

# Christopher J. Hazard, PhD

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RESEARCH INTERESTS Time and dynamical systems theory, particularly in

- Machine learning
- Information security
- Serious games and incentive design
- E-commerce: computational trust and reputation, markets and auctions, game theory and mechanism design, automated procurement, strategic aspects of supply chains
- Multi-agent systems: robot coordination, simulated time travel and reversible computing, artificial intelligence

EDUCATION **North Carolina State University**, Raleigh, North Carolina USA

Ph.D., Computer Science, August 2010  
Dissertation: Trust and Reputation in Multiagent Systems: Strategies and Dynamics with Reference to Electronic Commerce  
Advisor: Munindar P. Singh

**Valparaiso University**, Valparaiso, Indiana USA

Bachelor of Science with Honors, Computer Science, December 2001  
Minors: Computer Engineering, Physics, Mathematics

CERTIFICATIONS **National Guild of Hypnotists**  
Certified Hypnotist, October 2014

HONORS AND AWARDS Gamespot's Best Original Game Mechanic Editor's Choice Award, 2011  
University Outstanding Teaching Assistant Award, North Carolina State University, 2008  
Best Paper Award at the 9th International Conference on Electronic Commerce, 2007  
National Science Foundation Graduate Research Fellowship Honorable Mention, 2005  
North Carolina State University Dean's Fellowship, 2004  
Valparaiso University Departmental Honors, 2001  
ACM Programming Competitions, team placed 10th, 6th, US regional 2000, 2001  
Valparaiso University Board of Directors' Independent Research Award, 2000  
Valparaiso University Presidential Scholarship, 1998

ACADEMIC EXPERIENCE **North Carolina State University**, Raleigh, North Carolina USA

*Postdoctoral Researcher* **September 2010 - February 2011**  
Part-time appointment working on trust and quality of information for US Army, including mentoring PhD students.

*Graduate Student* **August 2004 - August 2010**  
Various appointments as a graduate research assistant. Sponsored by US Army, US NSF, and NCSU.

*Instructor*  
Taught senior-level undergraduate e-commerce course, covering the topics of Internet infrastructure, databases, web services, security, auctions, and game theory. Revamped course contents to include more up-to-date research and to make the class more engaging. Responsible for all lectures, exams, homework assignments, and grades.

CSC 413, Fall 2007 (46 students). Received University Outstanding Teaching Assistant Award.

CSC 413, Fall 2006 (48 students).

**Duke University**, Durham, North Carolina USA

*Instructor - TIP Summer Studies*

Taught 3 week, 7 hours/day Java programming and video game development course to highly gifted and talented high school students. Topics included the Java programming language and introductions to computer graphics, physics simulations, and game theory. Students completed a final project of creating their own 2D video game. Designed the course content and lectures, and adapted labs and assignments from another instructor.

Java for Video Games, July 2007 (17 students).

#### PUBLICATIONS

Christopher J. Hazard, Munindar P. Singh. Privacy Risks in Intelligent User Interfaces. IEEE Internet Computing on Natural Web Interfaces. December 12, 2016.

Joe Newman, Joseph Jerome, and Christopher Hazard. Press Start to Track?: Privacy and the New Questions Posed by Modern Videogame Technology. American Intellectual Property Law Association (AIPLA) Quarterly Journal, August 1, 2014.

Christopher J. Hazard, Munindar P. Singh. Macau: A Basis for Evaluating Reputation Systems. Proceedings of the 23th International Joint Conference on Artificial Intelligence (IJCAI). August, 2013. pp. 17.

Christopher J. Hazard, Munindar P. Singh. Intertemporal discount factors as a measure of trustworthiness in multiagent systems. IEEE Transactions on Knowledge and Data Engineering. May, 2011. 23(5). pp. 699-712.

Dmitri Droujkov, Christopher J. Hazard, and Maria Droujkova. Conceptual framework for designing math computer games: Elementary game theory dimensions for educators. 32nd Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education. Columbus, Ohio. October, 2010.

