

The Editors

Kevin Dill is a member of the Group Technical Staff at Lockheed Martin Global Training and Logistics, and chief architect of the Game AI Architecture. He is a veteran of the game industry, with seven published titles under his belt, including *Red Dead Redemption*, *Iron Man*, *Zoo Tycoon 2: Marine Mania*, *Zoo Tycoon 2: Endangered Species*, *Axis & Allies*, *Kohan 2: Kings of War*, and *Master of Orion 3*. Kevin was the technical editor for *Introduction to Game AI* and *Behavioral Mathematics for Game AI*, and a section editor for *AI Game Programming Wisdom 4* and the book you hold in your hands. He is a frequent speaker at conferences such as I/ITSEC and GDC, and has taught classes on game development and game AI at Harvard University, Boston University, Worcester Polytechnic Institute, and Northeastern University.

Damián Isla has been working on and writing about game technology for over a decade. He is president and cofounder of Moonshot Games, a studio dedicated to the creation of downloadable and mobile games with triple-A production values and technology. Before Moonshot, Damián was AI and Gameplay engineering lead at Bungie Studios, where he was responsible for the AI for the mega-hit first-person shooters *Halo 2* and *Halo 3*. A leading expert in the field of AI for Games, Damián has spoken on games, AI, and character technology at the International Joint Conference on Artificial Intelligence (IJCAI), at the AI and Interactive Digital Entertainment Conference (AIIDE), and at Siggraph, and is a frequent speaker at the Game Developers Conference (GDC). Before joining the industry, Damián earned a master's degree at the Massachusetts Institute of Technology Media Lab, where he did research on learning and behavior for synthetic characters. He holds a BS in computer science, also from MIT.

Neil Kirby is a member of the technical staff at Bell Laboratories, the R&D arm of Alcatel-Lucent. He is the author of *An Introduction to Game AI*, and his other publications include articles in volumes I, II, and IV of *AI Game Programming Wisdom*. His 1991 paper “Artificial Intelligence Without AI: An Evolutionary Approach” may well show the first use of what is now known as “circle strafing” in a game. His other papers and presentations can be found in the proceedings of the Computer Game Developers Conference

from 1991 to present as well as the 2003 Australian Game Developers Conference. Neil holds a master's degree in computer science from Ohio State University. He was a driving force behind the creation of the IGDA Foundation and serves on its board.

Dave Mark is the president and lead designer of Intrinsic Algorithm, LLC, an independent game development studio and AI consulting company in Omaha, Nebraska. He is the author of the book *Behavioral Mathematics for Game AI* and is a contributor to the *AI Game Programming Wisdom* and *Game Programming Gems* book series. Dave is also a founding member of the AI Game Programmers Guild and coadvisor of the annual GDC AI Summit. Dave continues to further his education by attending the University of Life. He has no plans to graduate any time soon.

Steve Rabin is a principal software engineer at Nintendo of America, where he researches new techniques for Nintendo's current and future platforms, architects development tools such as the Wii U CPU Profiler, and supports Nintendo developers. Before Nintendo, Steve worked primarily as an AI engineer at several Seattle start-ups including Gas Powered Games, WizBang Software Productions, and Surreal Software. He organized and edited the *AI Game Programming Wisdom* series of books, the book *Introduction to Game Development*, and has over two dozen articles published in the *Game Programming Gems* series. He's been an invited keynote speaker at several academic AI conferences, spoken at the Game Developers Conference, and spoken at numerous Nintendo development conferences in North America and Europe. He organizes the 2-day AI Summit at GDC and has moderated the AI roundtables. Steve founded and manages the professional group known as the AI Game Programmers Guild, with over 350 members worldwide. He has also taught game AI at the DigiPen Institute of Technology for the last 8 years and has earned a BS in computer engineering and an MS in computer science, both from the University of Washington.

Nathan Sturtevant is a professor of computer science at the University of Denver, working on AI and games. He began his games career working on shareware games as a college student, writing the popular Mac tank game *Dome Wars* in the mid-90s, and returned to the games industry to write the pathfinding engine for *Dragon Age: Origins*. Nathan continues to develop games in his free time, and is currently porting *Dome Wars* to iOS.

