

Micah H. Clark

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RESEARCH INTERESTS:

adversary modeling, AI, autonomy, behavioral economics, cognitive/social robotics, KR&R, human-machine cooperation, HSI, individual & team decision-making, machine ethics, NLU, trust, reputation, rhetoric, & persuasion

EDUCATION:

Ph.D., Cognitive Science. Rensselaer Polytechnic Institute, Troy, NY, May 2010.

Dissertation: *Cognitive Illusions and the Lying Machine: A Blueprint for Sophistic Mendacity* [[précis](#)][[fulltext](#)]

Advisor: Selmer Bringsjord

B.S., Computer Science and Philosophy. Rensselaer Polytechnic Institute, Troy, NY, May 1999, *cum laude*.

PROFESSIONAL EXPERIENCE:

Senior Staff Member, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 05/1999–Date
12 years in intelligent systems R&D fulfilling the complementary roles of AI technologist and practicing software systems engineer. Propose, plan, coordinate, and direct exploratory and advanced development of AI, autonomy, and simulation technologies for cyber-physical systems. Specialize in technology maturation and infusion. Provide guidance as an advisor, domain expert, and reviewer. Recent contributions, current activities, and prior duties follow.

Recent contributions include: Co-author of the draft NASA Fault Management Handbook. Acknowledged contributor to NASA's DRAFT Space Technology Roadmap (Technology Area 11).

Current activities include: Co-organizing second NASA Fault Management Workshop and stand-up of NASA Fault Management Working Group. Developing visualization and decision-support tools for multi-user planning & scheduling systems. Reviewing proposals (e.g., SBIR/STTR). Authoring proposals in cognitive robotics, in cognitive models and systems for orchestration of dynamic team cooperation, and in system autonomy, resiliency, and robustness.

From 2010 to 2011, developed multi-core processor simulation for fault tolerance and power/performance management R&D. Prototyped and performed trade-studies of flight software architectures that exploit partitioned operating systems (e.g., ARINC-653). Co-developed code generation tools and technology that produce approximately 75% of the flight software source code for NASA's Mars Science Laboratory Mission.

From 2007 to 2010, member of the mission operations team for NASA's EPOXI Mission and its DINET experiment through end of mission (flyby of comet Hartley 2). Executed test plans. Operated and maintained mission testbeds. Contributed to the development of DINET, a disruption-/delay-tolerant space networking experiment.

During 2006, software systems engineer for NASA's Constellation Project. Part of an intra-agency team responsible for Kennedy Space Center's new launch site command & control system. Collaboratively performed trade-studies, formulated requirements, and developed prototypes for a command & control programming language. Participated in requirements elicitation and evaluation for the launch site's service-oriented architecture.

From 2004 to 2005, member of the mission operations team for NASA's Deep Impact Mission. Supported spacecraft operations pre-launch through end of primary mission (impact with comet Tempel 1). Executed test campaigns. Approved spacecraft commands and command sequences. Operated and maintained mission testbeds.

From 2003 to 2005, co-I and software architect of the Multi-Platform Avionics Simulator, an R&D task producing multi-mission, simulation and testbed technologies. Customers include NASA's Mars Science Laboratory Mission and JPL's Multi-Mission System Architectural Platform. Funding secured on the merits of the successful Mars Exploration Rover Mission simulator (see below). Formulated technical and managerial plans, tracked progress, and briefed stakeholders. Designed simulation frameworks (e.g., for distributed simulation, failure injection, and 'hardware-in-the-loop' reconfiguration). Collaborated on the design and specification of testbed and support equipment.

From 2001 to 2003, technical lead and architect of medium-fidelity mission testbeds for NASA's Mars Exploration Rover Mission. Managed a team of 7 engineers. Oversaw development, deployment, and maintenance of 12 testbeds (used, e.g., for software development, testing, mission planning, training, and operations). Designed the real-time, closed-loop simulator of avionics, electronics, and dynamics that provided end-to-end mission simulation. Significant total-cost savings over comparable efforts. Performance resulted in promotion from staff to senior staff.

From 2000 to 2003, technologist for NASA's Deep Impact Mission. Originally part of a five-man, interdisciplinary team articulating philosophy, methodology, and design for autonomous system fault management. The Deep Impact Mission adopted the team and approach. Collaborated with systems engineers in the elicitation and evaluation of fault management requirements. Led development of software design and code-generation tools that automated production of the spacecraft's on-board fault management software and data products. Provided domain expertise and assistance to researchers attempting to mathematically verify and validate aspects of the fault management system.

From 1999 to 2001, technical lead for several autonomy technology, maturation and infusion tasks. Tasks increased technology readiness and mitigated adoption risks by demonstrating AI technologies in realistic mission scenarios and environments. For example, led an R&D effort applying autonomous sequencing and model-based fault management to complex, optical interferometer instruments (capstone demonstrations in JPL's Microarcsecond Metrology testbed and the NASA Space Interferometry Mission's system testbed).

