

# Stephen G. Ware

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Updated October 14, 2016

## Biography

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Stephen G. Ware is an Assistant Professor of Computer Science at the University of New Orleans where he directs the Narrative Intelligence Lab and oversees the Game Development Concentration.

Prof. Ware's research applies artificial intelligence techniques to model and reason about narratives, especially generating and adapting narratives in real time interactive virtual environments such as video games, training simulations, and tutoring systems. His work has earned three best paper awards to date. Since he joined the faculty of the University of New Orleans in 2014, Prof. Ware has received over \$450,000 in sponsored research funding from federal, state, and local agencies, including almost \$300,000 from the National Science Foundation, where he has served as a panelist.

Prof. Ware serves as a referee for the IEEE Transactions on Computational Intelligence and Artificial Intelligence in Games journal since 2013. He has also served as organizer or program committee member for top conferences and workshops in his field, including the AAAI International Conference for Artificial Intelligence and Interactive Digital Entertainment, International Conference on Intelligent Virtual Agents, International Conference on Interactive Digital Storytelling, Foundations of Digital Games, Intelligent Narrative Technologies, and Computational Models of Narrative.

Prof. Ware teaches classes in artificial intelligence, automated planning, and game development. He is proud to be part of the continuing effort to bring computer science research and the technology industry back to New Orleans after many universities cut these program in the wake of hurricane Katrina. He works with economic development groups and local game development studios to attract digital media companies to New Orleans.

## Interests

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- artificial intelligence
- computational models of narrative
- fast multi-agent planning
- plan recognition
- entertaining and educational games
- human computer interaction
- computational cognitive science
- narrative theory

## Professional Experience

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Fall 2014 to Present     Assistant Professor  
Director, Narrative Intelligence Lab  
University of New Orleans, Department of Computer Science

Spring 2014 to Summer 2014     Research Assistant  
North Carolina State University, Department of Computer Science

Spring 2013 to Fall 2013     Teaching Assistant  
North Carolina State University, Department of Computer Science

Summer 2013     Instructor  
North Carolina State University, Department of Computer Science

Fall 2009 to Fall 2012     Research Assistant  
North Carolina State University, Department of Computer Science

Summer 2009     Instructor  
North Carolina State University, Department of Computer Science

Fall 2008 to Spring 2009     Teaching Assistant  
North Carolina State University, Department of Computer Science

Summer 2007     Software Engineer, Intern  
DAXCO Inc. Birmingham AL, USA

## Education

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

June 2014     Doctor of Philosophy in Computer Science  
Thesis: *A Plan-Based Model of Conflict for Narrative Reasoning and Generation*  
Advisor: Professor R. Michael Young

May 2011     Master of Science in Computer Science, GPA 4.0 / 4.0

**Loyola University New Orleans**     New Orleans LA, USA

May 2008     Bachelor of Science, Summa Cum Laude with University Honors, GPA 4.0 / 4.0  
Majors in Computer Science and Philosophy  
Thesis: *Merlin's Bear and Odin's Eye: A Survey of the Wizard Archetype in Literature, Opera, and Cinema.*  
Advisor: Professor William T. Cotton, English Department

## Awards and Honors

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- March 2, 2016 Oral Presentation Award, 4<sup>th</sup> Place (awarded to Ashim Sitoula)  
Innovate UNO, Undergraduate Research Symposium
- October 2014 Best Student Paper  
10<sup>th</sup> AAAI International Conference on Artificial Intelligence and Interactive  
Digital Entertainment
- July 2012 Best Paper  
International Conference on Interactive Digital Storytelling
- May 2012 Best Student Paper on a Cognitive Science Topic  
Computational Models of Narrative Workshop
- April 2010 Honorable Mention, Graduate Research Fellowship  
U.S. National Science Foundation
- March 2010 Outstanding Teaching Assistant  
North Carolina State University Graduate Student Association
- August 2009 Dean's Fellowship  
North Carolina State University, Department of Computer Science
- May 2008 William T. Cotton Service Award  
Loyola University New Orleans
- May 2008 Percy A. Roy S.J. Award for Highest Grade Point Average  
Loyola University New Orleans, College of Humanities and Natural Sciences
- May 2008 Outstanding Computer Science Major  
Loyola University New Orleans, Dept. of Mathematics and Computer Science
- May 2008 Guy Lemieux S.J. Award for Excellence in Philosophy  
Loyola University New Orleans, Department of Philosophy
- May 2004 Ignatian Scholarship  
Loyola University New Orleans