Simon Tomlinson, PhD, studied physics at Manchester University in England and went on to gain a PhD in electrical engineering and to work as a research fellow in electronic applications and computational physics. In 1997 he joined the games industry as an AI programmer. He has worked on a variety of platforms and projects including billiard games, flight and space combat, racing games, FPS combat, and card games, including Poker. He has also worked as project lead on mobile Java platforms and had occasional forays into production and R&D. He has retained his academic interests with several game related publications and presentations in the UK and has assisted local academia in starting and running game programming courses. In 2008 he formed his own consultancy company, S1m On Ltd, and has most recently contributed to the highly acclaimed *Need for Speed Shift* series under a contract for Slightly Mad Studios.

The Contributors

Bobby Anguelov works as an AI/animation programmer at Io Interactive, where he focuses on low-level locomotion and behavior frameworks. He earned an MSc in computer science from the University of Pretoria, South Africa, and spent the first part of his career working in enterprise software. This was followed by a 2-year stint teaching graphics programming at a university before moving to Denmark to pursue his lifelong dream of working in games. He's currently working on building a new behavior-authoring framework for the *Glacier 2* game engine while trying to catch up on the latest animation techniques in his spare time. In his less busy past, he used to regularly update his tech blog at www.takinginitiative.net.

Tomasz Bednarz is a computational research scientist and project leader at CSIRO's Division of Mathematics, Informatics, and Statistics (www.csiro.au/cmisis). He is active in the computational simulation sciences where heterogeneous architectures play an essential role in speeding up computationally expensive scientific code. He coorganizes the Sydney GPU Meetup (<http://www.meetup.com/Sydney-GPU-Users/>) and also the OzViz workshops (<https://sites.google.com/site/ozvizworkshop/>).

Doug Binks makes games at Enkisoftware Limited, having recently left his position as technical lead of Games Architecture Initiative at Intel. Prior to joining Intel in 2008 he worked in the games industry in roles ranging from lead programmer, head of studio at Strangelite, and R&D development manager at Crytek. Despite an early interest in games development, Doug careered sideways into a doctorate in physics at Oxford University, and undertook two postdoctoral posts as an academic researcher in experimental non-linear pattern formation, specializing in fluid mechanics. His earliest memories are of programming games in assembly on the ZX81.

Stephen Bjore graduated from Washington State University with a bachelor's degree in computer science, and later acquired a BS in real-time interactive simulation from DigiPen

Institute of Technology. After graduating, he spent 2 years working at Wizards of the Coast, initially on various video game prototypes and later on the server side for *Magic the Gathering Online*. In 2008, he moved to Nintendo of America, where he became a part of its Software Development Support Group. After several years with SDSG, he switched over to an internal development group which has been working on 3DS and Wii-U projects.

Conan Bourke is a senior programming lecturer at the Academy of Interactive Entertainment's Sydney campus in Australia. His main role is teaching software engineering for all aspects of interactive media with his passions lying in graphics and AI programming. Prior to teaching he worked for Blue Tongue Entertainment Pty Ltd, an in-house studio for THQ, as a gameplay programmer on multiple systems and numerous cross-platform titles.

Daniel Brewer graduated from the University of Natal–Durban, South Africa, in 2000 with a BScEng in electronic engineering focusing on artificial intelligence, control systems, and data communications. He worked at Cathexis Technologies for 6 years, as a software engineer writing software for digital surveillance systems, responsible for operating system drivers for PCI video capture cards, image capture scheduling, video compression, and image processing algorithms such as motion detection, people counting, and visual camera tamper detection. He moved to Digital Extremes in 2007 where he is the lead AI programmer and has worked on several titles including *Dark Sector* (March 2008), *BioShock 2* multiplayer (February 2010), and *The Darkness II* (February 2012).

Phil Carlisle is an independent game developer at MindFlock Ltd and a senior lecturer in videogame design and development at the University of Bolton in England. Prior to setting up MindFlock, Phil was responsible for game programming duties on numerous titles in the “Worms” franchise for Team17 Ltd. Phil is a great believer in iterative prototype game development and a rabid observer of human behaviors.

Alex Champandard is the founder of AiGameDev.com, the largest online hub for artificial intelligence in games. He has worked in industry as a senior AI programmer for many years, most notably for Rockstar Games where he also worked on the animation technology of *Max Payne 3*. He regularly consults with leading studios in Europe, most notably at Guerrilla Games on the multiplayer bots for *KillZone 2 & 3*. Alex is also the event director for the Game/AI Conference, the largest independent event dedicated to AI in games.

