, 366
Steam, 96, 309
SteamSpy, 427
Stephenson, Neal, 418, 419
stimulation, 159
stock-image sites, 413

stock-picking, 301
storytelling games, 39, 49, 137
strategies
  experimenting with, 243–244
  successful, 244–245
  vs. goals, 133
strategy puzzles, 212
Streak for the Cash, 302
strict dominance, 220–223, 234
Sudoku, 195, 199, 206
Sudoku Together, 434
Suits, Bernard, 16
summary statistics, 382
Super Bowl ads, 319
Super Columbine Massacre RPG!, 153–154
Super Mario Bros., 89, 135, 167, 262, 285, 338
Super Metroid, 168
super-attack simulation, 386–388
Superman Returns, 50, 67
supply and demand, 174
surgeon puzzle, 207–208
survey questions, 76, 308–309
Sutton-Smith, Brian, 16
Swink, Steve, 155
sword-fighting game, 223–225, 418–421
Swrve, 415, 430, 435
symmetry, 171–172, 182, 220

T

Tabletop: Analog Game Design (Costikyan), 40
tabletop games, 40, 122, 337–338, 443, 453–454
take-home documents, 413
Talos Principle, 295
tangram puzzles, 213
task-switching, 313, 323
TDD (technical design document), 29, 33
Team Fortress 2, 65, 273
team presentations, 411
teams, game design, 440–441, 445
technical design document (TDD), 29, 33
Telephone game, 328
Telltale, 108
templates, documentation, 330
Temple Run, 444
tennis tournament, 358–360
terminology, 135
Terror in Meeple City, 40, 41
test phase, 30, 34
testing. *See also* playtesting
  A/B, 77, 79
  environment, 74–76
  usability, 74
Tetris, 152–153, 195
text
  adventures, 193
  onscreen, 320–321
  on slides, 407–409
themes, 40–42, 136, 150, 422
thenounproject.com, 413
Theory of Fun for Game Design (Koster), 99, 152
thesis, presentation, 406–407, 412
Think Aloud Protocol, 74–75
threat, 159
Ticket to Ride, 111, 176, 320
Tic-Tac-Toe, 84, 107, 194
time estimates, 36–37
time wasters, presentation, 411
time-shifting, 114
TIT-FOR-TAT strategies, 243–245
Tomb Raider, 193
tools, game design, 325
Tower of Hanoi, 214
trade-offs, 110–113, 116
transitions
  in games, 338–339
  in presentations, 410
triangular relationship, 176, 178–180
truth puzzles, 209
Tufte, Edward, 406, 409
TurboSquid, 82
turtling, 145–146
tutorials, 106, 127, 128, 285–286, 321
Tversky, Amos, 307
Twenty Four, 56, 57
Twine, 3

U-V

unified modeling language (UML), 339
Unity, 39
Urban Ministries of Durham, 162
usability testing, 74
usage rights, 53, 54
user acquisition cost, 428–429
user manuals, 286
value, expected, 114–115, 116, 304–307
Vandenberghe, Jason, 158–161
variable-interval schedule, 266, 267–268, 269
variable-ratio schedule, 266, 267, 272, 274
Vasel, Tom, 443
Venn diagrams, 206–207, 349
verbs, 167–168, 169
VGChartz, 427
Vickrey auctions, 174
video games, 85
video-game development, 439
virality, 431–435
Visual Display of Quantitative Information (Tufte), 409
Vlambeer, 38
VLOOKUP function, 178, 369–370
vocabulary, game design, 135
von Neumann, John, 385
vos Savant, Marilyn, 390

W

Walking Dead, 108, 156
War, 84, 118, 147, 167
war games, 145–146
waterfall method, 29–31, 34
Watson, Peter, 68–69
Watson Selection Task, 69
Well-Played Game (De Koven), 120
White, Matthew, 285
Wimbledon tournament, 358–360
Word, Microsoft, 52, 325
word games, 43
word processors, 52
word-recall study, 318–319
working memory, 279–280, 317
World of Warcraft, 137, 190
Wright, Will, 10, 102
WWE SuperCard, 292

X-Z

X concept, 20
X-acto knives, 52
XP. *See* experience points
Yahtzee, 165
Yooka-Laylee, 420–421
zero-sum games, 226
Zimmerman, Eric, 16, 103, 165
Zubek, Robert, 138