

THOMSON  
DELMAR LEARNING



# AI GAME PROGRAMMING WISDOM 3



*Edited by Steve Rabin*

# Contents

<b>Preface</b> .....	ix
<b>Acknowledgments</b> .....	xiii
<b>About the Cover Image</b> .....	xv
<b>Contributor Bios</b> .....	xvii
<b>SECTION 1 GENERAL WISDOM</b> .....	<b>1</b>
<b>1.1 Custom Tool Design for Game AI</b> .....	<b>3</b>
<i>P.J. Snavely</i>	
<b>1.2 Using STL and Patterns for Game AI</b> .....	<b>13</b>
<i>James Freeman-Hargis</i>	
<b>1.3 Declarative AI Design for Games—Considerations for MMOGs</b> .....	<b>29</b>
<i>Nathan Combs</i>	
<b>1.4 Designing for Emergence</b> .....	<b>45</b>
<i>Benjamin Wootton</i>	
<b>1.5 Fun Game AI Design for Beginners</b> .....	<b>55</b>
<i>Matt Gilgenbach</i>	
<b>1.6 Strategies for Multiprocessor AI</b> .....	<b>65</b>
<i>Sergio Garces</i>	
<b>1.7 Academic AI Research and Relations with the Game Industry</b> .....	<b>77</b>
<i>Christian Baekkelund</i>	
<b>1.8 Writing AI as Sport</b> .....	<b>89</b>
<i>Peter Cowling</i>	
<b>SECTION 2 PATHFINDING</b> .....	<b>97</b>
<b>2.1 Cooperative Pathfinding</b> .....	<b>99</b>
<i>David Silver</i>	
<b>2.2 Improving on Near-Optimality: More Techniques for Building Navigation Meshes</b> .....	<b>113</b>
<i>Fredrik Farnstrom</i>	
<b>2.3 Smoothing a Navigation Mesh Path</b> .....	<b>129</b>
<i>Geraint Johnson</i>	

<b>2.4</b>	<b>Preprocessed Pathfinding Using the GPU</b> .....	<b>141</b>
	<i>Renaldas Zioma</i>	
<b>SECTION 3 MOVEMENT</b> .....		<b>157</b>
<b>3.1</b>	<b>Flow Fields for Movement and Obstacle Avoidance</b> .....	<b>159</b>
	<i>Bob Alexander</i>	
<b>3.2</b>	<b>Autonomous Camera Control with Constraint Satisfaction Methods</b> .....	<b>173</b>
	<i>Owen Bourne and Abdul Sattar</i>	
<b>3.3</b>	<b>Insect AI 2: Implementation Strategies</b> .....	<b>189</b>
	<i>Nick Porcino</i>	
<b>3.4</b>	<b>Intelligent Steering Using Adaptive PID Controllers</b> .....	<b>205</b>
	<i>Euan Forrester</i>	
<b>3.5</b>	<b>Fast, Neat, and Under Control: Arbitrating Between Steering Behaviors</b> .....	<b>221</b>
	<i>Heni Ben Amor, Jan Murray, and Oliver Obst</i>	
<b>3.6</b>	<b>Real-Time Crowd Simulation Using AI.implant</b> .....	<b>233</b>
	<i>Paul Kruszewski</i>	
<b>SECTION 4 ARCHITECTURE</b> .....		<b>249</b>
<b>4.1</b>	<b>Flexible Object-Composition Architecture</b> .....	<b>251</b>
	<i>Sergio Garces</i>	
<b>4.2</b>	<b>A Goal-Based, Multitasking Agent Architecture</b> .....	<b>265</b>
	<i>Elizabeth Gordon</i>	
<b>4.3</b>	<b>Orwellian State Machines</b> .....	<b>275</b>
	<i>Igor Borovikov</i>	
<b>4.4</b>	<b>A Flexible AI System through Behavior Compositing</b> .....	<b>289</b>
	<i>Matt Gilgenbach and Travis McIntosh</i>	
<b>4.5</b>	<b>Goal Trees</b> .....	<b>301</b>
	<i>Geraint Johnson</i>	
<b>4.6</b>	<b>A Unified Architecture for Goal Planning and Navigation</b> .....	<b>311</b>
	<i>Dominic Fillion</i>	
<b>4.7</b>	<b>Prioritizing Actions in a Goal-Based RTS AI</b> .....	<b>321</b>
	<i>Kevin Dill</i>	
<b>4.8</b>	<b>Extending Simple Weighted-Sum Systems</b> .....	<b>331</b>
	<i>Sergio Garces</i>	