Jarosław Ciupiński knew what he wanted to do with his life when he turned 9 years old. While he was coding since then, he started to work professionally in game development in 2007 as an animation programmer. In 2012 he still sees many things that can be improved in the field of animation in game development.

Carle Côté has been a senior AI programmer at Eidos Montreal since 2009 and currently leads the AI development on the next *Thief* game. In 2012, he received his PhD in electrical engineering applied to AI and robotics from Sherbrooke University in Canada. His focus is mainly on decision-making systems and cognitive AI.

Michael Dawe has been programming AI in the games industry since 2007 and worked at Big Huge Games on NPC behavior for *Kingdoms of Amalur: Reckoning*. He has spoken numerous times at the AI Summit at the Game Developer's Conference, is a founding member of the AI Game Programmer's Guild, and has previously written for the *Game Programming Gems* series. Michael holds an MS in computer science from DigiPen Institute of Technology, as well as bachelor of science degrees in computer science and philosophy from Rensselaer Polytechnic Institute.

Luke Dicken is the founder of Robot Overlord Games, and a researcher with the Strathclyde Artificial Intelligence and Games group at the University of Strathclyde in the United Kingdom. He contributes to AltDevBlogADay and is a principal organizer for the AltDev Conference family. Luke has been passionate about artificial intelligence since playing *Creatures* as a teenager, and pursued it in college, first through several degrees in traditional AI before specializing in AI for games as part of a PhD he is still (occasionally) pursuing. Luke is a member of the AI Game Programmers Guild, on the board of directors for IGDA Scotland, and recently took over as chair of the IGDA's Special Interest Group on AI.

Kevin Dill is a member of the Group Technical Staff at Lockheed Martin Global Training and Logistics, and the chief architect of the Game AI Architecture. He is a veteran of the game industry, with seven published titles under his belt, including *Red Dead Redemption*, *Iron Man*, *Zoo Tycoon 2: Marine Mania*, *Zoo Tycoon 2: Endangered Species*, *Axis & Allies*, *Kohan 2: Kings of War*, and *Master of Orion 3*. Kevin was the technical editor for *Introduction to Game AI* and *Behavioral Mathematics for Game AI*, and a section editor for *AI Game Programming Wisdom 4* and the book you hold in your hands. He is a frequent speaker at conferences such as I/ITSEC and GDC, and has taught classes on game development and game AI at Harvard University, Boston University, Worcester Polytechnic Institute, and Northeastern University.

Philip Dunstan, as a senior AI R&D engineer at AiGameDev.com, prototypes cutting-edge solutions to the artificial intelligence challenges found in today's games. In addition, Philip has 6 years of development experience within Electronic Arts' EA Tech Central Technology Group. As a specialist in physics simulation, core technology, and console performance, he worked on several of EA's biggest franchises including *FIFA*, *Need for Speed*, *Battlefield*, and *Harry Potter*.

Elijah Emerson started his lifelong dream of creating video games in his childhood, creating games on paper for friends and family to play. Since then, every step in his life was toward that singular goal of creating new and creative game experiences for others to enjoy. After obtaining a BS in real-time interactive simulation from DigiPen Institute of Technology, he began work as a game programming teacher for DigiPen. A year later he went to Amaze Entertainment to work on *Harry Potter 2*. After that he moved to Gas Powered Games to work on *Dungeon Siege 2*, *Supreme Commander 1* and *2*, *Age of Empires Online*, and other unannounced titles over the last 12 years. He currently works at Gas Powered Games as the lead engineer on an unannounced project.

Simon Franco started programming on the Commodore Amiga by writing a *Pong* clone in AMOS and has been coding ever since. He joined the games industry in 2000, after completing a degree in computer science. He started at The Creative Assembly in 2004, where he has been to this day. When he's not keeping his daughter entertained, he'll be playing the latest game or writing games in assembly code for the ZX Spectrum.

Steve Gargolinski has been working on games professionally since 2003, spending time at Blue Fang Games, Rockstar New England, and 38 Studios. Steve has a strong technical background, and enjoys thinking, writing, and speaking about game AI, programming, and the development process. He has presented at conferences such as the Game Developers Conference (GDC) and the AI and Interactive Digital Entertainment Conference (AIIDE), and has been interviewed by *The Independent* and *Gamasutra* for his work in gaming AI. While not programming computers Steve enjoys nonfiction, cooking, hockey, and walking in the woods.

