Editors

Alex Champandard is the founder of AiGameDev.com, the largest online hub for artificial intelligence in games. He has worked in the industry as a senior AI programmer for many years, most notably for Rockstar Games where he 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* and *3*. Alex is also the event director for the Game/AI Conference, the largest independent event dedicated to AI in games.

Kevin Dill is a member of the group technical staff at Lockheed Martin Mission Systems and Training, the chief architect for Lockheed's Game AI Architecture, and the lead developer for the True Game-Based Learning project. Prior to coming to Lockheed, he worked as an AI engineer on seven published titles, ranging the gamut from strategy games (*Master of Orion 3*, *Kohan II: Kings of War*, and *Axis & Allies*) to simulation games (*Zoo Tycoon 2: Endangered Species* and *Zoo Tycoon 2: Marine Mania*) to action games (*Iron Man*) to open world shooter/adventure games (*Red Dead Redemption*).

Kevin is a prolific author and speaker and has spoken at the Game Developers Conference on several occasions. He has served as technical or section editor for five books, including the volume you hold in your hands, and has taught game programming and game AI at Boston University, Northeastern University, and Harvard University. He is also a veteran, having served for 4 years as an infantryman in the U.S. Army.

Damián Isla has been working on and writing about game technology for over a decade. He is president and cofounder of indie outfit Moonshot Games, purveyors of fun and innovative downloadable and mobile gaming fare. He is the creative director and project lead on *Third Eye Crime*, the innovative stealth/puzzle/telepathy game for PC and iOS. 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*. He also contributed to the AI on *Bioshock: Infinite*.

A leading expert in the field of artificial intelligence 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 (AIIDE) Conference, and at SIGGRAPH and is a frequent speaker at the Game Developer's Conference (GDC). Before joining the industry, Damián earned a master's degree with the Synthetic Characters group at the Massachusetts Institute of Technology (MIT) Media Lab. He holds a BSc in computer science, also from MIT.

Neil Kirby 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*. He cowrote "Effective Requirements Traceability: Models, Tools and Practices" for the *Bell Labs Technical Journal*. 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 Game Developers Conference (GDC) from 1991 to the present as well as the 2003 Australian GDC.

Neil Kirby is a member of the technical staff at Bell Laboratories, the R&D arm of Alcatel-Lucent. He currently develops .NET solutions used to support requirements traceability. He also provides software architecture consulting services. His previous assignments have included building speech recognition software and teaching at the university level. He has been a judge of the Ohio State University's Fundamentals of Engineering Honors robot competition for many years on behalf of Alcatel-Lucent.

Neil Kirby cofounded the IGDA Foundation and serves on its board. He oversees the Eric Dybsand AI Memorial Scholarship to GDC that is awarded each year.

Neil holds a master's degree in computer science from Ohio State University. He lives with his spouse in central Ohio. There he chairs his local village planning commission and volunteers for the historical society.

Steve Rabin has been a key figure in the game AI community for over a decade and is currently a principal software engineer at Nintendo of America. After initially working as an AI engineer at several Seattle start-ups, he managed and edited seven game AI books in the *Game AI Pro* series and the *AI Game Programming Wisdom* series. He also edited the book *Introduction to Game Development* and has over two dozen articles published in the *Game Programming Gems* series. He has been an invited keynote speaker at several AI conferences, founded the AI Game Programmers Guild in 2008, and founded the Game Developers Conference (GDC) AI Summit, where he has been a summit adviser since 2009. Steve is a principal lecturer at the DigiPen Institute of Technology, where he has taught game AI since 2006. He earned a BSc in computer engineering and an MS in computer science, both from the University of Washington.

Nathan R. Sturtevant is a professor of computer science at the University of Denver, working on artificial intelligence 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-1990s, and returned to the game industry to write the pathfinding engine for *Dragon Age: Origins*. He has spoken at the Game Developers Conference (GDC) AI Summit twice, and his students have presented their games at the E3 college pavilion. Nathan is currently working on tools to help design more compelling puzzles for games.

Contributors

Tarn Adams is the creator of the cult classic *Dwarf Fortress* and cofounder of Bay 12 Games, along with his brother Zach. Tarn earned his PhD in mathematics from Stanford and BSc in mathematics from the University of Washington, Seattle, Washington.

