and design in games, an examination of various definitions of aesthetics and fun from games scholars, and a meditation on why the Hamilton Building in Denver does not have playground slides, they examine how fun can be used to reevaluate philosophically our understanding of games and play.

The pieces in the book address these—and other more flippant responses to fun—using a confident tone clearly embedded in the bedrock of gaming thought and philosophy. A great deal of quiet scholarship offers a valuable, but not exhaustive, context for those not familiar with games studies. This comes as something of a relief, because many games-studies books still overexplain concepts and theories now so well trodden they do not need much elaboration. The freshness of the writing also means it can be exuberant. So, to answer my first question, yes, it is fun to read this book.

The authors identify three aspects needed for fun, aspects that allow them to explore different elements of fun in subsequent essays. These are "set-outsideness," which sets the preconditions for fun; "ludic forms," which enables the potentials for fun; and "ambiguity," through which fun is enacted. However, we also move through a number of critical definitions of fun as the book progresses, some of them rather charming. For example, we find that Ian Bogost thinks fun to be "the feeling of finding something new in something familiar." Jesse Schell finds that "fun is pleasure with surprises." And, rather more cynically, the provocative Pete Garcin claims that "fun is probably the most (over) used words in game design discourse" and that "it's also a broad, nonspecific, subjective term that actually doesn't actually tell us anything meaningful about a game experience" (pp. 41–56). Perhaps so, but the authors certainly intend to enjoy themselves trying to reach this last point.

Although some of the later chapters relate players and player communities to their aesthetic desires, they offer less than might be expected about playfulness—indeed this seems rather absent. My visiting mother became extremely aggrieved by the title of the book, which she holds suggests that fun, taste, and games are "idle and unproductive." She may have felt this way been because she had just beaten several friends at a new board game that weekend or because disagreeing with things is simply her favourite way of having fun. Still, the playful player does not take up much space in this book.

Have we pushed fun away because it is unquantifiable? A key takeaway from this book is that we might also have inadvertently orchestrated a very narrow description of what playfulness can be. This work refigures such narrow definitions of fun and thus provides a valuable contribution to games-studies scholarship.

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Playing Smart: On Games, Intelligence, and Artificial Intelligence

Julian Togelius
Cambridge, MA: The MIT Press, 2018.

Contents, introduction, prologue, further reading, notes, bibliography, and index. 168 pp. $21.95 hardcover.
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What do you think when you hear "artificial intelligence" (AI) and "video games" together? If you are like me, you think of the stuff that animates computer-controlled characters (NPCs), who appear to be so smart that the game seems unfair or so stupid that it seems mind-numbing. Players rarely extol a game for its realistic AI, but they commonly use adjectives such as "smart" or "dumb" to attribute intelligence (or a lack of it) to NPCs. Is artificial intelligence really intelligence? And do the aspirations of artificial intelligence researchers start and stop with giving players a good challenge?

Julian Togelius explores these questions by delving into the intersection of games, intelligence, and artificial intelligence. *Playing Smart* is an accessible, worthy contribution to MIT's Playful Thinking series of pocket-sized, digestible books that stoke deep contemplation about games. Written with a conversational tone in the first-person, the book offers readers tales about Togelius's childhood cats, driver's license status, and extensive and pioneering research work in games, AI, player modeling, and procedural content generation.

The book makes three interrelated claims tackled in reverse order. First, games are the future of AI. Second, AI is the future of games. And third, games and AI for games help us understand human intelligence. Early chapters define intelligence and AI. The first focuses on the classic board games chess and go, which have been used as laboratories for developing AI programs like the one housed on IBM's famous Deep Blue computer. Togelius introduces key algorithms at appropriate moments to foster understanding and subsequently builds upon them. For example, chess-playing programs use *minmax*, a type of tree-search algorithm, to find the best moves given the state of play on the board. The reason none of us can defeat our computer at chess on the highest difficulty is because the program stores multiple board states in memory simultaneously and determines optimal moves many turns into the future. Chess programs possess a narrow AI; they do one thing better than humans. Researchers excel at creating narrow AI, but artificial intelligence still cannot pass the Turing test. Universal, or general, AI remains out of reach.

Our perspective on intelligence is androcentric. We seem quite primitive when asked to perform quickly millions of mathematical operations. Driverless cars may soon deliver us to our vacation destinations safer than we can. And even though you cannot beat your computer at chess (a game humanity has had fifteen hundred years to master), another AI could. So, intelligence is relative. To illustrate this point, Togelius offers a dramatization familiar to readers with experience in first-person shooter games. Basic enemies are often finite state machines. At any given time, they exist in a state of behavior, for example, patrol, take cover, charge the player character, or die (R.I.P. Enemy 362). Movement-based state changes are controlled by the A* algorithm, a pathfinding algorithm that determines the best route between positions. Note

the similarity between A*, minmax, and algorithms such as neural networks, which drive autonomous vehicles. Each searches for the best solution to a problem.

The middle chapters of Togelius's book direct AI research to problems of game development and address in turn AI methods for playing games, modeling players, and generating content. These chapters also exemplify the strengths and weaknesses of the book. Togelius regularly reminds the reader why the book is important, observing that "the games industry is confined by economic realities to be highly risk averse and rather shortsighted" and that, therefore, "games are designed to not need (nontrivial) AI" (p. 52). This limits the potentiality of games in every domain; if video games are to continue maturing as a medium, developers need to experiment with new AI methods. Imagine the time and money we might save should developers teach AI to train itself to play their games rather than manually programming the AI (the subject of chapter 5). Togelius's expertise helps him break down his doctoral work, which used evolutionary algorithms to train neural networks to drive digital cars and to present others' research in clear, concise terms. It is important for readers to understand how researchers study AI and games.

By chapter 7, readers have been presented with increasingly complex concepts and algorithms underlying one of the most fascinating examples in the text. Togelius and a team of researchers used a version of *Super Mario Bros* to create a model of player preference (the subject of chapter 6) that "given two levels in the game and a particular playing style, could predict which of the two levels the player would prefer" (p. 104). They then created an experience-driven procedural content generator to create levels likely to elicit specific experiences. Imagine that game AI could conjure levels based on mood and even induce specific moods or move players along a gradient of emotions. This would go far beyond the notion of player types to reflect the situational dynamics of the self.

Playing Smart is still a lay book. Examples are intergenerational, often using a classic board game and popular video games. Readers with expertise in games studies, artificial intelligence, and psychology (especially related to learning) may find little here; however, experts in only one of these areas will find their knowledge of the others significantly bolstered. The book is an excellent primer on these topics for undergraduates, aspiring game developers, and general-interest hobbyists. In addition to sources in the slight section of further readings, readers may also enjoy Jesse Schell's *The Art of Game Design* and peruse archives of numerous games studies publications, including *Game Studies*, *Games and Culture,* and the *Transactions of the Digital Games Research Association*. Togelius's concluding invitation, "Perhaps you would like to join us?" (p. 140) is a call to seek the book's holy grail: not only AI that can design games for our pleasure, but a reevaluation of the possible roles of AI in games and game development, and AI that can play all games, a step toward universal artificial intelligence.

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