

Dr. Mark Owen Riedl

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RESEARCH INTERESTS

Artificial Intelligence; Computational Models of Narrative; Narrative and Story Generation; Intelligent Control of Interactive Virtual Storytelling Environments; Virtual Cinematography; Intelligent Virtual Agents; Intelligent User Interfaces; Discourse Processing

EDUCATION

Ph.D. in Computer Science, North Carolina State University; Raleigh, North Carolina; September 2004.

Dissertation title: *Narrative Generation: Balancing Plot and Character*

Dissertation committee:

R. Michael Young, Ph.D. (chair), Department of Computer Science, NC State University

Michael Capps, Ph.D., Epic Games

Jon Doyle, Ph.D., Department of Computer Science, NC State University

James Lester, Ph.D., Department of Computer Science, NC State University

Brad Mehlenbacher, Ph.D., College of Education and Psychology, NC State University

M.S. in Computer Science, North Carolina State University; Raleigh, North Carolina; May 2001.

Dissertation title: *A Computational Model of Navigation in Social Environments*

Thesis Committee:

Robert St. Amant, Ph.D. (chair), Department of Computer Science, NC State University

James Lester, Ph.D., Department of Computer Science, NC State University

R. Michael Young, Ph.D., Department of Computer Science, NC State University

B.S. in Computer Science with minor in Psychology, North Carolina State University, Raleigh, North Carolina; May 1999.

EMPLOYMENT

Research Scientist, Institute for Creative Technologies, University of Southern California, Marina Del Rey, California; October 2004 to date.

Research Assistant, Department of Computer Science, North Carolina State University, Raleigh, North Carolina; January 1999 – September 2004.

Adjunct Faculty, Department of Computer Science, North Carolina State University, Raleigh, North Carolina; May 2002 – August 2002.

Teaching Assistant, Department of Computer Science, North Carolina State University, Raleigh, North Carolina; August 1997 – December 1998, January 2003 – May 2003.

EXPERIENCE

Research systems developed

Automated Story Director; October 2004 to date

Automated Story Director is a technology and methodology for training cognitive skills such as situation, social, and cultural awareness. The technology uses narrative scenarios that describe the expected experience of a trainee immersed in a virtual environment. By manipulating story world characters, the Automated Story Director coerces the trainee into relevant learning situations where the trainee experiences dilemmas that must be overcome. When trainee actions cause significant deviations from the expected narrative experience, the Automated story Director invokes a story generator to repair the scenario in such a way that trainee initiative is preserved and relevant learning situations are still achievable.

Cambot, May 2006 to date

Machinima is a low-cost alternative to full-production filmmaking. However, practically speaking, even machinima requires a high degree of ability and effort to produce compelling cinematic visualizations. Cambot is a lightweight artificial intelligence system that can be used to assist in machinima production. Cambot takes a script as input and produces a cinematic visualization. In contrast to many other virtual cinematography systems, Cambot favors a lightweight, offline algorithm coupled with a large knowledgebase of highly specific, combinable and reusable cinematic knowledge. One of the advantages of this approach to virtual cinematography is the tight coordination of camera and character action.

Adaptive Opponents; October 2004 – May 2005

The goal of the Adaptive Opponents project is to build computer games for training that have computer generated opposition forces that can adapt their behavior to meet the pedagogical needs of the trainee. This research resulted in a two-tier architecture in which opponent forces could adapt their behavior in two ways. First, opponent forces could adapt their behavior reactively to take into consideration rapidly changing environmental conditions. Second, opponent forces could adapt their overall strategy for achieving scenario goals. The research was performed in the context of the training computer game, *Full Spectrum Command* (a precursor to the commercially released, *Full Spectrum Warrior*).

Fabulist; August 2001 – September 2004

Fabulist is an automated narrative generation system designed to be integrated with the Mimesis interactive narrative system (see below). The Fabulist architecture splits the narrative generation process into three layers: fabula generation – the generation of what the narrative is about – discourse generation – the generation of content that tells the story content – and media representation. The fabula generation uses a planning approach to narrative generation. Fabulist uses a modified planning algorithm, Intent-Driven Partial Order Causal Link (IPOCL), to reason about and generate narrative content with strong causal coherence and character believability.