## Sponsored Research

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- August 2016 to July 2017 *EAGER: Planning Believable Narratives by Modeling Agent Beliefs*  
Role: Principal Investigator  
US National Science Foundation  
\$156,969
- July 2016 to June 2017 *Bringing Use-of-Force Training Simulations into Virtual Reality*  
Role: Principal Investigator  
University of New Orleans Office of Research and Sponsored Programs  
\$14,982

- November 2015 to June 2016 *Intelligent Planning of Interactive Narratives to Teach Best Practices*  
 Role: Principal Investigator  
 University of New Orleans Office of Research and Sponsored Programs  
 \$20,000
- May 2015 to Present *CRII: CHS: Structuring Narratives in Interactive Virtual Environments Using Computational Models of Possible Worlds*  
 Role: Principal Investigator  
 US National Science Foundation  
 \$138,436
- May 2015 to May 2016 *Creating an Interdisciplinary Digital Media Laboratory*  
 Role: Principal Investigator  
 Louisiana Board of Regents, Enhancement Program  
 \$110,042
- May 2015 to August 2015 *Reading Rocket: A Game-Based Reading Level Test for Children Based on Stealth Assessment*  
 Role: Principal Investigator  
 University of New Orleans Office of Research and Sponsored Programs  
 \$11,800

## Publications

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### Refereed Journal Articles

- [1] Stephen G. Ware, R. Michael Young, "Intentionality and conflict in *The Best Laid Plans* interactive narrative virtual environment," *IEEE Transactions on Computational Intelligence and Artificial Intelligence in Games*, 2015 (forthcoming).
- [2] Brent Harrison, Stephen G. Ware, Matthew William Fendt, and 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 Special Issue on MMO Technologies*, vol. 3, num. 2, pp. 260-274, 2014.
- [3] Stephen G. Ware, R. Michael Young, Brent Harrison, and David L. Roberts, "A computational model of narrative conflict at the fabula level," *IEEE Transactions on Computational Intelligence and Artificial Intelligence in Games*, vol. 6, num. 3, pp. 271-288, 2014.
- [4] R. Michael Young, Stephen G. Ware, Bradly A. Cassell, Justus Robertson, "Plans and planning in narrative generation: a review of plan-based approaches to the generation of story, discourse, and interactivity in narratives," *SDV. Sprache und Datenverarbeitung, Special Issue on Formal and Computational Models of Narrative*, vol. 37, num. 1-2, pp. 41-64, 2013.

### Refereed Journal Articles in Preparation and Under Review

- [1] Stephen G. Ware and R. Michael Young, "The Glaive Narrative Planning System," *Journal of Artificial Intelligence Research*, 2016.