Bobby Anguelov is a South African expat currently working as a senior programmer at Ubisoft, Montreal, Canada, primarily in the field of animation. Prior to joining Ubisoft, he worked as an AI/animation programmer at IO-Interactive. Outside of the game industry, he has worked in a variety of roles ranging from computer graphics lecturer to enterprise software consultant. Bobby holds an MS in computer science from the University of Pretoria, South Africa, with a focus on computational intelligence and computer graphics.

Mark Botta has been programming in the video game industry for 20 years. He started on the Sega Genesis and has created games for the PC and almost every generation of the Sony PlayStation and Microsoft Xbox. He has worked on side-scrollers, shooters, MMORPGs, and action, stealth, and horror games, including *Tomb Raider*, *Uncharted 3*, and *The Last of Us*. He has a wide range of game programming experience but specializes in AI. He earned his BSc in computer science from the University of California, San Diego. When not programming, he's exploring Los Angeles looking for the perfect iced tea.

Vadim Bulitko is a professor of computing science at the University of Alberta, Edmonton, Alberta, Canada. He has been working in the area of artificial intelligence for 19 years and in the area of video-game-related AI for 11 years. Vadim has published a number of journal papers on video-game-related AI as well as three book articles/chapters, including one in *AI Game Programming Wisdom 4*. Vadim has collaborated with BioWare for over 8 years and presented at CCP (Crowd Control Productions), Disney Imagineering, Lockheed Martin, and Google. Vadim chaired the Artificial Intelligence for Interactive Digital Entertainment (AIIDE) Conference in 2010 and 2011. He has been the head instructor for the University of Alberta's first undergraduate course on video games for the last 10 terms and taught video game AI at the graduate level over the last 13 years.

Phil Carlisle is a senior lecturer at the University of Bolton, Bolton, United Kingdom. He is also the owner of an indie studio called MindFlock Ltd., which he founded after over a decade in the game industry working on game characters and artificial intelligence. Phil has worked on numerous published games, primarily from the multimillion-selling *Worms* franchise.

Jérémy Chanut has a master's degree in computer science. Passionate about development and AI, he has been working as a software engineer at MASA Group since 2013, in the MASA LIFE team. As an intern, he worked on Recast/Detour and group navigation under the supervision of Clodéric Mars. He now focuses on software architecture in MASA LIFE while maintaining and updating his work on Recast/Detour.

Zhengxing Chen is currently a PhD student at Northeastern University College of Computation and Information Science, Boston, Massachusetts. His research focus is on game analytics and machine learning. He previously worked on interesting projects on embedded systems and mobile systems. As an undergraduate, he was part of the team that won 2nd prize for developing the *Virtual Costume Trial System*. Having experience in software development on mobile systems, he also published two mobile applications aiming to promote healthy habits.

Caroline Chopinaud received her PhD in computer science at the Pierre and Marie Curie University, Paris, France, in 2007, specializing in artificial intelligence. She joined MASA Group in 2008 as a developer of MASA LIFE, working on agent communications and the modeling of security and military behaviors. Caroline has since become head of R&D at MASA, in charge of innovation and the R&D team. She is mainly involved in research activities, in particular scientific monitoring and project building. She handles relations between MASA and academia. She published scientific papers in international conferences in the field of multiagent systems (ECAI, IAT, PAAMS, etc.).

Michael Dawe has been solving AI and gameplay problems in games since 2007, working on games such as *Kingdoms of Amalur: Reckoning*, *Dance Central Spotlight*, and *Grand Theft Auto 5*. He is a frequent speaker for the AI Summit at the Game Developers Conference, is a founding member of the AI Game Programmers Guild, and has written previously for the Game Programming Gems and Game AI Pro series. Michael holds an MS in computer science from DigiPen Institute of Technology, Redmond, Washington, as well as a BSc in computer science and philosophy from Rensselaer Polytechnic Institute, Troy, New York.

Etienne de Sevin earned his PhD in artificial intelligence at École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, in 2006. During his research in several renowned labs, he designed, implemented, and evaluated cognitive architectures and real-time decision-making processes for autonomous nonplayer characters in order to populate virtual environments such as virtual cities or video games. He published several scientific papers in international conferences (AAMAS, CGI, CASA, etc.). He joined MASA Group as a research engineer in the R&D team in 2012.