Mimesis; October 2001 – September 2004

Mimesis is an interactive narrative system. An interactive narrative system is an interactive computer system that attempts to tell a story in which the user is a participant, meaning he or she can perform actions in the virtual story world environment that changes the direction and/or outcome of the story being told. The Mimesis system uses an intelligent approach of intervention and accommodation. User actions that interfere with the goals of the storytelling system can be intervened with and changed or accommodated, resulting in a new story being generated automatically.

iBots: User Interface Sofibots; 1999 – August 2001

An iBot controls an interactive system through the graphical user interface, as human users do, without relying on an application programming interface (API) or access to source code. Instead of tailoring interface agents to the APIs of different applications, our goal is to build what Nils Nilsson has called *habile agents*: general tool-using agents. Our work has led to a programmable substrate for iBots, with sensors, effectors, and skeleton controllers for this purpose. Sensor modules take pixel-level input from the display, run the data through image processing algorithms, and build a representation of visible interface objects. Effector modules generate mouse and keyboard gestures to manipulate these objects. These sensors and effectors act as eyes and hands to be managed by a controller appropriate for an application domain.

Courses taught

Introduction to Computing in Java; Summer 2002.

Taught a 10-week course, “Introduction to programming in Java” to a class of 70+ students; Course designed for students with no programming background; Developed all course material including exams, programming assignments, semi-weekly homework assignments.

Course	Semester	Difficulty of Course	Fairness in Grading	Course Effectiveness	Recommend Instructor	Instructor Effectiveness
CSC 116	Summer 2002	4.23 / 3.62	4.10 / 4.24	3.62 / 3.85	4.44 / 4.16	4.03 / 4.02

(Departmental averages are given in italics)

Course Teaching Assistant

Computer Game Design and Development; Spring 2003

Full semester course, “Computer Game Design and Development,” covered technologies used in game development and actual game programming with the Unreal Tournament commercial game engine; Development of course assignments and material; Managing project groups; Technical assistance with UnrealScript (Unreal Tournament scripting language) programming; Grading; Lectured units; Ran weekly lab meetings.

Course	Semester	Attends Office Hours	Well Informed	Understands Subject	Understands Platforms	Overall
CSC 481	Spring 2003	4.65 / 4.11	4.68 / 4.16	4.64 / 4.18	4.68 / 4.19	4.68 / 3.94

(Departmental averages are given in italics)

PUBLICATIONS

Journal articles (refereed)

Mark O. Riedl and R. Michael Young. From Linear Story Generation to Branching Story Graphs. *IEEE Journal of Computer Graphics and Animation*, 26(3), 2006.

---. Story Planning as Exploratory Creativity: Techniques for Expanding the Narrative Search Space. *New Generation Computing*, 24(3), 2006.

R. Michael Young, Mark O. Riedl, Mark Branly, Arnav Jhala, R.J. Martin, and C.J. Saretto. An Architecture for Integrating Plan-Based Behavior Generation with Interactive Game Environments. *Journal of Game Development*, 1, 2004.

Robert St. Amant and Mark O. Riedl. A Perception/Action Substrate for Cognitive Modeling in HCI. *International Journal of Human-Computer Studies*, 55(1), 2000.

Conference publications (refereed)

Mark O. Riedl, Jonathan P. Rowe, and David K. Elson. Toward Intelligent Support of Authoring Machinima Media Content: Story and Visualization. *Proceedings of the 2nd International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN)*, Playa del Carmen, Mexico, January 2008.

David K. Elson and Mark O. Riedl. A Lightweight Intelligent Virtual Cinematography System for Machinima Production. *Proceedings of the 3rd Conference on Artificial Intelligence and Interactive Digital Entertainment*, Palo Alto, California, June 2007.

Mark O. Riedl and Andrew Stern. Believable Agents and Intelligent Story Adaptation for Interactive Storytelling. *Proceedings of the 3rd International Conference on Technologies for Interactive Digital Storytelling and Entertainment*, Darmstadt, Germany, December 2006.