Christopher J. Hazard, Munindar P. Singh. An Architectural Approach to Combining Trust and Reputation. Proceedings of the 13th AAMAS Workshop on Trust in Agent Societies. May 2010.

Christopher J. Hazard. ¿Por favor? Favor reciprocation when agents have private discounting. In Proceedings of the 2008 AAI Workshop on Coordination, Organizations, Institutions and Norms (COIN). pp 9-16, Chicago, Illinois, USA. July 14, 2008.

Christopher J. Hazard, Peter R. Wurman. The game of scale: Decision making with economies of scale. In Proceedings of the 9th International Conference on Electronic Commerce (ICEC07), pp 329-337, Minneapolis, Minnesota, USA. 2007. **Best Paper Award**

Christopher J. Hazard, Peter R. Wurman, Raffaello D'Andrea. Alphabet Soup: A testbed for studying resource allocation in multi-vehicle systems. In Proceedings of the 2006 AAI Workshop on Auction Mechanisms for Robot Coordination. pp 23-30, Boston, Massachusetts, USA. July 17, 2006.

Christopher J. Hazard, Kyle Kimport, David Johnson. Emergent behavior in two complex cellular automata rule sets. Complexity, 2005. 10(5) pp 45-55.

#### PATENTS

Methods, systems, and computer program products for simulating a scenario by updating events over a time window including the past, present, and future. Submitted July 10, 2008. Issued October 2, 2012.

## TALKS & PANELS

MAGFest: participated in 20 hours worth of panels across a variety of topics in a 4-day convention. National Harbor, MD. January 5-8, 2017.

Replication, Automation, and Augmentation of Subject Matter Expertise: Building AI Partners for Simulation and Live Operations. Keynote at NATO International What-If? Workshop. Valkeakoski, Finland. September 24, 2016.

Bias, Conformance, and Hypnosis: Psychological Tricks to Hack the Mind for Social Engineering. Triangle InfoSeCon. Raleigh, NC. October 21, 2016.

Game Theory for Security Professionals. Opening talk at Information Systems Security Professionals Raleigh Chapter Meeting. September 7, 2016.

Bias, Conformance, and Hypnosis: Psychological Tricks to Hack the Mind for Social Engineering. Keynote at Information Systems Security Professionals Raleigh Chapter Meeting. August 4, 2016.

Measuring and Manipulating Player Biases and Trust Through Choice and Game Mechanics. Serious Play Conference. Chapel Hill, NC. July 27, 2016.

Modeling, Math and Science for Building Games that Improve Organization Operation, Workforce Effectiveness. Serious Play Conference. Chapel Hill, NC. July 26, 2016.

What Is Operations Research and What Is It Doing In My Game? East Coast Game Conference. Raleigh, NC. April 20, 2016.

Artificial Intelligence on Both Sides of the Battle for Influence and Privacy. International Association of Privacy Professionals Global Privacy Summit 2016. Washington, DC. April 6, 2016.

Plosh: Time Bomb. Experimental Gameplay Workshop, Game Developers Conference (GDC). San Francisco, CA. March 18, 2016.

AI Devs Rant. Game Developers Conference (GDC). San Francisco, CA. March 15, 2016.

A Stitch in Time: Metaplanning for AI with Unusual Time Controls. Game Developers Conference (GDC). San Francisco, CA. March 15, 2016.

MAGFest convention talks and panels. National Harbor, MD. February 18-21, 2016.

Creativity, Gaming, and Information Theory: Influence Through Engagement. Laboratory for Analytic Sciences, North Carolina State University. October 28, 2015.

Measuring and Manipulating Player Trust through Choice and Game Mechanics. Triangle IGDA. Chapel Hill, NC. September 22, 2015.

Flow and States of Mind in Gaming: What Do Hypnotism and Creativity Have To Do With Playing Games? IGDA Charlotte. Charlotte, NC. August 28, 2015.