Max Dyckhoff is an AI software engineer with 10 years of industry experience at Naughty Dog, Blizzard, Bungie, and Free Radical Design. His experience includes work on the AI of blockbuster titles such as *The Last of Us*, *Halo 3*, and *Halo Reach*. He has spoken on buddy AI, behavior trees, and knowledge representation at the Game Developers Conference and the Neural Information Processing Systems Conference. He holds a master of engineering in computer systems and software engineering from the University of York in the United Kingdom. He was born in Scotland, moved to the United States in 2006, and now lives in Santa Monica with his daughter. Currently, he is at Naughty Dog working on AI and other fun things for upcoming titles.

Leif Foged is currently a software engineer at Facebook, where he works on the Facebook Games Platform.

Andrew Fray is a ten-year veteran of the video game industry. He has worked on AI in many genres, including FPS and racing games. Andrew was the lead AI programmer on Codemasters' *F1 2010* and *F1 2011*. He has spoken at the Game Developers Conference (GDC) multiple times, as well as at other conferences. Andrew currently works for Spry Fox, making original digital games. You should follow him on twitter at @tenpn and read his blog at http://andrewfray.wordpress.com.

Stephen J. Guy is an assistant professor in the Department of Computer Science and Engineering at the University of Minnesota, Minneapolis, Minnesota. His research focuses on the areas of interactive computer graphics (real-time crowd simulation, path planning, intelligent virtual characters) and multirobot coordination (collision avoidance, sensor fusion, path planning under uncertainty). Stephen's work on motion planning has been licensed for use in games and virtual environments by Relic Entertainment, EA, and other companies; his work in crowd simulation has been recognized by best paper awards at international conferences. Prior to joining the University of Minnesota, he received his PhD in computer science in 2012 from the University of North Carolina at Chapel Hill with support from fellowships from Google, Intel, and the UNCF, and his BSc in computer engineering with honors from the University of Virginia in 2006.

Ian Horswill is associate professor of computer science at Northwestern University, Evanston, Illinois. His research interests include game AI, emotion, and cognitive architecture.

Éric Jacopin is a professor at the French military academy of Saint-Cyr where he headed the computer science research laboratory from 1998 to 2012; this includes teaching Turing machines, war games, and project management and the management of international internships for computer science cadets. His research has been in the area of planning for the past 25 years, not only from the viewpoint of artificial intelligence but also from everyday life perspectives. He received his PhD (1993) and his habilitation to direct research (1999) from the Pierre and Marie Curie University, Paris, France.

Ioannis Karamouzas is a research associate in the department of computer science and engineering at the University of Minnesota, Minneapolis, Minnesota. His research focuses

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Kevin A. Kirst has specialized in artificial intelligence in the gaming and simulation industries since 2008. His previous work with companies including Crytek and Ubisoft has blessed him with the opportunity to be credited on two released titles (*Crysis 2* and *Tom Clancy's Splinter Cell: Blacklist*) as well as two unreleased titles. He is a graduate of Full Sail University in Orlando, Florida, The City Beautiful, where he once again resides. His current employment with RealTime Immersive, Inc., a subsidiary of Crytek, allows him the freedom and resources to continue growing, researching, and solving problems concerning AI development in the entertainment gaming, serious gaming, and simulation market spaces. Programming is his love; AI is his passion.

Sven Koenig is a professor in computer science at the University of Southern California, Los Angeles, California. He received his PhD in computer science from Carnegie Mellon University and is a fellow of the Association for the Advancement of Artificial Intelligence. Most of his research centers on techniques for decision making (planning and learning) that enable single agents (such as robots or decision-support systems) and teams of agents to act intelligently in their environments and exhibit goal-directed behavior in real time, even if they have only incomplete knowledge of their environment, imperfect abilities to manipulate it, limited or noisy perception, or insufficient reasoning speed.

Greg Lee is a PhD graduate of computing science at the University of Alberta, Edmonton, Alberta, Canada, and is currently working as the lead data scientist at FundMetric, Halifax, Nova Scotia, Canada. His PhD dissertation focused on the Sports Commentary Recommendation System (SCoReS), which automatically selects stories for a game by comparing features of the current game state to features of stories. Greg has published conference and journal papers on this subject, and SCoReS has been featured in popular science magazines and radio shows.