---. Failing Believably: Toward Strong Autonomy and Strong Story in Interactive Narratives. *Proceedings of the 3rd International Conference on Technologies for Interactive Digital Storytelling and Entertainment*, Darmstadt, Germany, December 2006.

Mark O. Riedl, Andrew Stern, and Don Dini. Mixing Story and Simulation in Interactive Narrative. *Proceedings of the 2nd Conference on Artificial Intelligence and Interactive Digital Entertainment*, Marina Del Rey, California, June 2006.

Mark O. Riedl and Andrew Stern. Believable Agents and Intelligent Scenario Direction for Social and Cultural Leadership Training. *Proceedings of the 15th Conference on Behavior Representation in Modeling and Simulation*, Baltimore, Maryland, May 2006.

Mark O. Riedl and R. Michael Young. An Objective Character Believability Evaluation Procedure for Multi-Agent Story Generation Systems. *Proceedings of the 5th International Conference on Intelligent Virtual Agents*, Kos, Greece, September 2005.

---. Open-World Planning for Story Generation. *Proceedings of the 19th International Joint Conference on Artificial Intelligence*, Edinburgh, July/August 2005.

Robert St. Amant and Mark O. Riedl. Image Processing in Cognitive Models with SegMan. *Proceedings of the 11th International Conference on Human-Computer Interaction*, Las Vegas, Nevada, July 2005.

Mark O. Riedl and R. Michael Young. From Linear Story Generation to Branching Story Graphs. *Proceedings of the 1st Conference on Artificial Intelligence and Interactive Digital Entertainment*, Marina Del Rey, California, June 2005.

Michael van Lent, Mark O. Riedl, Paul Carpenter, Ryan McAlinden, and Paul Brobst. Increasing Replayability with Deliberative and Reactive Planning. *Proceedings of the 1st Conference on Artificial Intelligence and Interactive Digital Entertainment*, Marina Del Rey, California, June 2005.

R. Michael Young and Mark O. Riedl. Integrating Plan-Based Behavior Generation with Game Environments. *Proceedings of the 2nd International Conference on Advances in Computer Entertainment Technology*, Valencia, Spain, June 2005.

Mark O. Riedl and R. Michael Young. A Planning Approach to Story Generation for History Education. *Proceedings of the 3rd International Conference on Narrative and Interactive Learning Environments*, Edinburgh, August 2004.

---. An Intent-Driven Planner for Multi-Agent Story Generation. *Proceedings of the 3rd International Conference on Autonomous Agents and Multi-Agent Systems*, New York, July 2004.

---. Character-Focused Narrative Planning for Execution in Virtual Worlds. *Proceedings of the 2nd International Conference on Virtual Storytelling*, Toulouse, France, November 2003.

Mark O. Riedl, C.J. Saretto, and R. Michael Young. Managing Interaction between Users and Agents in a Multi-Agent Storytelling Environment. *Proceedings of the 2nd International Conference on Autonomous Agents and Multi-Agent Systems*, Melbourne, Australia, July 2003.

Mark O. Riedl and Robert St. Amant. Social Navigation: Modeling, Simulation, and Experimentation. *Proceedings of the 2nd International Conference on Autonomous Agents and Multi-Agent Systems*, Melbourne, Australia, July 2003.

---. Towards Automated Exploration of Interactive Systems. *Proceedings of the 7th International Conference on Intelligent User Interfaces*, San Francisco, California, January 2002.

Mark Riedl. A Computational Model and Classification Framework for Social Navigation. *Proceedings of the 6th International Conference on Intelligent User Interfaces*, Santa Fe, New Mexico, January 2001.

Robert St. Amant, Chris G. Healey, Mark O. Riedl, Sarat Kocherlakota, David A. Pegram, and Mika Torhola. Intelligent Visualization in a Planning Simulation. *Proceedings of the 6th International Conference on Intelligent User Interfaces*, Santa Fe, New Mexico, January 2001.

Symposia and workshop publications (refereed)

Mark O. Riedl. Emergent and Guided Narrative for Training and Education in Virtual Worlds. *Proceedings of the 3rd Annual International Colloquium on Online Simulations, Role-Playing, and Virtual Worlds*, Boone, North Carolina, October/November 2006.