## Refereed Conference Papers

- [1] Rachelyn Farrell and Stephen G. Ware, "Predicting user choices in interactive narratives using Indexter's pairwise event salience hypothesis," in *Proceedings of the 9<sup>th</sup> International Conference of Interactive Digital Storytelling*, (forthcoming). 36% acceptance rate
- [2] Rachelyn Farrell, Scott Robertson, and Stephen G. Ware, "Asking hypothetical questions about stories using QUEST," in *Proceedings of the 9<sup>th</sup> International Conference of Interactive Digital Storytelling*, (forthcoming). 36% acceptance rate
- [3] Rachelyn Farrell and Stephen G. Ware, "Fast and diverse narrative planning through novelty pruning," in *Proceedings of the 12<sup>th</sup> AAAI International Conference of Artificial Intelligence and Interactive Digital Entertainment*, pp. 37-43, 2016. 28% acceptance rate
- [4] Christopher Kives, Stephen G. Ware, and Lewis J. Baker, "Evaluating the Pairwise Event Salience Hypothesis in Indexter," in *Proceedings of the 11<sup>th</sup> AAAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 30-36, 2014. 28% acceptance rate
- [5] Stephen G. Ware and R. Michael Young, "Glaive: a state-space narrative planner supporting intentionality and conflict," in *Proceedings of the 10<sup>th</sup> AAAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 80-86, 2014 (awarded Best Student Paper). 26% acceptance rate
- [6] Rogelio E. Cardona-Rivera, Justus Robertson, Stephen G. Ware, Brent Harrison, David L. Roberts, and R. Michael Young, "Foreseeing meaningful choices," in *Proceedings of the 10<sup>th</sup> AAAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 9-15, 2014. 26% acceptance rate
- [7] Stephen G. Ware, R. Michael Young, Brent Harrison, and David L. Roberts, "Four quantitative metrics describing narrative conflict," in *Proceedings of the 5<sup>th</sup> International Conference on Interactive Digital Storytelling*, pp. 18-29, 2012. 29% acceptance rate
- [8] Matthew William Fendt, Brent Harrison, Stephen G. Ware, Rogelio E. Cardona-Rivera, and David L. Roberts, "Achieving the illusion of agency," in *Proceedings of the 5<sup>th</sup> International Conference on Interactive Digital Storytelling*, pp. 114-125, 2012 (awarded Best Paper). 29% acceptance rate
- [9] Stephen G. Ware and R Michael Young, "Validating a plan-based model of narrative conflict," in *Proceedings of the International Conference on the Foundations of Digital Games*, pp. 220-227, 2012. 29% acceptance rate
- [10] Stephen G. Ware and R. Michael Young, "CPOCL: a narrative planner supporting conflict," in *Proceedings of the 7<sup>th</sup> AAAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 97-102, 2011. 35% acceptance rate
- [11] Stephen G. Ware and R. Michael Young, "Modeling narrative conflict to generate interesting stories," *Proceedings of the 6<sup>th</sup> AAAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 210-215, 2010. (full paper presented as poster) 33% acceptance rate for full papers presented as posters

## **Strongly Refereed Workshop and Consortium Papers**

- [1] Stephen G. Ware, "The Intentional Fast-Forward narrative planner," in *Proceedings of the 5th Intelligent Narrative Technologies Workshop at the 8th AAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 57-62, 2012.
- [2] Rogelio E. Cardona-Rivera, Bradley A. Cassell, Stephen G. Ware and R. Michael Young, "Indexer: a computational model of the Event-Indexing Situation Model for characterizing narratives," in *Proceedings of the 3<sup>rd</sup> Workshop on Computational Models of Narrative at the Language Resources and Evaluation Conference*, pp. 34-43, 2012 (awarded Best Student Paper on a Cognitive Science Topic).
- [3] Stephen G. Ware, Brent Harrison, R. Michael Young, and David L. Roberts, "Initial results for measuring four dimensions of narrative conflict," in *Proceedings of the 4th Workshop on Intelligent Narrative Technologies at the 7th AAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 115-122, 2011.
- [4] Stephen G. Ware, "A computational model of narrative conflict," Doctoral Consortium at the *International Conference on the Foundations of Digital Games*, 2011.
- [5] Stephen G. Ware and R. Michael Young, "Rethinking traditional planning assumptions to facilitate narrative generation," in *Proceedings of the AAI Fall Symposium on Computational Models of Narrative*, pp. 71-72, 2010.

## **Refereed Book Chapters**

- [1] Stephen G. Ware, "An introduction to Graph Theory," *Practical Graph Mining with R*. CRC Press, pp. 9-26, 2012.
- [2] Brent Harrison, Jason Smith, Stephen G. Ware, "Frequent subgraph mining," *Practical Graph Mining with R*. CRC Press, pp. 181-221, 2013.

