

Dr. MATTHEW JOHNSON
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Bio: Dr. Matthew Johnson is a research scientist in the area of human-machine teaming for technologies such as robotics, software agents, and autonomous vehicles, in a variety of domains including disaster response, space applications, aviation, and military operations. Matt came to the Florida Institute for Human & Machine Cognition (IHMC) out of the military where he served as a Naval Aviator, flying both fixed wing aircraft and helicopters. Matt continued in the Navy Reserves retiring after 20 years of service. Matt obtained his undergraduate degree in Aerospace Engineering at the University of Notre Dame prior to entering the Navy. He obtained a Master of Science in Computer Science from Texas A&M – Corpus Christi while on active duty. He completed his PhD from Delft University in the Netherlands; his thesis proposed a new approach to human-machine system design called Coactive Design. Matt has been a researcher for over 19 years with IHMC. He has worked on numerous projects including the Oz flight display for reducing the cognitive workload in the cockpit, DARPA Augmented Cognition for improving human performance, and several human-robot coordination projects for both NASA and the Department of Defense. He played a leadership role in IHMC’s 2nd place finish at the international robotics competition known as the DARPA Robotics Challenge. He has worked with Nissan on fleet management of autonomous vehicles and AeroVironment on the management of multiple unmanned aircraft. Matt was also part of the DARPA ALIAS project focused on developing a robotic copilot. He is currently working on DARPA ASIST which is studying how AI can facilitate teamwork within a human team and DARPA CREATE which is investigating context reasoning for autonomous teaming. He also continues to work with both the local police department and SWAT unit on their drone program. Matthew’s research interest focuses on improving performance in human-machine systems through design of more effective human-machine teamwork.

Education

<u>Institution</u>	<u>Major</u>	<u>Degree</u>	<u>Year</u>
Delft University of Technology, Delft, The Netherlands	Computer Science	Ph.D., Cum Laude	2014
Texas A&M – Corpus Christi, Corpus Christi, Texas	Computer Science	M.S.	2001
University of Notre Dame, South Bend, Indiana	Aerospace Engineering	B.S.	1992

Research Interests

Autonomy, Human-Machine System Design, Human-Machine Teamwork, Human-Robot Interaction, Trust, Robotics, Control Theory, Interface Design, Artificial Intelligence, Data visualization, Software Engineering.

Professional Experience

2014- present Research Scientist, Institute for Human and Machine Cognition
2002-2014 Research Associate, Institute for Human and Machine Cognition
2001-2012 U.S. Navy Reserves Flight Instructor, Training Air Wing Five
2000-2001 U.S. Navy Senior Officer of IT Division, Training Air Wing Four
1992-2001 U.S. Naval Aviator Active Duty

Selected Recent Projects

- DARPA Context Reasoning for Autonomous Teaming (CREATE) – (2019-present) [PI] CREATE aims to explore the utility of artificial intelligence (AI) on the autonomous formation of scalable

machine-to-machine teams capable of reacting to and learning from unexpected missions in the absence of centralized communication and control.

- DARPA Artificial Social Intelligence for Successful Teams (ASIST) - (2019-present) – [PI] ASIST will work to create agents that demonstrate a machine Theory of Mind and the ability to participate in an effective team by representing and helping to maintain shared models.
- Developing Drone program for local SWAT (2019-present) – [PI]
- Developing Drone program for local police department (2018-present) – [PI]
- Working with AeroVironment to develop operations centers for large scale unmanned aircraft operations (2017-2019) [PI]
- *Humanoid Avatar Robots for Co-exploration of Hazardous Environments* (2012-2018) – Co-principal Investigator for this NRI project exploring the role and effectiveness of humanoid robots as avatars in hazardous environments. Developing humanoid behaviors and advanced interface concepts to enable complex work using both Boston Dynamics Atlas robot and NASA’s Valkyrie robot.
- *Aircrew Labor In-Cockpit Automation System (ALIAS)* (2015-2016) – [PI] Subcontractor to Humatics/Aurora Flight Services developing a robotic copilot. Our role was developing a knowledge acquisition process that captures the knowledge necessary for all aspects of flight and is extensible across heterogeneous airframes.
- *Context Augmented Robotic Interaction Layer* (2014-2017) – Co-principal investigator collaborating with CHI systems on this NASA SBIR developing a framework for representing context, and for using this context to enable robot adaptive decision-making and behavior in NASA mission related scenarios.
- *Fleet Management Services* (2015-2016) – Co-principal Investigator for this collaboration with Nissan and NASA. IHMC works on hierarchical interfaces in support of managing fleets of autonomous vehicles and those assisting them.
- *DARPA Robotics Challenge* (2012-2015) – Co-principal Investigator for IHMC and lead human-machine system designer. Our team placed first or second in all three phases of this international competition with over 46 teams competing across three years of competition.