Mike Lewis has been working as a programmer in the game industry since early 2002, often with a focus on AI and related systems. He has lectured at the Game Developers Conference AI Summit and published a chapter in the first Game AI Pro book. Today, he calls ArenaNet home, where he plans to unleash bigger, better, and more entertaining AI on the world of massively multiplayer online gaming.

John Manslow started writing games on his Vic-20 as a teenager and gradually became more and more interested in smart AI. Having completed a degree and then a PhD in the subject, he joined Codemasters as the AI specialist in their R&D team, where he worked

on several projects to bring next-generation AI to Codemasters' games. Since then, John has worked for several companies outside the industry but has remained focused on AI and statistical analytics.

Dave Mark is the president and lead designer of Intrinsic Algorithm, an independent game development studio in Omaha, Nebraska. He does consulting on AI, game design, and mathematical modeling for clients ranging from small indie game studios to AAA companies including EA, Sony Online Entertainment, and ArenaNet. Dave 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 from Charles River Media and the first Game AI Pro book from CRC Press. He has also spoken at numerous game conferences and universities around the world on the subjects of AI, game theory, and psychology. He is a founding member of the AI Game Programmers Guild and has been a coadvisor of the Game Developers Conference AI Summits. Dave continues to further his education by attending the University of Life. He has no plans to graduate anytime soon.

Clodéric Mars has tried to make simulated characters behave "autonomously *and* as they are told to" for more than 6 years. At Golaem, he worked on a navigation engine used, for example, in a train passengers' simulation and a crowd simulation tool for animation and vfx. Now leading the developments of MASA LIFE, he is dedicated to make behavior authoring easy, fun, and accessible to game designers and field experts. Clodéric has a master's degree in computer science, with a specialization in AI. He spoke at the Paris Game/AI Conference 2011 and at the Game Developers Conference (GDC) 2014 AI Summit.

Travis McIntosh has worked at Naughty Dog, Santa Monica, California, for 9 years. He was lead programmer on *Uncharted 1*, *2*, and *3*, as well as *The Last of Us*. He has personally worked on gameplay systems as diverse as player control, cameras, AI, and animation. He is a devout Christian and lives with his wonderful wife, Vivien, and their son, Corin, in El Segundo, California.

Jan Müller studied computational visualistics at the University of Koblenz-Landau, Germany. During his master's thesis, he worked for the Fraunhofer Institute for Applied Information Technology near Bonn, Germany. The focus of his research was augmented and virtual reality as well as early prototypes of VR smart phone games. Among others, he published a research poster about image space constructive solid geometry at the Visualization 2005 conference. After graduating in 2005, he joined Crytek to work as a game and network programmer on *Crysis 1* and *Crysis 2*. In 2009, he joined the Fachhochschule Darmstadt as a guest lecturer teaching game development with CRYENGINE 2. In September 2010, he moved to Los Angeles, California, to work for Insomniac Games. There he was involved with the *Ratchet & Clank* franchise, *Fuse*, and *Sunset Overdrive* as a senior game programmer.

Alex Nash received his BSc in computer science from Yale University, New Haven, Connecticut, in 2004, his MS in computer science from the University of Southern California in 2006, and his PhD in computer science from the University of Southern California, Los Angeles, California, in 2012 for his dissertation on "Any-angle path planning." Since 2005, he

has been performing mission-planning research and development for the information systems sector of the Northrop Grumman Systems Corporation. His research has been used on ground-based and embedded mission-planning systems for both manned and unmanned aerial vehicles.

Miguel A. Nieves has been programming games professionally for 10 years and is currently senior developer at Shenandoah Studio. Shenandoah Studio creates high-quality turn-based strategy war games from "Euro" board games. Working within the constraints of mobile and portable platforms, he has engineered creative and personality-driven characters in over half a dozen titles. In his latest release, *Desert Fox* (iOS), he uses the triune brain model of human brain evolution to develop six different AI generals. Check out earlier implementations of this architecture in *Drive on Moscow* and *Battle of the Bulge* available on Apple's App Store.

Truong-Huy D. Nguyen is currently working as a postdoctoral research associate at Northeastern University, Boston, Massachusetts. His research interests include, but are not limited to, artificial intelligence, data mining, and machine learning. His dream research outcomes are smart technologies that address all tedious and physically involved work, eventually allowing us to live lazily ever after. He enjoys playing both fast-paced sports games (*FIFA*, *Pro Evolution Soccer*) and take-your-time turn-based strategy games (*Fire Emblem* and the *Civilization* series) in his spare time. *Prison Break*, a puzzle game he created, won the Most Entertaining Game Award in a 24-hour game jam competition.

