

# Brent Harrison

## Curriculum Vitae

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Entertainment Intelligence Lab  
Georgia Institute of Technology  
Technology Square Research Building  
85 5<sup>th</sup> St. NW. Atlanta, GA 30332

brent.harrison@cc.gatech.edu  
<http://www.brenteharrison.com>

## Research

My research involves finding ways to utilize the wealth of human behavior and decision making data currently available in order to imbue AI systems with a greater understanding of humans in order to better enable communication between AI and humans. This involves using various forms of data in order to build models of human behavior/decision making and making AI systems that exhibit more humanlike behavior. As a research scientist at the Georgia Institute of Technology, I am currently researching how crowdsourced knowledge can be used to train reinforcement learning agents to exhibit believable behaviors.

## Education

### North Carolina State University, Raleigh NC

- Doctorate of Philosophy in Computer Science *August 2014*  
Dissertation title: "Dynamically Adapting Games Using Vanity and Actionable Analytics to Increase Session-Level Retention"  
Advisor: Dr. David Roberts  
College of Engineering  
North Carolina State University  
Raleigh, NC

- Master of Science in Computer Science *May 2012*

### Auburn University, Auburn AL

- Bachelor of Science in Computer Science, Summa Cum Laude *August 2008*
- Bachelor of Arts in English, Summa Cum Laude *August 2008*

## Publications

### Refereed Journal Papers

- Brent Harrison and David L. Roberts. An Analytic and Psychometric Evaluation of Dynamic Game Adaption for Increasing Player Retention in Casual Games. *IEEE Transactions on Computational Intelligence and AI in Games*.
- Brent Harrison, Stephen G. Ware, Matthew William Fendt, David L. Roberts. A Survey and Analysis of Techniques for Player Behavior Prediction in Massively Multiplayer Online Games. *IEEE Transactions on Emerging Topics in Computing*.
- Stephen G. Ware, R. Michael Young, Brent Harrison, and David L. Roberts. A Computational Model of Plan-Based Narrative Conflict at the Fabula Level. *IEEE Transactions on Computational Intelligence and AI in Games*.

## Refereed Conference Papers

- Lara J. Martin, Brent Harrison, and Mark O. Riedl. Improvisational Computational Storytelling in Open Worlds. *Proceedings of the 2016 International Conference on Interactive Digital Entertainment*, Los Angeles, California, 2016.
- Brent Harrison and Mark O. Riedl. Learning From Stories: Using Crowdsourced Narratives to Train Virtual Agents. *Proceedings of the 2016 AAAI Conference on Artificial Intelligence for Interactive Digital Entertainment*, Burlingame, California, 2016.
- Alexander Zook, Brent Harrison, and Mark O. Riedl. Monte-Carlo Tree Search for Simulation-Based Play Strategy Analysis. In *Proceedings of the 2015 Foundations of Digital Games Conference*. Pacific Grove, CA. 2015. *Best Paper Nominee*.
- Matthew Guzdial, Brent Harrison, Boyang Li, and Mark O. Riedl. Crowdsourcing Open Interactive Narrative. In *Proceedings of the 2015 Foundations of Digital Games Conference*. Pacific Grove, CA. 2015.
- Brent Harrison and David L. Roberts. Analytics-Driven Dynamic Game Adaption for Player Retention in a 2-Dimensional Adventure Game. In *Proceedings of Tenth Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE 2014)*. Raleigh, North Carolina. 2014.
- Rogelio E. Cardona-Rivera, Justus Robertson, Stephen G. Ware, Brent Harrison, David L. Roberts and R. Michael Young. Foreseeing Meaningful Choices. In *Proceedings of Tenth Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE 2014)*. Raleigh, North Carolina. 2014.
- Pu Yang, Brent Harrison, and David L. Roberts. Identifying Patterns in Combat that are Predictive of Success in MOBA Games. In *Proceedings of the 2014 Foundations of Digital Games Conference. Exceptional Full Paper*.
- Brent Harrison and David L. Roberts. Analytics-Driven Dynamic Game Adaption for Player Retention in *Scrabble*. In *Proceedings of the Computational Intelligence and Games Conference (CIG 2013)*. Niagara Falls, Canada. *Best Paper Nominee*.
- Titus Barik, Arpan Chakraborty, Brent Harrison, David L. Roberts, Robert St. Amant. Modeling the Concentration Game with ACT-R. In *Proceedings of the International Conference on Cognitive Modeling (ICCM 2013)*. Ottawa, Canada.
- Matthew Fendt, Brent Harrison, Stephen Ware, Rogelio Cardona-Rivera and David L. Roberts. Achieving the Illusion of Agency. In *Proceedings of the Fifth International Conference on Interactive Digital Storytelling (ICIDS 2012)*. San Sebastian, Spain. 2012. *Winner: Best Paper Award*
- Stephen G. Ware, R. Michael Young, Brent Harrison, and David L. Roberts. Four Quantitative Metrics Describing Narrative Conflict. In *The International Conference on Interactive Digital Storytelling (ICIDS 2012)*. San Sebastian, Spain. 2012.
- Brent Harrison and David L. Roberts. When Players Quit (Playing Scrabble). In *Proceedings of Eighth Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE 2012)*. Stanford, California. 2012.
- Brent Harrison, Titus Barik, David L. Roberts, and Xuxian Jiang. Spatial Game Signatures for Bot Detection in Social Games. In *Proceedings of Eighth Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE 2012)*. Stanford, California. 2012.
- Tatdow Pansombut, William Hendrix, Jacob Gao, Brent Harrison, and Nagiza Samatova. Biclustering-Driven Ensemble of Bayesian Belief Network Classifiers for Underdetermined Problems. *International Joint Conferences on Artificial Intelligence*. Barcelona, Spain, 2011.
- Brent Harrison and David L. Roberts. Using Sequential Observations to Model and Predict Player Behavior. In *Proceedings of the 2011 Foundations of Digital Games Conference*. Bordeaux, France, 2011.