Recent Lectures, Tutorials and Presentations

16 OCT 2019: Assured Autonomy Workshop

29 JUL 2019: Human Computer Interaction (HCI) conference

08 MAY 2019: Defense Science Board: Counter Autonomy

02 OCT 2018: NASA Blue Sky Presentation: What Makes a Good Robotic Surgery Assistant?

11 SEP 2018: NASA Webcast: Automation Myths and the Virtues of Human-Machine Teaming

09 JUL 2018: Panelist for USN National Academies’ workshop on Multi-Domain Autonomous Systems

12 MAR 2018: NASA Autonomous Systems Capability Leadership Team talk on Human-Machine Teaming

06 FEB 2018: Two-day workshop on Function and Hazard Assessment for UAS operations

30 NOV 2017: Embry-Riddle President's Symposium: “The Future Role of AI and Autonomy for UAS”

22 AUG 2017: HRT Summer School invited speaker: “Human-Machine Teaming”

25 MAY 2017: John’s Hopkins Applied Physics Lab: “The Future of Humans & Machines”

Selected Publications (complete list at <https://www.ihmc.us/groups/mjohnson/>)

1. Johnson, M. and Vera, A. (2019). **No AI is an Island: The Case for Teaming Intelligence**. AI Magazine (Spring 2019 issue).
2. Johnson, M., Vignati, M., & Duran, D. (2018). **Understanding Human-Autonomy Teaming through Interdependence Analysis**. In *NATO HFM-300 Symposium on Human Autonomy Teaming (presented at HFM-300 Symposium pending publication)*.

3. Johnson, M., Bradshaw, J. M., & Feltovich, P. J. (2017). **Tomorrow's Human-Machine Design Tools: From Levels of Automation to Interdependencies.** *Journal of Cognitive Engineering and Decision Making.*
4. Johnson, M., Shrewsbury, B., Bertrand, S., Calvert, D., Wu, T., Duran, D., Stephen, D., Mertins, N., Carff, J., Rifenburg, W. and Smith, J. (2017). **Team IHMC's Lessons Learned from the DARPA Robotics Challenge: Finding Data in the Rubble.** *Journal of Field Robotics*, 34(2), 241-261.
5. Johnson, M., J.M. Bradshaw, P. J. Feltovich, C. M. Jonker, M. B. van Riemsdijk, and M. Sierhuis. (2104) **Coactive design: Designing support for interdependence in joint activity.** *Journal of Human-Robot Interaction*, Vol. 3, No. 1, pp. 43-69.
6. Johnson, M., Bradshaw, J. M., Hoffman, R. R., Feltovich, P. J., & Woods, D. D. (2014). **Seven Cardinal Virtues for Human-Machine Teamwork: Examples from the DARPA Robotic Challenge.** *IEEE Intelligent Systems*, November/December 2014 (vol. 29 iss. 6), pp. 74-80.
7. Bradshaw, J. M., Hoffman, R. R., Johnson, M., & Woods, D. D. (2013). **The Seven Deadly Myths of "Autonomous Systems."** *IEEE Intelligent Systems*, 28(3), 54-61. doi:10.1109/MIS.2013.70
8. Bradshaw, J. M., P. J. Feltovich, and M. Johnson. (2011) **"Human-Agent Interaction."** Chap. 13 In *Handbook of Human-Machine Interaction*, edited by G. Boy. 293-302: Ashgate.
9. Johnson, M., Bradshaw, J. M., Feltovich, P. J., Hoffman, R. R., Jonker, C. M., van Riemsdijk, M. B., & Sierhuis, M. (2011). **Beyond Cooperative Robotics: The Central Role of Interdependence in Coactive Design.** *IEEE Intelligent Systems*, 26, 81-88.
10. Hoffman, R. R., Johnson, M., Bradshaw, J. M., & Underbrink, A. (2013). **Trust in automation.** *IEEE Intelligent Systems*, 28(1).

Synergistic Activities

- NASA ECF review panel (2019)
- NSF Review panel (2019)
- UWF Intelligent Systems PhD program Coordinator for IHMC (2018-2019)
- HFES Human Factors Award Review Committee (2018-2019)
- Assisted in organization of NASA Autonomous Crew Operations TIM (Aug 2018)
- Organizer of workshop on Human-Agent-Robot-Teamwork (2015)
- Volunteer Science Saturday Youth Education Teacher (2002-2019)

Student Mentoring and Advising

- UWF PhD student advisor (2020-present)
- Georgia Tech PhD committee member (2018-2019)
- Help mentor seven Naval Post Graduate Masters students (2015-2017)
- MIT PhD committee member (2015-2016)