From 1999 to 2000, software systems engineer for NASA's Mars Sample Return Mission. Part of an international team developing technologies for autonomous rendezvous and capture of small bodies in orbit. Performed software architecture trade-studies and prototyping to reduce operational costs and enable autonomy. Participated in evaluations of collision-avoidance strategies and in avionics and sensor trade-studies.

Graduate Research Assistant, Rensselaer Polytechnic Institute, Troy, NY

08/2005–12/2009

Member of the Rensselaer AI & Reasoning Laboratory. Conceived, initiated, planned, organized, and performed basic and applied AI & cognitive science research. Coordinated the technical tasks of others. Oversaw psychological experiments and the development of intelligent analytical and decision-support systems. Frequently participated in proposal development, technical consulting, guest lecturing, and scientific outreach.

Sponsored research emphasized the application of cognitive theories and AI tools to assist and empower military decision-makers, intelligence analysts, and robotic war-fighters. As examples: Proposed, planned, and led the development of *Solomon*, an inference-based, question answering system (DTO/IARPA). Planned and led the development of *micro-PsyPre*, a wargaming system for predictive and retrospective analysis of psychologically intense, effects-based operations (AFOSR). Participated in the development of *Slate*, an AI assistant for intelligence analysts (DTO/IARPA). Additionally, contributed to research in ontology interoperability, roboethics, and synthetic characters.

Dissertation research emphasized philosophical, computational, and cognitive theories of reasoning and deception. Formalized and mechanized the generation of psychologically persuasive, yet deceptive, argumentation. Confirmed the potency of generated arguments via human subject experiments.

Technical Co-op, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

01/1997–05/1999

Member of the systems engineering team for NASA's Deep Space 1 Mission and its on-board Remote Agent Experiment, a large-scale AI demonstration. Liaison between academically-oriented AI researchers and mission-oriented systems engineers. Assisted in the characterization, verification, and validation of the Remote Agent.

Undergraduate Research Assistant, Rensselaer Polytechnic Institute, Troy, NY

08/1998–05/1999

Founding member of the Minds & Machines Laboratory, an AI and cognitive robotics lab promoting undergraduate involvement in research. Assisted in basic and applied research in telepresence, teleoperation, autonomy, and robotics.

Software Engineer / Web Designer, General Information Systems, Troy, NY

1996

Developed courseware for textbooks and created public websites for corporate customers.

ARTICLES & CHAPTERS:

Bringsjord, S., & Clark, M. (forthcoming). [Red-Pill Robots Only, Please](#). To appear in *IEEE Transactions on Affective Computing*. DOI:10.1109/T-AFFC.2011.35

Bringsjord, S., Clark, M., & Taylor, J. (forthcoming). Sophisticated Knowledge Representation and Reasoning Requires Philosophy. To appear in R. Hagengruber (Ed.), *Philosophy's Relevance in Information Science*. Springer.

Bringsjord, S., Taylor, J., Heuveln, B. van, Arkoudas, K., Clark, M., & Wojtowicz, R. (2011). Piagetian Roboethics via Category Theory: Moving beyond Mere Formal Operations to Engineer Robots Whose Decisions are Guaranteed to be Ethically Correct. In M. Anderson & S. L. Anderson (Eds.), *Machine Ethics* (chapter 20, pp. 361–374). New York, NY: Cambridge University Press. ISBN:978-0521112352

Shilliday, A., Taylor, J., Clark, M., & Bringsjord, S. (2010). Provability-Based Semantic Interoperability for Information Sharing and Joint Reasoning. In L. Obrst, T. Janssen, & W. Ceusters (Eds.), *Ontologies and Semantic Technologies for Intelligence* (chapter 7, pp. 109–128). *Frontiers in Artificial Intelligence and Applications*, Vol. 213. Amsterdam, The Netherlands: IOS Press. ISBN:978-1-60750-580-8

Steinke, R., Clark, M., & McMahon, E. (2005). A New Pattern for Flexible Worker Threads with In-Place Consumption Message Queues. *SIGOPS Operating Systems Review*, 39(2), 71–73. DOI:10.1145/1055218.1055224

CONFERENCE PAPERS:

Clark, M. (2011). [Mendacity and Deception: Uses and Abuses of Common Ground](#). In *Building Representations of Common Ground with Intelligent Agents: Papers from the 2011 AAAI Fall Symposium* (Technical Report No. FS-11-02, pp. 2–9). Menlo Park, CA: AAAI Press.

Bringsjord, S., Clark, M., & Taylor, J. (2010). [Honestly Speaking, How Close are We to HAL 9000?](#) In H. Guerra (Ed.), *Physics and Computation 2010, 3rd International Workshop, Luxor / Aswan, Egypt, August 30–September 6, Pre-Proceedings* (pp. 39–53).