Strategy Level Serious Games, Practice and Theory: Bringing M&S to Life. Student Orientation at Central Piedmont Community College. Charlotte, NC. August, 28, 2015.

Strategy Level Serious Games, Practice and Theory: Bringing M&S to Life. NATO Task Group on Data Farming. Stockholm, Sweden. June 8, 2015.

Trust Between Man and Machine. Plenary talk at MODSIM World. Virginia Beach, VA. March 31,

2015.

Measuring and Manipulating Player Trust through Choice and Game Mechanics. Game Developers Conference (GDC). San Francisco, CA. March 3, 2015.

MAGFest convention talks and panels. National Harbor, MD. January 23-26, 2015.

Creativity and Game Mechanics: Press X to Attend This Talk. East Coast Game Conference. Raleigh, NC. April 24, 2014.

Game Verbs for Change. Games for Change. Workshop co-run with Lindsay Grace (American University) and Chris Totten (George Mason University). New York, NY. April 22, 2014.

Behavior Engineering with Games and Incentives. Keynote talk at Paradoxos NEXT. Durham, NC. April 11, 2014.

Selected Advances in Psychology, Mathematics, and Technology Driving the Future of Game Development. UNC Department of Computer Science. February 7, 2014.

The Next Ender's Game: using games to solve problems. IBM Global Entrepreneurship Day, Durham, NC. February 4, 2014.

MAGFest convention talks and panels. National Harbor, MD. January 2-5, 2014.

Analytical Methods of Game Design for Serious Strategy Games. MODSIM World. Hampton Roads, VA. April 30 - May 2, 2013.

Is the Metaphor Right? Diversifying Genre and Theme in Serious Games. East Coast Game Conference. Raleigh, NC. April 24-25, 2013.

Beyond Scripting and Optimization: Bringing Procedural Content Generation to Gameplay and AI. East Coast Game Conference. Raleigh, NC. April 24-25, 2013.

Analytical Methods of Game Design for Serious Strategy Games. Defense GameTech User's Conference. Orlando, FL. April 17-19, 2013.

MAGFest convention talks and panels. National Harbor, MD. January 3-6, 2013.

Escapist Expo talks and panels. Durham, NC. September 14-16, 2013.

Information, Conveyance, and Surprisal: How Game Mechanics Communicate Strategic Choice to Players. East Coast Game Conference. Raleigh, NC. April 25, 2012.

MAGFest convention talks and panels. National Harbor, MD. January 5-8, 2012.

MAGFest convention talks and panels: Achron: Past, Present, and Future; Achievements and Meta-Gaming (panel); Technology and Game Design (panel); Gaming and Education (panel). Alexandria, VA. January 13-16, 2011.

Disruptive Innovation: Serious Gaming. Global Solutions Projects and Defense Exchange (SPADE) Conference. Brussels, Belgium. September 14, 2011.

Creating a Xanatos Gambit: All Paths Lead to Victory. Penny Arcade Expo (largest gaming convention in USA). Seattle, WA. August 27, 2011.

Strategic Serious Gaming to Improve the Enterprise. Keynote talk at TECHNET Mid-America 2011 Cyberlog/DPO EA Conference. Collinsville, IL. June 22, 2011.

Panelist on Information Sharing in Contested Networks (panel included CIO of USTRANSCOM and CIO of USSTRATCOM). TECHNET Mid-America 2011 Cyberlog/DPO EA Conference. Collinsville, IL. June 22, 2011.

Is This a Game? Strategic Serious Gaming to Improve the Enterprise. Keynote talk at AFCEA (Armed Forces Communications and Electronics Association) Scott-St. Louis Chapter Annual Awards Banquet. May 19, 2011.

Next Gen Serious Games: Redefining Training (with Phaedra Boinodiris). East Coast Game Conference. April 14, 2011.

Trust as a Game Mechanic. East Coast Game Conference. April 13, 2011.