Sergio Ocio Barriales has been working in the game industry since 2005. He received his PhD from the University of Oviedo, Spain, in December 2010 with his thesis about hinted-execution behavior trees. He was an AI tech lead/AI programmer for 6 years at Ubisoft, working on the AI of *Driver: San Francisco* and *Tom Clancy's Splinter Cell: Blacklist*. He joined the AI team at id Software in May 2014.

Jeff Orkin is co-founder of Giant Otter Technologies. Previously, Jeff was the AI lead on *F.E.A.R.* and *No One Lives Forever 2* at Monolith Productions. He earned a PhD from MIT, where he researched artificial intelligence, natural language processing, and crowdsourcing in the MIT Media Lab's Cognitive Machines Group.

Graham Pentheny is a senior software engineer at Giant Otter Technologies, where he works with Dr. Jeff Orkin to develop innovative and engaging social simulations. Previously, he led AI and engine development at Subatomic Studios and is credited on the *Fieldrunners* tower defense games. He received his BSc in both computer science and interactive media and game development from Worcester Polytechnic Institute, Worcester, Massachusetts. In addition to game AI, he enjoys programming language design, ultimate frisbee, and music composition (grahampentheny.com).

Sergio Poo Hernandez is an MSc student in computing science at the University of Alberta, Edmonton, Alberta, Canada, focusing on interactive narratives and advised by Dr. Vadim Bulitko. His work and publication focus on how to use automated planning to

generate content stubs that can be used along player modeling to ensure the player's emotional trajectory is as close as possible as the author intended.

Alejandro Ramirez is a PhD student in computing science at the University of Alberta, Edmonton, Alberta, Canada. He received his MSc in computing science from the University of Alberta 2013, with a dissertation and publications focusing on artificial intelligence and video games, particularly on how to use automated planning to generate content stubs that could be later used along player modeling to increase the player's sense of agency and fun. Alejandro has also performed initial user studies and evaluations of these techniques with positive results.

Jeff Rollason currently heads up and is cofounder of AI Factory Ltd., Middlesex, United Kingdom, with some estimated 200 million users (including over 75 million Android downloads). AI Factory was founded in 2003 with the premise of creating modular AI and games that would be licensed to third parties. The business has been very successful with clients such as Microsoft, among other licensees, incorporating AI Factory game engines within software on consoles, PCs, in-flight entertainment, and mobile devices. His primary contribution is game AI. His education includes combined sciences BSc (1st) at Westfield College, University of London (UOL), and computer science MSc at University College London, UOL. His 17 years in academia included teaching core computer architecture courses at Kings College, UOL. His programs have also competed in computer tournaments for Chess, Go, and particularly Shogi (Japanese Chess), where his program *Shotest* twice ranked third in the world.

Andrea Schiel has more than 18 years of experience developing AAA games and has worked on most of the major EA Sports™ titles. A recognized specialist in AI, she leads the AI special interest group at EA™ and mentors other engineers in this field. Andrea has shipped over 25 titles on all major platforms and is currently working for BioWare Montreal™ on the *Mass Effect*™ franchise.

Magy Seif El-Nasr is an associate professor in the Colleges of Computer and Information Sciences and Arts, Media and Design at Northeastern University, Boston, Massachusetts. She is also the director of the Game Educational Programs and Research at Northeastern University and the director of the game design program in the College of Arts, Media and Design. She also directs the Game User Experience and Design Research Lab. Dr. Seif El-Nasr earned her PhD in computer science from Northwestern University, Evanston, Illinois. Magy's research focuses on interactive narrative, enhancing game designs by developing tools and methods for evaluating and adapting game experiences. Her work is internationally known and cited in several game industry books, including Programming Believable Characters for Computer Games (Game Development Series) and Real-time Cinematography for Games. In addition, she has received several best paper awards for her work. Magy worked collaboratively with teams at Electronic Arts, Bardel Entertainment, and Pixel Ante. She is also listed as an advisor for the Game for Health, Spa Play, in development by IgnitePlay.