Jay Goldblatt is a programmer at Nintendo Technology Development and contributed to the hardware launch of the Wii U. He earned an MS in computer science from the DigiPen Institute of Technology, where he helped TA the artificial intelligence class for over a year. Jay also earned a BS in computer science from Lawrence University.

David “Rez” Graham is an AI programmer at Electronic Arts, working at Maxis on *The Sims* team. His most recent game was *The Sims Medieval* and the *Pirates & Nobles* expansion. Rez is currently the lead AI programmer on an upcoming *Sims* title. He has worked in the games industry as an engineer since 2005 spending most of that time working on various kinds of AI, from platformer enemy AI to full simulation games. He is the coauthor of *Game Coding Complete, 4th Edition*, and regularly speaks at the Game Developers Conference, as well as various colleges and high schools. Rez spends his free time performing improv, running tabletop RPGs, and dyeing his hair shades of blue.

Fabien Gravot made his debut in the game industry in 2011 as AI researcher with SQUARE ENIX. Previously, he had been working on robot AI and autonomous driving. He thought that games were less risky than moving one ton of metal with his program. He received his PhD in computer science from the University Paul Sabatier in France in 2004.

D. Hunter Hale, PhD, completed his doctoral work at the University of North Carolina at Charlotte in 2011. He has been a research assistant in the Game Intelligence Group in the Games + Learning Lab for the last 4 years; prior to that he was a research assistant in the Visualization Lab at UNC–Charlotte while completing his master's degree. He received his bachelor's degree with honors from Western Carolina University in 2005.

Daniel Hilburn has been making video games since 2007. He has worked on several console games including *Kinect Star Wars™*, *Ghostbusters: The Video Game™*, and *DefJam's Rapstar™*. He currently works in Irving, Texas, at Terminal Reality, Inc.

Troy Humphreys has been involved in game mechanics and AI since 2005. Since then, he has worked on the games *The Bourne Conspiracy*, *Transformers: War for Cybertron*,

and *Transformers: Fall of Cybertron*. He currently works as a senior programmer at High Moon Studios, where he helps lead the studio's AI development. Prior to working on games, he taught game development as an Associate Course Director at Full Sail, where he still serves as an adviser.

Matthew Jack founded Moon Collider (www.mooncollider.com) in 2010, where he consults on AI for companies in the US and Europe and builds bespoke AI systems. He specializes in *CryEngine 3* and *Recast/Detour*. He developed AI at Crytek for many years in a senior R&D role, including work on *Crysis* and *Crysis 2*. He has since worked for Microsoft and AiGameDev.com, and consulted for games and serious games companies. Clients include Xaviant LLC and Enodo, with products delivered to companies such as BMW. He has written for *Games Programming Gems* and presented at the GDC, Paris Game AI Conference, Develop and at Google.

Hylke Kleve (hylke.kleve@guerrilla-games.com) is principal AI programmer at Guerrilla Games, where he has worked on *Killzone 2* and *Killzone 3*. He developed planning and pathfinding technology. Hylke Kleve holds an MS in computer science (2003) from the University of Groningen, the Netherlands.

Brett Laming has now been in the industry for more years than anyone should care to remember. He currently finds himself in the enviable role of leading the full range of technical teams at Rockstar Leeds. Critical-thinking skills matured by years of AI, gameplay, and engine programming now drive much wider development, production, and management arenas—skills that see *LA Noire* join a portfolio of titles that span Rockstar Games, Criterion, Argonaut, and Particle Systems. His long-suffering partner Katherine continues to be exasperated by a heavy bias towards game development over that of DIY.

Mike Lewis broke into the game industry as an AI and gameplay programmer in early 2002. He has since shipped three successful titles with Egosoft GmbH in the “X Series,” and designed AI systems instrumental to a fourth, as-yet unreleased title. Today, he calls ArenaNet, Inc., home, where he plots incessantly to unleash bigger, better, and more entertaining AI upon the realm of massively multiplayer online gaming.