## **Refereed Demonstrations**

- [1] Nathan R. Sturtevant, Jeff Orkin, Robert Zubek, Michael Cook, Stephen G. Ware, Christian Stith, R. Michael Young, Phillip Wright, Squirrel Eiserloh, Alejandro Ramirez-Sanabria, Vadim Bulitko, Kieran Lord, "Playable experiences at AIIDE 2014," in *Proceedings of the 10<sup>th</sup> AAI International Conference on Artificial Intelligence and Interactive Digital Entertainment*, pp. 203-209, 2014.

## **Software Demonstrations**

- [1] Stephen G. Ware, R. Michael Young, Christian Stith, and Phillip Wright, "Interactive narrative planning in *The Best Laid Plans*," in *Proceedings of the 29<sup>th</sup> Association for the Advancement of Artificial Intelligence Conference*, Virtual Agents Demonstrations, 2015.

## **Non-Refereed Publications**

- [1] Stephen G. Ware, R. Michael Young, Christian Stith, Phillip Wright, "Interactive Narrative Planning in *The Best Laid Plans*," in *Proceedings of the AI Open House at the 29<sup>th</sup> Conference of the Association for the Advancement of Artificial Intelligence*, pp. 4313-4314, 2015.

- [2] Oliver Gown, Arne Eigenfeldt, Rania Hodhod, Philippe Pasquier, Reid Swanson, Stephen G. Ware, and Jichen Zhu, "Reports on the 2012 AIIDE workshops," *AI Magazine*. 2012, vol. 34:1, pp. 90.
- [3] Stephen G. Ware, "Crossed swords and broken hearts: a computational model of narrative conflict." Poster, North Carolina State University Graduate Research Symposium. 2012.

### **Non-Computer Science Publications**

- [1] Stephen G. Ware, "The Wise Old Man as the archetype of the spirit," *Reader's Response*. Loyola University Press. 2009.
- [2] Stephen G. Ware, "Nobody's problem: a response to Thomas Metzinger's *Being No One*," *Elenchos: The Loyola Undergraduate Journal of Philosophy*. 2008.

### **Professional Organizations**

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Association for the Advancement of Artificial Intelligence (member #53757)

Association for Computing Machinery (member #2211285)

Institute of Electrical and Electronics Engineers (member #92209981)

International Game Developers Association (member #22066812)

Phi Sigma Tau, Philosophy Honor Fraternity

Alpha Sigma Nu, International Jesuit Honors Fraternity

### **Professional Service**

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#### **Funding Panels and Reviews**

May 2015      National Science Foundation, CISE Directorate  
Arlington, VA, USA

#### **Journal Referee**

October 2013    IEEE Transactions on Computational Intelligence and Artificial Intelligence in  
to Present      Games

#### **Conference and Workshop Organization**

July 2016      Organizer, 7<sup>th</sup> Workshop on Computational Models of Narrative  
Co-Located with the 2016 Digital Humanities Conference  
Kraków, Poland

October 2012 Organizer, 5<sup>th</sup> Workshop on Intelligent Narrative Technologies  
Co-Located with the 8<sup>th</sup> AAAI Conference on Artificial Intelligence and  
Interactive Digital Entertainment  
Stanford University, Palo Alto CA, USA

## **Conference and Workshop Program Committees**

AAAI International Conference on Artificial Intelligence and Interactive Digital Entertainment

- 12<sup>th</sup> Conference, Burlingame, CA, USA, October 2016
- 11<sup>th</sup> Conference, University of California Santa Cruz, Santa Cruz, CA, USA, November 2015
- 10<sup>th</sup> Conference, North Carolina State University, Raleigh, NC, USA, October 2014

International Conference on Interactive Digital Storytelling

- 9<sup>th</sup> Conference, Institute for Creative Technologies, Los Angeles, CA, USA, November 2016
- 5<sup>th</sup> Conference, Technological Park, San Sebastián, Spain, November 2012

International Conference on Intelligent Virtual Agents

- 15<sup>th</sup> Conference, Delft University of Technology, Delft, The Netherlands, August 2015