Bringsjord, S., Taylor, J., Shilliday, A., Clark, M., & Arkoudas, K. (2008). [Slate: An Argument-Centered Intelligent Assistant to Human Reasoners](#). In F. Grasso, N. Green, R. Kibble, & C. Reed (Eds.), *Proceedings of the 8th Workshop on Computational Models of Natural Argument, July 21, University of Patras, Greece* (pp. 1–10). Held in conjunction with the 18th European Conference on Artificial Intelligence (ECAI 2008), July 21–25. ISBN:978-960-6843-12-9

Clark, M., & Bringsjord, S. (2008). [Persuasion Technology Through Mechanical Sophistry](#). In J. Masthoff, C. Reed, & F. Grasso (Eds.), *AISB 2008 Convention on Communication, Interaction and Social Intelligence, 1st–4th April 2008, University of Aberdeen, Scotland. Vol. 3: Proceedings of the Symposium on Persuasive Technology* (pp. 51–54). Brighton, England: Society for the Study of Artificial Intelligence and Simulation of Behaviour. ISBN:1-902956-62-1

Bringsjord, S., Shilliday, A., Taylor, J., Werner, D., Clark, M., Charpentier, E., & Bringsjord, A. (2008). [Toward Logic-Based Cognitively Robust Synthetic Characters in Digital Environments](#). In P. Wang, B. Goertzel, & S. Franklin (Eds.), *Artificial General Intelligence 2008. Proceedings of the First AGI Conference* (pp. 87–98). *Frontiers in Artificial Intelligence and Applications*, Vol. 171. Amsterdam, The Netherlands: IOS Press. ISBN:978-1-58603-833-5

Bringsjord, S., Arkoudas, K., Mukherjee, D., Shilliday, A., Taylor, J., Clark, M., & Bringsjord, E. (2007). [The Multi-Mind Effect](#). In H. R. Arabnia, M. Q. Yang, & J. Y. Yang (Eds.), *Proceedings of the 2007 International Conference on Artificial Intelligence, ICAI 2007, June 25–28, 2007, Las Vegas, Nevada, USA* (Vol. 1, pp. 43–49). CSREA Press. ISBN:1-60132-023-X

Bringsjord, S., Arkoudas, K., Clark, M., Shilliday, A., Taylor, J., Schimanski, B., & Yang, Y. (2007). [Reporting On Some Logic-Based Machine Reading Research](#). In O. Etzioni (Ed.), *Machine Reading. Papers from the AAAI Spring Symposium* (Technical Report No. SS-07-06, pp. 23–28). Menlo Park, CA: AAAI Press. ISBN:978-1-57735-315-7

Bringsjord, S., & Clark, M. (2006). [For Sufficiently Hard Problems ... AI Needs CogSci](#). In C. Lebiere, & R. Wray (Eds.), *Between a Rock and a Hard Place: Cognitive Science Principles Meet AI-Hard Problems. Papers from the AAAI Spring Symposium* (Technical Report No. SS-06-02, pp. 23–26). Menlo Park, CA: AAAI Press. ISBN:978-1-57735-263-1

Ingham, M., Williams, B. C., Lockhart, T., Oyake, A., Clark, M., & Aljabri, A. (2001). [Autonomous Sequencing and Model-based Fault Protection for Space Interferometry](#). In *Proceedings of the 6th International Symposium on Artificial Intelligence, Robotics and Automation in Space: A New Odyssey, Montreal, Canada, June 18–22, 2001*. St-Hubert, Quebec, Canada: Canadian Space Agency. CD-ROM.

Smith, B., Millar, W., Dunphy, J., Tung, Y.-W., Nayak, P., Gamble Jr., E. B., & Clark, M. (1999). [Validation and Verification of the Remote Agent for Spacecraft Autonomy](#). In *Proceedings of the IEEE Aerospace Conference, March 6–13, 1999, Snowmass at Aspen, Colorado, USA* (Vol. 1, pp. 449–468). IEEE Press. DOI:10.1109/AERO.1999.794352

PERSONAL & SHARED AWARDS:

- 2011, NASA Group Achievement Award, EPOXI Spacecraft Team.
- 2010, NASA Group Achievement Award, EPOXI-DINET Flight Team.
- 2009, NASA Group Achievement Award, EPOXI Project Team.
- 2006, NASA Space Act Award, R. Steinke, M. Clark, & E. McMahon.
- 2006, NSF Graduate Research Fellowship Honorable Mention.
- 2005, NASA Space Act Award, K. Barltrop, M. Clark, E. Kan, J. Levison, & G. Watney.
- 2003, NASA Group Achievement Award, Mars Exploration Rover Flight Software Team.