Mark O. Riedl and R. Michael Young. Story Planning as Exploratory Creativity: Techniques for Expanding the Narrative Search Space. *Proceedings of the 2005 IJCAI Workshop on Computational Creativity*, Edinburgh, July 2005.

Mark O. Riedl. Towards Integrating AI Story Controllers and Game Engines: Reconciling World State Representations. *Proceedings of the 2005 IJCAI Workshop on Reasoning, Representation, and Learning in Computer Games*, Edinburgh, July/August 2005.

Mark O. Riedl, H. Chad Lane, Randall Hill, and William Swartout. Automated Story Direction and Intelligent Tutoring: Towards a Unifying Architecture. *Proceedings of the 2005 AIED Workshop on Narrative Learning Environments*, Amsterdam, July 2005.

David B. Christian, Mark O. Riedl, and R. Michael Young. Conversation Starters: Using Spatial Context to Initiate Dialogue in First Person Perspective Games. *Proceedings of the 2002 AAAI Spring Symposium on Artificial Intelligence and Interactive Entertainment*, Palo Alto, California, March 2002.

David A. Pegram, Robert St. Amant, and Mark O. Riedl. An Approach to Visual Interaction in Mixed-Initiative Planning. *Proceedings of the 1999 AAAI Mixed-Initiative Intelligence Workshop*, Orlando, Florida, July 1999.

Technical reports and non-refereed publications

Mark O. Riedl. *Narrative Generation: Balancing Plot and Character*. Ph.D. Dissertation, Department of Computer Science, North Carolina State University, Raleigh, North Carolina, 2004.

---. *Equivalence between Narrative Mediation and Branching Story Graphs* (Technical Report TR04-004). Liquid Narrative Group, Department of Computer Science, North Carolina State University, Raleigh, North Carolina, 2004.

---. *Actor Conference: Character-Focused Narrative Planning* (Technical Report TR03-00). Liquid Narrative Group, Department of Computer Science, North Carolina State University, Raleigh, North Carolina, 2003.

---. *A Computational Model of Navigation in Social Environments*. Masters Thesis, Department of Computer Science, North Carolina State University, Raleigh, North Carolina, 2001.

Papers under preparation

Mark O. Riedl and R. Michael Young. Narrative Planning: Balancing Plot and Character. To be submitted to the *Journal of Artificial Intelligence Research*.

Mark O. Riedl. Dynamic Experience Management in Virtual Worlds for Entertainment, Education, and Training. Submitted to the *International Transactions on System Science and Applications*, Special Issue on Agent Based Systems for Human Learning and Entertainment.

Mark O. Riedl and Carlos León. Toward Vignette-Based Story Generation for Drama Management Systems. Submitted to the 2nd International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN), Workshop on Integrating Technologies for Interactive Stories, Playa del Carmen, Mexico, January 2008.

PRESENTATIONS

Invited Talks

University of Southern California, School of Occupational Therapy, Los Angeles, California, September 2007. Title: *Artificial Intelligence and Narrative*.

University of Southern California, Department of Computer Science, Los Angeles, California, February 2007. Title: *Narrative Generation and Interactive Storytelling*.

Air Force Research Lab Workshop on Storytelling as an Instructional Method: In Search of Theoretical and Empirical Foundations, Mesa, Arizona, November 2006. Title: *Emergent and Guided Narrative for Training and Education in Virtual Worlds*.

University of North Carolina, Charlotte, Department of Computer Science, Charlotte, North Carolina, November 2006. Title: *Narrative Generation and Interactive Storytelling*.

Charles River Analytics, Cambridge, Massachusetts, July 2006. Title: *Narrative Generation for Interactive Storytelling*.

Invited Panelist

2005 Joint Advances in Distance Learning Co-Lab Implementation Fest, Panel on AI and Storytelling, Orlando, Florida, August 2005. Title: *Automated Story Direction for Training and Education*.