Discussion panelist on J. Richard Gott's A Time Travel Lecture. A Time Travel Conference. North Carolina State University, Raleigh, NC. April 8, 2011.

MAGFest convention talks and panels: Achron: Past, Present, and Future; Achievements and Meta-Gaming (panel); Technology and Game Design (panel); Gaming and Education (panel). Alexandria, VA. January 13-16, 2011.

Trust and Reputation in Automated Procurement: Strategies and Dynamics. School of Industrial and Systems Engineering, Georgia Institute of Technology. Atlanta, GA. December 6, 2010.

On Developing Achron. Department of Computer Science, George Mason University. Washington, DC. November 18, 2010.

Trust and Reputation in Multiagent Systems: Strategies and Dynamics. Department of Computer Science, George Mason University. Washington, DC. November 18, 2010.

Innovation Roundtable Outbrief: Imagine the Impossible. Presentation at the Pentagon to Under Secretary of Defense for Acquisition Technology & Logistics; Vice Chairman, Joint Chiefs of Staff; Director, Defense Research & Engineering for Department of Defense; Commander, U.S. Transportation Command; and Director, Defense Advanced Research Projects Agency. November 16, 2010.

Balancing Game Mechanics Using Game Theory: Modern Analytical Approaches to Achieving Desired Gameplay Dynamics. Montreal International Game Summit. November 9, 2010.

Time manipulation for serious gaming. Keynote (with Phaedra Boinodiris, IBM Corp.) at USTRANSCOM and DARPA Innovation Roundtable. Awarded Challenge Coin for presentation by General McNabb (4-star, USAF). October 6, 2010.

What every game designer should know about game theory. Triangle Game Conference, Raleigh, North Carolina. April 7, 2010.

Time travel and time manipulation: Perspectives from computation and gaming. Department of Philosophy, North Carolina State University. Raleigh, NC. April 5, 2010.

Designing math-rich games. Math 2.0 Interest Group. International web conference based in Raleigh, NC. September 2, 2009.

Timeline manipulation for training and analysis. IBM Corp., Research Triangle Park, NC. June 23, 2009.

Innovative gameplay using time travel and time manipulation. Department of Computer Science, North Carolina State University. Raleigh, NC. June 3, 2009.

Innovative gameplay using time travel and time manipulation. Epic Games, Inc. Cary, NC. June 2, 2009.

Timeline manipulation for training and analysis. Army National Simulation Center. Ft. Leavenworth, Kansas. May 19, 2009.

Innovative gameplay using time travel and time manipulation. Triangle Game Conference. Raleigh, North Carolina. April 29, 2009.

Achron. Experimental Gameplay Sessions at the Game Developers Conference (GDC). San Francisco, California. March 26, 2009.

A fresh look at trust and reputation systems. Department of Computer Science, North Carolina State University. Raleigh, NC. February 13, 2009.

Coordination in multi-agent systems: The effects of economies of scale and switching costs. Department of Computer Science and Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign. July 31, 2008.

Resource allocation and routing in multi-vehicle warehousing: Alphabet Soup. Guest Lecture in Course ISyE 6202, Warehouse and Distribution Science. School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA. February 12, 2008.

Applying market-oriented programming to product routing. Mini-Workshop on Selected Topics in E-Commerce, North Carolina State University, Raleigh, NC. April 9, 2007.

#### PROFESSIONAL SERVICE

Program committee member for 12th Annual AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE), 2016.

Judge for the Serious Games Showcase and Challenge at I/ITSEC. 2011-present.

NATO Task Group, Developing Actionable Data Farming Decision Support for NATO, MSG-124. 2015-present.

Reviewer for ACM Computing Surveys, 2015.

Reviewer for the IEEE journal Transactions on Reliability, 2014.

Reviewer for the ACM journal Transactions on Autonomous and Adaptive Systems, 2012.

Program committee member of the 14th International Conference on Principles and Practice of Multi-Agent Systems, 2011 (PRIMA).

Reviewer for the journal Artificial Intelligence, 2010.