<b>4.9</b>	<b>AI Waterfall: Populating Large Worlds Using Limited Resources . . .</b>	<b>341</b>
	<i>Sandeep V. Kharkar</i>	
<b>4.10</b>	<b>An Introduction to Behavior-Based Systems for Games . . . . .</b>	<b>351</b>
	<i>Aaron Khoo</i>	
<b>4.11</b>	<b>Simulating a Plan . . . . .</b>	<b>365</b>
	<i>Petar Kotevski</i>	
<b>SECTION 5 TACTICS AND PLANNING . . . . .</b>		<b>377</b>
<b>5.1</b>	<b>Probabilistic Target Tracking and Search Using Occupancy Maps . . . . .</b>	<b>379</b>
	<i>Damián Isla</i>	
<b>5.2</b>	<b>Dynamic Tactical Position Evaluation . . . . .</b>	<b>389</b>
	<i>Remco Straatman, Arjen Beij, and William van der Sterren</i>	
<b>5.3</b>	<b>Finding Cover in Dynamic Environments . . . . .</b>	<b>405</b>
	<i>Christian J. Darken and Gregory H. Paull</i>	
<b>5.4</b>	<b>Coordinating Teams of Bots with Hierarchical Task Network Planning . . . . .</b>	<b>417</b>
	<i>Héctor Muñoz-Avila and Hai Hoang</i>	
<b>SECTION 6 GENRE SPECIFIC . . . . .</b>		<b>429</b>
<b>6.1</b>	<b>Training Digital Monsters to Fight in the Real World. . . . .</b>	<b>431</b>
	<i>James Boer and John Corpening</i>	
<b>6.2</b>	<b>The Suffering: Game AI Lessons Learned . . . . .</b>	<b>445</b>
	<i>Greg Alt</i>	
<b>6.3</b>	<b>Environmental Awareness in Game Agents. . . . .</b>	<b>457</b>
	<i>Penny Sweetser</i>	
<b>6.4</b>	<b>Fast and Accurate Gesture Recognition for Character Control. . . . .</b>	<b>469</b>
	<i>Markus Wöß</i>	
<b>6.5</b>	<b>Being a Better Buddy: Interpreting the Player's Behavior. . . . .</b>	<b>479</b>
	<i>William van der Sterren</i>	
<b>6.6</b>	<b>Ant Colony Organization for MMORPG and RTS Creature Resource Gathering. . . . .</b>	<b>495</b>
	<i>Jason Dunn</i>	
<b>6.7</b>	<b>RTS Citizen Unit AI . . . . .</b>	<b>507</b>
	<i>Shawn Shoemaker</i>	
<b>6.8</b>	<b>A Combat Flight Simulation AI Framework . . . . .</b>	<b>517</b>
	<i>Phil Carlisle</i>	

<b>SECTION 7 SCRIPTING AND DIALOG</b> .....	<b>529</b>
<b>7.1 Opinion Systems</b> .....	<b>531</b>
<i>Adam Russell</i>	
<b>7.2 An Analysis of Far Cry Instincts' Anchor System</b> .....	<b>555</b>
<i>Eric Martel</i>	
<b>7.3 Creating a Visual Scripting System</b> .....	<b>567</b>
<i>Matthew McNaughton and Thomas Roy</i>	
<b>7.4 Intelligent Story Direction in the Interactive Drama Architecture</b> . . .	<b>583</b>
<i>Brian Magerko</i>	
<b>SECTION 8 LEARNING AND ADAPTATION</b> .....	<b>597</b>
<b>8.1 Practical Algorithms for In-Game Learning</b> .....	<b>599</b>
<i>John Manslow</i>	
<b>8.2 A Brief Comparison of Machine Learning Methods</b> .....	<b>617</b>
<i>Christian Baekkelund</i>	
<b>8.3 Introduction to Hidden Markov Models</b> .....	<b>633</b>
<i>Robert Zubek</i>	
<b>8.4 Preference-Based Player Modeling</b> .....	<b>647</b>
<i>Jeroen Donkers and Pieter Spronck</i>	
<b>8.5 Dynamic Scripting</b> .....	<b>661</b>
<i>Pieter Spronck</i>	
<b>8.6 Encoding Schemes and Fitness Functions for Genetic Algorithms</b> .....	<b>677</b>
<i>Dale Thomas</i>	
<b>8.7 A New Look at Learning and Games</b> .....	<b>687</b>
<i>Christian Baekkelund</i>	
<b>8.8 Constructing Adaptive AI Using Knowledge-Based Neuroevolution</b> .....	<b>693</b>
<i>Ryan Cornelius, Kenneth O. Stanley, and Risto Miikkulainen</i>	
<b>About the CD-ROM</b> .....	<b>709</b>
<b>Index</b> .....	<b>711</b>