Dave Mark is the president and lead designer of Intrinsic Algorithm, LLC, an independent game development studio and AI consulting company in Omaha, Nebraska. He is the author of the book *Behavioral Mathematics for Game AI* and is a contributor to the *AI Game Programming Wisdom* and *Game Programming Gems* book series. Dave is also a founding member of the AI Game Programmers Guild and coadvisor of the annual GDC AI Summit. Dave continues to further his education by attending the University of Life. He has no plans to graduate any time soon.

Eric Martel began his career in the games industry in 2001 when he joined Microids to work on the acclaimed adventure games series *Syberia*. In 2004 he joined Ubisoft Montreal where he had the opportunity to work on *FarCry: Instincts* and *Assassin's Creed*. He then joined GRIP Entertainment (now Autodesk) in 2007 to shape the development of its *Digital Extra System* and finally moved to Eidos Montreal in 2008 to work on *Thief 4*.

He also had the pleasure to be the technical reviewer for Mat Buckland's book *Game AI by Example* and wrote an article for *AI Game Programming Wisdom 3* on the anchor system in *FarCry: Instinct*.

Michael Mateas is the codirector of Expressive Intelligence Studio and director of the Center for Games and Playable Media at the University of California–Santa Cruz. His research in game AI focuses on enabling new forms of gameplay through innovative AI solutions. The Expressive Intelligence Studio has ongoing projects in autonomous characters, interactive storytelling, game design support systems, AI models of creativity, and automated game generation. With Andrew Stern, Michael created *Façade*, which uses AI techniques to combine rich autonomous characters with interactive plot control to create the world's first, fully-produced, real-time, interactive drama. Michael received his PhD in computer science from Carnegie Mellon University.

Josh McCoy recently completed his PhD in Computer Science in the Expressive Intelligence Studio at the University of California–Santa Cruz. Coming to UC–Santa Cruz with a dual background in computer science and sociology, his PhD dissertation was on social simulation. He was the lead developer of the CiF architecture, and a core team member in the creation of *Prom Week*. Josh is currently a postdoc at UC–Santa Cruz in the Center for Games and Playable Media, where he is working on extending CiF to support real-time first-person character performance.

Dr. Nic Melder, prior to attending university, worked for a global bank designing and implementing their payment and query systems. Upon graduating with a BSc in cybernetics and control engineering, instead of doing the sensible thing and getting a “real” job, he entered the games industry as an AI programmer. After working on some predator–prey simulations and a third-person action title, he returned to academia for 5 years to conduct research in multifingered haptics before taking up a position as an AI programmer at Codemasters. Over 6 years later, Nic has worked on the hugely successful *DiRT*, *GRID*, and *F1* titles and is now lead AI programmer within the racing studio. However, even after spending over 6 years making racing games, Nic is still regarded as the worst driver in the studio!

Bill Merrill is the AI lead at Turtle Rock Studios working hard on an unannounced project, having previously worked as AI lead and senior generalist at Double Helix Games, shipping cross-platform game projects including *Dirty Harry*, *Silent Hill: Homecoming*, *Front Mission: Evolved*, and various tools and demos. He currently splits his time between technology and toddlers.

Brook Miles was inspired by games like *SimCity 2000* and the *King's Quest* series, and began teaching himself C++ while in high school. Shortly after graduating he was interviewed and hired on an EFNet IRC channel to work remotely for a Silicon Valley startup during the rise of the dot-com bubble. After the bubble burst, he dabbled in enterprise software before finally getting his break into game development at EA Black Box in 2006 where he worked on *Skate* and *Need For Speed: Undercover*. Brook joined Klei Entertainment in early 2011 to work on *Mark of the Ninja*, because ... you know ... Ninjas.

Youichiro Miyake is the lead AI researcher at SQUARE ENIX, working as leader of the AI unit for the next-generation game engine, Luminous Studio. He is chairman of IGDA JAPAN SIG-AI and a member of the committee of DiGRA JAPAN. He has been developing and researching game AI since 2004. He developed the technical design of AI for the following game titles: *CHROME HOUNDS* (2006, Xbox360), *Demon's Souls* (2009, PlayStation3), and *Armored Core V* (2012, Xbox360, PlayStation3) developed by FROM SOFTWARE. He has published several papers and books about game AI technologies as well as given many lectures at universities and conferences. He was a keynote speaker of GAMEON ASIA 2012.