Foundations of Digital Games Conference

- Royal Caribbean Liberty of the Seas, April 2014
- Raleigh, North Carolina, USA, May 2012

Intelligent Narrative Technologies Workshop

- 8<sup>th</sup> Workshop, University of California Santa Cruz, Santa Cruz, CA, USA, November 2015
- 7<sup>th</sup> Workshop, University of Wisconsin-Milwaukee, Milwaukee WI, USA, June 2014
- 6<sup>th</sup> Workshop, Northeastern University, Boston MA, USA, October 2013
- 5<sup>th</sup> Workshop, Stanford University, Palo Alto CA, USA, October 2012

Computational Models of Narrative Workshop

- 7<sup>th</sup> Workshop, Kraków, Poland, July 2016
- 4<sup>th</sup> Workshop, University of Hamburg, Berlin, Germany, August 2013

## **Invited Panels**

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November 2012 Panelist, *Expert Panel*

5<sup>th</sup> International Conference on Interactive Digital Storytelling  
Technological Park, San Sebastián, Spain

October 2012 Moderator, *The Near Future of Intelligent Narrative Technologies*

5<sup>th</sup> Workshop on Intelligent Narrative Technologies  
Stanford University, Palo Alto CA, USA



February 2012 Panelist, *Two Cultures: Crossing the Divide*  
Collaborations: Humanities and Technology Festival  
Duke University, Durham NC, USA

## Teaching

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### Classes Taught, University of New Orleans

CSCI 6645: *Planning in Artificial Intelligence*

Fall 2016: 7 graduate

Fall 2015: 14 graduate (taught as *CSCI 6990: Special Topics*)

CSCI 4525 / 5525: *Introduction to Artificial Intelligence*

Spring 2016: 17 undergraduate, 3 graduate

Spring 2015: 19 undergraduate, 14 graduate

CSCI 4675 / 5675: *Advanced Game Development*

Spring 2016: 7 undergraduate, 3 graduate

CSCI 4670 / 5670: *Fundamentals of Game Development*

Fall 2016: 13 undergraduate, 2 graduate

Fall 2015: 10 undergraduate, 10 graduate

Fall 2014: 11 undergraduate, 2 graduate

### Classes Taught, North Carolina State University

CSC 316: *Data Structures for Computer Scientists*

Summer 2013: 21 undergraduate

CSC 216: *Programming Concepts – Java*

Summer 2009: 12 undergraduate

### Teaching Assistantships and Guest Lectures, North Carolina State University

CSC 522: Automated Learning and Data Analysis (Data Mining)

CSC 565: Graph Theory

CSC 326: Software Engineering

CSC 281: Foundations of Interactive Game Design

CSC 295: Foundations of Game Design

## Research Supervised

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### Doctor of Philosophy, University of New Orleans

- Summer 2015 to Present Rachelyn Farrell (degree in progress)  
Topic: Fast multi-agent narrative planning in a network of possible worlds.
- Fall 2015 to Present Edward Garcia (degree in progress)  
Topic: Narrative planning for teaching best practices in training simulations.
- Fall 2016 to Present Oluwatosin King (degree in progress)  
Topic: Micronarratives in simple games for assessment of reading level

### Master of Science, University of New Orleans

- Fall 2015 to Present Dharmesh Desai (degree in progress)  
Topic: Police training in a virtual use-of-force simulation
- Spring 2016 to Present Dustin Peabody (degree in progress)  
Topic: Machine learning to predict win rates in *League of Legends*
- Spring 2015 to Present Chris Kives (degree in progress)  
Topic: Fast multi-agent narrative planning in a network of possible worlds