Jeet Shroff comes from a background in AI, animation, and gameplay programming and direction, where he has worked as a programmer and realization director on game titles

across multiple genres and studios for the last 10 years. His industry experience includes working at Avalanche Studios, Ubisoft (Montreal), and Electronic Arts, where he has worked on successfully shipped titles for major franchises such as *FIFA* and *Far Cry 3*. Currently, he is a lead character programmer at Avalanche Studios, where he is responsible for the development of AI, animation, and player mechanics for an unannounced open-world AAA title. Jeet holds a bachelor of mathematics in computer science from the University of Waterloo, Ontario, Canada, and has spoken on open-world AI behavior and design at the Game Developers Conference.

Fernando Silva is a software engineer at Microsoft ATG, providing engineering support to licensed game developers and internal groups, specializing in the Xbox One platform. He completed an undergraduate degree in computer science in real-time interactive simulation at DigiPen Institute of Technology, Redmond, Washington, where he minored in mathematics. Before Microsoft, he worked as a software engineer at Nintendo of America. 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.

Gillian Smith is an assistant professor at Northeastern University, Boston, Massachusetts, jointly appointed between the College of Computer and Information Science and the College of Arts, Media, and Design, and is a member of the Playable Innovative Technologies research group. She earned her PhD in computer science from University of California, Santa Cruz's Center for Games and Playable Media in 2012. Her research focuses on procedural content generation (PCG) and how humans—be they players or designers—can interact with it. She is particularly interested in the use of PCG to create new design experiences in the form of intelligent tools for designers and innovative game designs and has authored several articles on the subject. She is an associate editor for the *IEEE's Transactions on Computational Intelligence* and *AI in Games* and sits on the IEEE Computational Intelligence in Games Technical Committee. Her website is at http://www.sokath.com.

David Thue is a professor in the School of Computer Science at Reykjavik University, Reykjavik, Iceland. He has been working on the area of artificial intelligence for video games for 9 years, having published several related conference papers and two book chapters, one in *AI Game Programming Wisdom 4*. David has worked on AI-driven interactive experience management in the industry at Walt Disney Imagineering Research and Development and has presented at both BioWare and Lockheed Martin. He cochaired the International Conference on Interactive Digital Storytelling in 2011 and 2014 and has presented his work at the Artificial Intelligence for Interactive Digital Entertainment (AIIDE) Conference on five separate occasions (2006–2011). David teaches Reykjavik University's undergraduate course on video game design and development and also advises students on topics in game AI.

Tansel Uras is a PhD student in computer science at the University of Southern California, Los Angeles, California, working with Sven Koenig. Tansel received his BSc in computer science (with a minor in mathematics) in 2009 and his MSc in computer science in 2011 from Sabanci University, Istanbul, Turkey. Tansel is interested in incremental heuristic

search, path planning, and game theory, among other topics. He developed a novel optimal path-planning approach (based on subgoal graphs) that was nondominated in the Grid-Based Path Planning Competitions in 2012 and 2013 and won a Best Research Assistant Award from the Computer Science Department at USC in 2014 for this achievement.

Martin Walsh has been in the industry for 10 years. In that time, he worked on *Rainbow Six: Lockdown* and then on *Splinter Cell: Conviction* as AI technical lead. On *Splinter Cell: Conviction*, he created a dynamic navmesh system that became a middleware at Ubisoft (used in titles such as *Assassin's Creed* and *ZombiU*) and was the subject of a Game Developers Conference (GDC) presentation in 2010. After leading the middleware team, Martin rejoined production to work as AI lead on *Splinter Cell: Blacklist*.

Rich Welsh graduated from Durham University, Durham, United Kingdom, in 2007 and went immediately into the game industry. From humble beginnings at a studio in his hometown of Newcastle, he has gone from strength to strength working on both gameplay and AI for the *Crackdown* and the *Crysis* series of games, as well as being part of the AI system development team for *CRYENGINE*. Presently, he is a senior gameplay programmer working at Ubisoft Massive on *Tom Clancy's The Division*.

Robert Zubek is a game developer and cofounder of SomaSim in San Francisco. Previously, he was a principal software engineer at Zynga, where he was on the founding teams of *CityVille* and *FarmVille 2*, the company's two large-scale social games. Prior to Zynga, he developed online game infrastructure at Three Rings Design and console games at Electronic Arts/Maxis. Before joining the industry, he specialized in artificial intelligence and robotics research. Robert holds a PhD in computer science from Northwestern University, Evanston, Illinois, where he also received his previous CS degrees.