INTERNAL FUNDING

Current

Institute for Creative Technologies internal proposal, *Automated Story Director*. Mark O. Riedl (PI). \$700k; funding period: 11/1/2005 – 11/16/2007.

Institute for Creative Technologies internal proposal, *Multimedia Interactive Story Telling*. Jim Korris (PI) (I assumed project leadership on 10/9/06). \$173k; funding period: 5/1/2006 – 10/31/2007.

Past

Institute for Creative Technologies internal proposal, *Rapid Training Development for Adaptive Leaders*. Randall Hill (PI), Andrew Gordon (co-PI), and Mark O. Riedl (co-PI) (Added later). \$900k; funding period: 9/1/2004 – 10/31/2005.

HONORS

Best Paper Award, 3rd International Conference on Technologies for Interactive Digital Storytelling and Entertainment, Darmstadt, Germany, December 2006.

Best Paper Award, 15th Conference on Behavior Representation in Modeling and Simulation, Baltimore, Maryland, May 2006.

Outstanding Teaching Assistant Award, Department of Computer Science, North Carolina State University, 2004.

PROFESSIONAL SERVICE

Organizing Committees

AAAI Fall Symposium on Interactive Narrative Technologies (co-chair), Washington D.C., November 2007.

International Conference on Artificial Intelligence in Education (AIED) Workshop on Narrative Learning Environments (chair), Marina Del Rey, California, July 2007.

International Conference on Intelligent Virtual Agents (IVA), Marina Del Rey, California, August 2006.

International Conference on Automated Planning and Scheduling (ICAPS) Workshop on AI Planning for Computer Games and Synthetic Characters, Cumbria, UK, June 2006.

Program Committees

International Joint Conference on Autonomous Agents and Multi Agent Systems (AAMAS), 2008;

International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN), 2008.

Annual Conference of the Florida Artificial Intelligence Research Society (FLAIRS), 2008.

Workshop on Integrating Technologies for Interactive Stories (ITIS), 2008.
International Conference on Virtual Storytelling, (ICVS), 2007;

International Conference on Intelligent Virtual Agents (IVA), 2006, 2007.

National Conference on Artificial Intelligence (AAAI), 2006, 2007.

National Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE), 2006, 2007.

Workshop on Agent Based Systems for Human Learning and Entertainment (ABSHLE), 2007.

Australasian Conference on Interactive Entertainment (IE), 2005, 2006, 2007.

Annual Simulation Symposium, 2006;

International Conference on Entertainment Computing (ICEC), 2006.

Reviewing

Conferences: International Joint Conference on Artificial Intelligence (IJCAI), 2007; International Conference on Advances in Computer Entertainment Technology (ACE), 2006; Annual ACM Symposium on User Interface Software and Technology (UIST), 2004; International Conference on Human Factors in Computing Systems (CHI), 2001.

Other: *IEEE Transactions of Visualization and Computer Graphics*, Special Issue on the Best of EuroVis, 2007; *Connection Sciences*, 2007; *Journal of Virtual Reality and Broadcasting*, 2006; *New Generation Computing*, Special Issue on Computational Creativity, 2006; *IEEE Journal of Computer Graphics and Animations*, Special Issue on Interactive Narrative in Computer Games, 2006; *The Practical Handbook of Internet Computing*, 2003.

Conference Session Chair

International Conference on Technologies for Interactive Digital Storytelling and Entertainment (TIDSE), 2006.

International Conference on Intelligent Virtual Agents (IVA), 2006.

Master's and Doctoral Thesis Committees

Mei Si, Ph.D. in Computer Science, ongoing (committee member). Thesis title: *Thespian: A Decision Theoretic Framework for Authoring and Simulating Interactive Dramas*.

Shumin Wu, Ph.D. in Computer Science, ongoing (committee member). Thesis title: *Reducing Unproductive Learning Activities in Serious Games for Second Language Acquisition*.

PROFESSIONAL SOCIETY MEMBERSHIP

Association for Computing Machinery (ACM), special interest group SIGART

American Association for Artificial Intelligence (AAAI)

Narrative and Learning Environments, Special Interest Group of the European Community
Kaleidoscope Network of Excellence

REFERENCES

Available on request