- Brent Harrison, Tatdow Patsombut, Dennis Bahler, and Nagiza F. Samatova. Improving the Performance of Bayesian Belief Network Classifiers via Decision Tree Based Feature Selection. In *Proceedings of IKE*. Las Vegas, Nevada, USA, 2010.

### Refereed Workshop and Symposium Papers

- Brent Harrison, Siddhartha Banerjee and Mark Riedl. Learning from Stories: Using Natural Communication to Train Believable Agents. *Proceedings of the IJCAI'16 Workshop on Interactive Machine Learning*, New York City, 2016.
- Brent Harrison and Mark O. Riedl. Towards Learning From Stories: An Approach for Interactive Machine Learning. *Proceedings of the AAAI Workshop on Symbiotic Cognitive Systems*, Phoenix, Arizona, 2016.
- Mark O. Riedl and Brent Harrison. Using Stories to Teach Human Values to Artificial Agents. *Proceedings of the 2nd International Workshop on AI, Ethics and Society*, Phoenix, Arizona, 2016.
- Arpan Chakraborty, Brent Harrison, Pu Yang, David L. Roberts, and Robert St. Amant. Exploring Key-Level Analytics for Computational Modeling of Typing Behavior. In *Proceedings of the 2014 Symposium and Bootcamp on the Science of Security (HotSoS 14)*. 2014.
- Brent Harrison. Creating Model-Based Adaptive Environments Using Game-Specific and Game-Independent Analytics. In AAAI Doctoral Consortium Bellevue, Washington, 2013.
- Brent Harrison and David L. Roberts. A Review of Student Modeling Techniques in Intelligent Tutoring Systems. In The First Workshop on Artificial Intelligence for Serious Games at the 2012 AI and Interactive Digital Entertainment Conference (AIIDE), Stanford, California, 2012.
- Brent Harrison. Creating Model-Based Adaptive Environments Using Game-Specific and Game-Dependent Analytics. In The First Doctoral Consortium at the 2012 AI and Interactive Digital Entertainment Conference (AIIDE), Stanford, California, 2012.
- Stephen G. Ware, Brent Harrison, R. Michael Young, and David L. Roberts. Initial Results for Measuring Four Dimensions of Narrative Conflict. Fourth Workshop on Intelligent Narrative Technologies (INT 4).

### Refereed Book Chapters

- Brent Harrison, Jason Smith, Stephen G. Ware, et al. Frequent Subgraph Mining. In *Practical Graph Mining with R*. Nagiza Samatova ed. CRC Press. 2013.
- Kanchana Padmanabhan, Brent Harrison, Kevin Wilson, et al. Cluster Analysis. In *Practical Graph Mining with R*. Nagiza Samatova ed. CRC Press. 2013.