Program committee member of the 2011 International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

Program committee member of the 13th International Conference on Principles and Practice of Multi-Agent Systems, 2010 (PRIMA).

Program committee member of the 2009 IJCAI workshop on Coordination, Organizations, Institutions, and Norms in Agent Systems (COIN).

#### BOARDS

Board member, Szl.it Inc. 2015-present.

Board member, Tilt Inc. 2015-present.

Advisory committee, Wake Tech Community College. 2013-present.

Advisory board, Central Piedmont Community College Department of Simulation and Game Development. 2013-present.

#### SELECTED MEDIA APPEARANCES

*Motherboard*. Want to See Your Video Game Reborn at the Pentagon? IBM Can Help. March 5, 2015.

*WRAL TechWire*. Gaming's future: Not just for entertainment but solving serious problems, too. February 5, 2014.

*Australian Broadcasting Corporation*. Frag Reel Friday: Multiplayer time travel in Achron. May 27, 2011.

*The Age*. Your Turn: Time is on your side November 22, 2010.

*GamePro*. Armed and Ready: What's Next for Real-time Strategy? Sept 2, 2010.

*Ars Technica*. Achron: Indie RTS where time is your plaything, and enemy. May 9, 2010.

*Spiegel Online*. Tanz auf der Zeitachse (Dancing on the time axis). April 25, 2010.

*Slashdot*. Achron – an RTS With Time Travel. August 26, 2009.

*Igromania* (Russian & European Gaming magazine). Achron. August 20, 2009.

*The Escapist*. The Escapist Show Episode 43: Hazardous Software's Achron. August 25, 2009.

*The Escapist*. TGC 2009: Highlights From the Programming Front. May 1, 2009.

*The Escapist*. (US gaming magazine). TGC 2009: Day One Wrap-Up. April 29, 2009.

*bit-tech*. (UK computer magazine). Achron Interview: Your Head Will Explode. April 14, 2009.

*The Guardian*. Experimental Gameplay: post-GDC2009 special. April 6, 2009. (discusses Achron)

*Shacknews*. Time Travel RTS Achron Revealed. March 27, 2009.

*Associated Press*. Experimental games get play at conference. March 27, 2009.

#### INDUSTRY EXPERIENCE

**Hazardous Software Inc.**, Raleigh, North Carolina USA

*President/CEO, Game Designer, AI Researcher, Engine Developer*

**2009-present full-time**  
**1999-2009 part-time**

- Won numerous contracts to develop serious games for major corporations, government entities, and nonprofit organizations, and directed and oversaw their development.
- Managed approximately 60 employees and contractors across all aspects of game development to bring Achron to market.
- Built relationships with many senior executives in major organizations, including many individuals who directly control multibillion dollar budgets.
- Consulted for senior US government officials on serious games for military strategy and tactics.
- Designed the world's first free-form time travel game, Achron, which won Gamespot's 2011 Best Original Game Mechanic Editor's Choice Award.
- Architected, designed, and coded Hazardous Software's Resequene Engine and Amalgam Engine.
- Prepared and executed company's business, legal, and marketing strategies.
- Architected, designed, and implemented an inventory management and distribution system for the science supplies warehouse of the Chicago Public School system servicing 500 schools.

**Szl Inc.**, Durham, North Carolina USA

*Chief Technology Officer*

**January 2015-October 2015 (part-time appointment)**

- Guided technological aspects of a product pivot and major infrastructure upgrade
- Developed core algorithms to improve and scale product offerings involving user similarity, user preferences, and recommendations
- Lead technology team in internal processes improvements

**Kiva Systems**, Burlington, Massachusetts USA

*Research Intern*

**May 2005 - August 2005**

- Analyzed, tuned, and evaluated algorithms to control and coordinate teams of robots for a revolutionary warehouse distribution system.
- Developed algorithms, methodologies, and tools to evaluate the performance and cost impacts of design decisions on customers' needs.
- Implemented features on product simulator to prototype and evaluate new product designs and accommodate existing product features.
- Worked closely with key technology decision makers in a venture capital setting.