Robert Morcus is a senior AI developer at Guerrilla Games. There, he has helped build the tools and technology for most titles released by Guerrilla Games: *ShellShock:Nam'67*, *Killzone*, *Killzone 2*, and *Killzone 3*. His field of interest before starting game development was in electronics and audio synthesis / signal processing.

Graham Pentheny leads AI development at Subatomic Studios in Cambridge, Massachusetts, where he recently worked on the iOS games *Fieldrunners* and *Fieldrunners 2*. He received a BS in computer science and a BS in interactive media and game development from Worcester Polytechnic Institute. In his spare time he reads an unhealthy number of books on AI and programming language theory and is an avid musician.

Steve Rabin is a principal software engineer at Nintendo of America, where he researches new techniques for Nintendo's current and future platforms, architects development tools such as the Wii U CPU Profiler, and supports Nintendo developers. Before Nintendo, Steve worked primarily as an AI engineer at several Seattle start-ups including Gas Powered Games, WizBang Software Productions, and Surreal Software. He organized and edited the *AI Game Programming Wisdom* series of books, the book *Introduction to Game Development*, and has over two dozen articles published in the *Game Programming Gems* series. He's been an invited keynote speaker at several academic AI conferences, presented at the Game Developers Conference, and spoken at numerous Nintendo development conferences in North America and Europe. He organizes the 2-day AI Summit at GDC and has moderated the AI roundtables. Steve founded and manages the professional group known as the AI Game Programmers Guild, with over 350 members worldwide. He has also taught game AI at the DigiPen Institute of Technology for the last 8 years and has earned a BS in computer engineering and a MS in computer science, both from the University of Washington.

Mike Ramsey is the principle programmer on the *Noumena AI Engine*. Mike has developed core technologies for the Xbox 360, PC, and Wii at various companies, including a handful of shipped games: *World of Zoo* (PC and Wii), *Men of Valor* (Xbox and PC), *Master of the Empire*, *Second Life*, and several *Zoo Tycoon 2* products. Mike has contributed multiple articles to the *Game Programming Gems*, *AI Game Programming Wisdom*, and the *Game Engine Gems* series, as well as presented at the AIIDE conference at Stanford on uniform spatial representations for dynamic environments. Mike has a BS in computer science from MSCD and his forthcoming book is titled *A Practical Cognitive Engine for AI*.

When Mike isn't working he enjoys long walks in the Massachusetts countryside with his wife, daughter, and their dog, Rose!

Michael Robbins is a gameplay engineer with Gas Powered Games working on everything from UI to AI. He has been working in the industry since 2009, after being a long time member of the Gas Powered Games modeling community. His most notable work is featured in the AI of *Supreme Commander 2*, released in March 2010.

Fernando Silva is a software engineer at Nintendo of America, providing engineering support to licensed game developers and internal groups, specializing on the Nintendo Wii U platform. He completed an undergraduate degree in computer science in real-time interactive simulation at DigiPen Institute of Technology, where he minored in mathematics. He also develops tools for current and next-gen Nintendo platforms. In his free time, Fernando enjoys working on electronic projects with a focus on the Arduino platform, reverse engineering processes or devices, studying biological processes that can be applied to computer science, and most importantly, dining.

Remco Straatman for 10 years led the AI coding team at Guerrilla, and developed AI for *ShellShock:Nam67*, *Killzone*, *Killzone:Liberation*, *Killzone 2*, and *Killzone 3*. Currently, Remco is feature architect and leads a game code team at Guerrilla. Before joining Guerrilla, Remco worked as a researcher in the field of expert systems and machine learning, and as developer of multimedia software. He holds an MS in computer science (1991) from the University of Amsterdam.

William van der Sterren is an AI consultant for games and simulations at CGF-AI. He worked on the AI of Guerrilla Games' *Killzone* and *Shellshock Nam'67* games. William has spoken at the Game Developer Conference and AIGameDev conference, and has contributed chapters to both the *Game Programming Gems* and *AI Game Programming Wisdom* series. His interest is in creating tactical behaviors, from tactical path-finding and terrain analysis to squad behaviors and company level maneuver planning. William holds an MSc in computer science from University of Twente and a PDEng Software Technology from Eindhoven University of Technology.