### Invited Talks

- AI in Storytelling. Auburn University. October 30<sup>th</sup> 2014.
- Analytics-Driven Game Design. Auburn University. October 29<sup>th</sup> 2014.
- Game Analytics: Fighting for the User. IGDA North Carolina-Triangle Professional Chapter. June 11<sup>th</sup> 2013.

## Employment

- Research Scientist, Georgia Institute of Technology

*August 2014 to Present*

Currently researchers using crowdsourced knowledge of cultural and social behavior to create believable NPCs in a virtual environment using reinforcement learning techniques. These algorithms allow for crowds to train virtual characters to exhibit believable behavior. These algorithms also enable individuals without a background in statistics or machine learning to train NPCs to exhibit a variety of different behaviors.

- Machine Learning Intern, Epic Games *May 2014 to August 2014*
- Research Assistant, NCSU *Jan 2009 to Jun 2009, Jun 2010 to May 2014*  
 Researched the application of game analytics to the creation of adaptive game environments. Studied the effect that these environments had on player engagement and intrinsic motivation. Studied to detection of bots in social games by analyzing low-level user input data (such as mouse and keyboard inputs). Researched if similar techniques could be applied to detecting deceptive play in game environments. Studied the application of Bayesian Networks to the construction of transcription regulatory networks using gene expression data.
- Teaching Assistant, NCSU *Aug 2008 to Dec 2008, Aug 2009 to Dec 2009*
- Research Assistant, Auburn *Jun 2007 to Aug 2008*  
 Helped develop a cognitive architecture meant to model a driver and the cognitive load experienced during normal automobile operation.

## Awards

- *Best Paper Nominee, FDG* *2015*
- *Exceptional Full Paper, FDG* *2014*
- *Best Paper Nominee, CIG* *2013*
- *Best Paper Winner, ICIDS* *2012*
- Dean's Fellowship, NCSU *Aug 2008*

## Teaching

- Guest Lecturer: Introduction to Artificial Intelligence *Fall 2015*
- Instructor: Introduction to Artificial Intelligence *Summer 2015*  
*Student Evaluation for Overall Effectiveness: 4.8*
- Guest Lecturer: Game AI *Spring 2015*
- Guest Lecturer: Introduction to Artificial Intelligence *Spring 2015*
- Teaching Assistant: Senior Design Project *Fall 2012*
- Guest Lecturer: Game AI *Fall 2011*  
 Title: Introduction to Player Modeling Techniques in Games
- Teaching Assistant: Automated Learning and Data Analysis *Fall 2010*
- Teaching Assistant: Introduction to Artificial Intelligence *Fall 2009*
- Teaching Assistant: Data Structures *Fall 2009*
- Teaching Assistant: Operating Systems Principles *Fall 2008*

## Advising and Mentoring

- Michael Clifton, Computer Science Undergraduate *Fall 2013*  
 Advised for one semester on creating a procedurally generated text adventure game.
- Thomas Hege, Computer Science Undergraduate *Spring 2013 – Fall 2013*  
 Advised for two semesters on creating an adaptive platform game that was, at least partially, procedurally generated.

## Professional Activities

- Program Committee Member: *International Conference on Autonomous Agents and Multiagent Systems* 2016
- Program Committee Member: *International Joint Conference on Artificial Intelligence* 2016
- External Reviewer: *AAAI Conference on Artificial Intelligence* 2015
- Senior Program Committee Member: *Foundations of Digital Games* 2014
- External Reviewer: *International Joint Conference on Artificial Intelligence* 2013
- External Reviewer: *Foundations of Digital Games* 2013
- External Reviewer: *Artificial Intelligence and Interactive Digital Entertainment* 2011, 2012, 2013
- Reviewer: *Transactions on Computational Intelligence and AI in Games* 2012, 2013, 2014
- External Reviewer: *International Conference on Autonomous Agents and Multiagent Systems* 2010, 2011

## Press

### Quixote:

- <http://www.news.gatech.edu/2016/02/12/using-stories-teach-human-values-artificial-agents>
- <http://www.cnet.com/news/fairy-tales-teach-robots-not-to-murder/>
- <http://www.newsweek.com/artificial-intelligence-taught-ethics-reading-books-426663>

### Achievement Prediction in World of Warcraft:

- <https://news.ncsu.edu/2011/06/wmsrobertspredict/>

## References

Professional, academic, and personal references are available upon request.