**Motorola Inc.**, Arlington Heights, Illinois USA

*Software Architect*

**December 2002 - August 2004**

- Gathered and drafted requirements for high-performance simulation software to test CDMA Base Station Transceivers.
- Specified high level and low level designs for large-scale automation initiative.
- Directed software engineering teams in Poland, Illinois, and Arizona.
- Lead reviews of designs and code and actively participate in change control boards.
- Developed control software for high performance product testing.

*Software Engineer*

**Summer 2001 and December 2001 - November, 2002**

- Developed testing software and simulators for cutting edge cellular phone infrastructure technology (CDMA).
- Worked closely with testers and developers to design, develop, and tailor software to fit their needs.
- Lead initiatives to optimize the development cycle and increase automation.
- Appointed to a lead developer role of an existing team of 4 within first month of being an intern in Summer 2001.

**Helgesen Industries**, Hartford, Wisconsin USA

*Consultant Intern*

**Summer 2000**



- Performed and automated data collection and analysis of the paint line in a metal fabrication shop.
- Independently designed and implemented techniques and databases for statistic collection and analysis.
- Communicated ideas/techniques between workers and management.

**Hartford Union High School, Hartford, Wisconsin USA**

*Network Administrator*

**1996-1998**

- Maintained and troubleshot a network of 500 computers.
- Performed large hardware and software network upgrade.
- Consulted with school administration on decisions regarding the network.

UNDERGRADUATE  
RESEARCH  
EXPERIENCE

- Honors Thesis: Designed a parallel/distributed programming language based on C++ syntax, and created a compiler for it.
- 2D Graphic Manipulation Engine: Created a fully scriptable and customizable, powerful 2D image editor.
- Quantum Computing: Contributed to a large multi-university project of designing computers using quantum mechanics, specifically the development of simulation algorithms for electron tunneling in quantum cellular arrays.
- Robotics: Built a parallel processor robot with various environmental sensors and programmed it to play simplified soccer.
- Fractal Music Composition: Developed algorithms based on fractal mathematics and programs to compose music.
- Artificial Life: Used cellular automata and mathematical rule sets to generate self-reproducing/self-organizing patterns, as well as performed entropy and graphical analysis.
- Weather Modeling: Worked on real-time weather simulation and 3-D weather renderer to generate realistic data and construct visual models of weather systems.

COMPUTER SKILLS

- Platforms: Windows, Linux, Mac OS X, Solaris, other Unix variants.
- Applications: Microsoft Visual Studio, L<sup>A</sup>T<sub>E</sub>X, Eclipse, Microsoft Office, Unix shells, Mercurial, Git, Subversion, Weka, Blender, Adobe Photoshop, Internet.
- Programming Languages (sorted highest proficiency first): C++, Perl, Java, Python, SQL, C, Lisp/Scheme, Ruby, PHP, Assembly (i86, MIPS variations, HC11, IA64), UML, VHDL, ML, Prolog, Pascal, Lex/Yacc, Expect. Additionally authored 6 languages, and implemented 7 compilers/interpreters.
- APIs: OpenGL, DirectX, POSIX, OpenAL, SDL, Win32, Tk, VESA.
- Transports: TCP, UDP, IP, SCTP, SNMP.

VOLUNTEER  
ACTIVITIES

- Pro bono consulting for Natural Math / Math 2.0 on games and techniques to teach mathematics to children. 2010-present.
- Pro bono consulting on data mining and privacy in the games industry for The Future of Privacy Forum, a DC-based think tank focusing on privacy, 2014.
- North Carolina Student Academy of Science, State Competition Judge, 2006.
- Volunteer at the Adler Planetarium, Chicago, IL: explained astronomy concepts to the public and aided in demonstrations, 2003-2004.
- FIRST LEGO League middle school robotics competition judge, IL, 2004.