### Bachelor of Science, University of New Orleans

- Spring 2016 Ashim Sitoula  
Privateer Undergraduate Research and Scholarly UNO Experience
- Spring 2016 Pujan Pokhrel  
UNO Collage of Sciences Undergraduate Research Program
- Spring 2016 Scott Robertson, Hung Le  
Independent Study
- Fall 2015 to Spring 2016 Abhishek Sapkota  
UNO Collage of Sciences Undergraduate Research Program
- Summer 2015 Rodrigo Rodrigues do Carmo, Maurice Robert III  
*Reading Rocket: A Game-Based Reading Level Test for Children Based on Stealth Assessment*
- Summer 2015 Thiago Vieira, Gabriel Miranda  
Brazil Scientific Mobility Program
- Spring 2015 Gabriel Queiroz, Rodrigo Rodrigues do Carmo  
Independent Study
- Spring 2015 Christopher Toups  
Independent Study

## **Bachelor of Science, North Carolina State University**

Fall 2013      Christian Stith, Phillip Wright  
Fall 2012      Eric Lang, Zack Litzsinger  
Spring 2011    Evan Kochuk, Courtney Harrison

## **Institutional Service**

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### **University of New Orleans**

Fall 2015      Faculty Advisor  
to Present    International Game Developers Association, Student Chapter  
Fall 2015      Undergraduate Studies Committee  
to Present    Department of Computer Science  
Fall 2015      Action Team for the recruitment and retention of active military and veterans

### **North Carolina State University**

Spring 2009 to    Tutoring Coordinator for CSC 116: Introduction to Programming  
Fall 2010      STARS Alliance: Students and Technology in Academia, Research, and Service

### **Loyola University New Orleans**

Fall 2006 to    President  
Spring 2008    Loyola University Gaming Society  
Fall 2006 to    President  
Spring 2007    Philosophy Club

## **Research Software**

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[1] Project Lead, *Reading Rocket*

A data-driven game-based assessment tool for measuring reading level in middle school children.

<http://nil.cs.uno.edu/projects/readingrocket>

[2] Author, *Glaive Narrative Planner*

A fast multi-agent planner that coordinates cooperative and conflicting agents toward a single goal using only actions consistent with each individual's goals. Integrates intentional domain graphs into Hoffmann's Fast-Forward heuristic for significant speedups on intentional planning problems.

<http://nil.cs.uno.edu/projects/glaive>

[3] Project Lead and AI Programmer, *The Best Laid Plans*

An adventure game created with the Unity 3D engine in which the story is generated and adapted entirely at run time by multi-agent narrative planning technology.

<http://liquidnarrative.csc.ncsu.edu/blp/>

[4] Project Lead, *MOOLA: Multi-User Dungeon Object-Oriented Little Adventures*

A highly-customizable rapid prototyping environment for interactive narratives and multi-agent planning technology.

[5] Author, *simple-SAT*

An education-focused classical planner which reduces planning problems to satisfiability axioms similar to the BlackBox planner.

<http://www4.ncsu.edu/~stamant/simple-planners/simple-planners.html>

[6] Author, *WebPlan*

A web service for using classical planning algorithms.

<http://webplan.csc.ncsu.edu/>

## Publicity

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- 26 July, 2016 “Computer Science Professor Wins \$157,000 NSF Grant to Study Narrative Intelligence,” University of New Orleans Campus News, uno.edu. [Link]
- 31 May, 2016 “Game On: UNO’s Video Game Development Concentration Simulates Real World Experience,” University of New Orleans Campus News, uno.edu. [Link]
- 13 May, 2015 “University of New Orleans to get new digital media lab,” by Jed Lipinski, NOLA.com. [Link]
- 26 February, 2015 Guest on *All Things Considered*, WWNO National Public Radio, New Orleans, LA. Discussed computer science at the University of New Orleans, narrative intelligence, and the future of AI. [Link]
- 12 February, 2015 Guest on *Think Tank* with Garland Robinette, WWL Radio, New Orleans, LA. Discussed narrative intelligence, the future of AI, and higher education in New Orleans. [Link]
- 10 February, 2015 “UNO professor gets grant to study artificial intelligence,” by Maria Clark, neworleanscitybusiness.com. [Link]
- 9 February, 2015 “UNO professor wins National Science Foundation grant for artificial intelligence research,” by Jed Lipinski, NOLA.com. [Link]