Nathan Sturtevant is a professor of computer science at the University of Denver, working on AI and games. He began his games career working on shareware games as a college student, writing the popular Mac tank game *Dome Wars* in the mid-90s, and returned to the games industry to write the pathfinding engine for *Dragon Age: Origins*. Nathan continues to develop games in his free time, and is currently porting *Dome Wars* to iOS.

Ben Sunshine-Hill received a PhD in computer science from the University of Pennsylvania for his work in video game-focused computational techniques. Since then, he has been a software developer at Havok.

Simon Tomlinson, PhD, studied physics at Manchester University in the United Kingdom and went on to gain a PhD in electrical engineering and to work as a research

fellow in electronic applications and computational physics. In 1997 he joined the games industry as an AI programmer. He has worked on a variety of platforms and projects including billiard games, flight and space combat, racing games, FPS combat, and card games, including poker. He has also worked as project lead on mobile Java platforms and had occasional forays into production and R&D. He has retained his academic interests with several game-related publications and presentations in the UK and has assisted local academia in starting and running game programming courses. In 2008 he formed his own consultancy company, SIm On Ltd., and has most recently contributed to the highly acclaimed *Need for Speed Shift* series under a contract for Slightly Mad Studios.

Joseph Vasquez II provides engineering support to third party developers and internal groups at Nintendo, specializing in the Nintendo 3DS platform. He completed an undergraduate degree in real-time interactive simulation at DigiPen Institute of Technology, where he minored in computer engineering and codeveloped the Augger: a handheld game system with augmented reality features. He also wrote the AI for all of his game projects. He is currently finishing a master's of computer science at DigiPen. When he is not doing homework or hiking with his wife and dog in the beautiful Northwest, he enjoys going to work.

Tim Johan Verweij is a senior AI programmer at Guerrilla, Amsterdam, The Netherlands. The past six years he has worked on AI technology and AI behaviors for *Killzone 2* and *Killzone 3*, both first-person shooters for the Playstation 3. He studied AI at VU University, Amsterdam. For his master's thesis he did a research project on multiplayer bot AI at Guerrilla.

Rich Welsh, after graduating from Durham University and moving abroad to teach games development in a Californian summer camp, returned back to his hometown of Newcastle to work on PC games at Virtual Playground. While the team there taught him a lot about both programming and the games industry, he eventually left in order to pursue the chance of working on AAA titles. Rich has been programming professionally for the games industry for over 5 years with a focus on AI, and has worked on the following titles to date: *Crackdown 2*, *Crysis* for Console, *Crysis 2*, *Crysis 3*, and *Homefront 2*.

Will Wilson recently founded Indefiant Ltd. in order to focus on developing software and consulting for improving the iteration times and reducing costs in game development and testing. His 10 years in the games industry includes being lead programmer at Firefly Studios and senior programmer at Crytek, where he worked on *Crysis 2* and the *Crysis* console conversion. At Crytek he developed the SoftCoding implementation for the CryENGINE 3 for use in *Ryse* and *Crysis 3*.

Takanori Yokoyama has worked as a game programmer in the game industry since 2004. He has been especially interested in game AI and implemented it for many game titles: *ENCHANT ARMS* (2006, Xbox360), *CHROME HOUNDS* (2006, Xbox360), and *Demon's Souls* (2009, PlayStation3) developed by FROM SOFTWARE. Now he is working as an AI engineer at SQUARE ENIX.

G. Michael Youngblood, PhD, is an associate professor of computer science at the University of North Carolina at Charlotte. He is codirector of the Games + Learning Lab and head of the Game Intelligence Group, which conducts research on and builds systems involving interactive artificial intelligence in the games and simulation domains, focusing on character behaviors, creation, and analysis. He has published over 60 scholarly papers on topics of interactive artificial intelligence and support technologies. More information about him can be seen on his website at gmichaelyoungblood.com.

Mieszko Zielinski, People Can Fly Senior AI programmer, has been developing games for nearly a decade. He found his game industry calling in 2003, when he joined a little known studio, Aidem Media, to get his foot in the door. Since then, Zielinski has worked at CD Projekt Red, Crytek, and People Can Fly, where he developed the AI system for *Bulletstorm* almost from scratch, with a team of great programmers. He is currently developing AI system elements for Epic Games' *Unreal Engine 4*. Also, he's a retired Polish national kickboxing champion, so don't mess with him!