CORPORATE AWARDS:

- 2007, Sir Arthur Clarke Award for Best Corporate/Team Achievement, Mars Exploration Rover Team.
- 2006, Stellar Award, Deep Impact Team. Rotary National Awards for Space Achievement.
- 2006, National Air and Space Museum Trophy, Mars Exploration Rover Team.
- 2005, Vision to Reality Award, Deep Impact Team. Space Frontier Foundation.
- 2005, Aviation Week & Space Technology Laurel Award, Mars Exploration Rover Team.
- 2004, Exploration Award (first awarding), Mars Exploration Rover Team. Earth and Space Foundation.
- 2002, AIAA Space System Award, Deep Space 1 Team.

GRANTS:

2006, *Advanced Knowledge Representation and Reasoning for Interactive Visualization* (Contract No. FA8750-08-2-0200). \$xxx,xxx (withheld at sponsor's request), 36 months, sponsor: DTO ASpace-X. Proposal by S. Bringsjord (PI), A. Shilliday, J. Taylor, & M. Clark.

2006, *Solomon: A Next-Generation QA System* (Contract No. N61339-06-C-0175). \$xxx,xxx (withheld at sponsor's request), 12 months, sponsor: DTO AQUAINT. Proposal by S. Bringsjord (PI), & M. Clark.

2006, *Micro-PsyPre: Toward Computing the Future* (Contract No. FA9550-06-1-0257). \$50,000, 6 months, sponsor: AFOSR. Proposal by S. Bringsjord (PI), M. Clark, & K. Arkoudas (Co-I).

2003, *Multi-Platform Avionics Simulator*. \$750,000, 36 months, sponsor: NASA Mars Technology Program. Proposal by E. McMahon (PI), M. Clark (Co-I), & C. Chu.

TECHNICAL REPORTS & WHITE PAPERS:

Fault Management Handbook, Draft 1 (NASA-HDBK-1002). Released to NASA Centers for official review, July 2011, Washington, DC.

Bringsjord, S., Clark, M., Houston, T., & Arkoudas, K. (2007). *Micro-PsyPre: Toward Computing the Future* (DTIC Accession No. ADA475621, Report No. AFRL-SR-AR-TR-09-0149). Report to AFRL about Contract No. FA9550-06-1-0257, Rensselaer AI & Reasoning Laboratory, Rensselaer Polytechnic Institute, Troy, NY.

Bringsjord, S., Clark, M., Werner, D., & Shilliday, A. (2007). *Solomon: Next-Generation Inference-Based QA*. Unpublished report to NAVAIR/PEO STRI about Contract No. N61339-06-C-0175, Rensselaer AI & Reasoning Laboratory, Rensselaer Polytechnic Institute, Troy, NY.

Bringsjord, S., Clark, M., Shilliday, A., & Taylor, J. (2006). *Harder, Knowledge-Based QA Questions for Intelligence Analysts and the Researchers Who Want to Help Them*. Unpublished white paper, Rensselaer AI & Reasoning Laboratory, Rensselaer Polytechnic Institute, Troy, NY.

Barltrop, K., Clark, M., Kan, E., Levison, J., & Watney, G. (2005). *Fault Protection Flight Software: Architecture and Applications Program for the Deep Impact Mission* (No. NTR-21184). New technology report, Jet Propulsion Laboratory, Pasadena, CA.

Steinke, R., Clark, M., & McMahon, E. (2005). *Multi-Platform Avionics Simulator* (No. NTR-41277). New technology report, Jet Propulsion Laboratory, Pasadena, CA.

Chang, W., Clark, M., Giovannoni, B., Glück, P., Hassan, R., & Meyer, K. (1999). *Evaluation of Java with Real-time Extensions*. Unpublished technical report, Mission Data Systems, Jet Propulsion Laboratory, Pasadena, CA. (Authors ordered alphabetically.)

SELECTED PRESENTATIONS:

Bringsjord, S. (presenter), & Clark, M. (2010). *What Recent Developments Bring Us Closer to HAL 9000?*. Invited presentation at the 3rd International Workshop on Physics and Computation (P&C 2010), special session on *2010: The awakening of the computer*, September 3, on the Nile, Egypt.

Bringsjord, S. (presenter), Clark, M., Coretti, D., Houston, T., & Sundar, N. G. (2009). *Toward an Interaction with Arnie, a Genuinely Evil Synthetic Character*. Invited presentation at Union College, November 12, Schenectady, NY.

Bringsjord, S. (presenter), Wojtowicz, R., Taylor, J., Arkoudas, K., Clark, M., Gilbert, E., Houston, T., & Heuveln, B. van (2009). *Piagetian Roboethics via Category Theory: Moving Beyond Mere Formal Operations to Engineer Robots Whose Decisions are Guaranteed to be Ethically Correct*. Refereed presentation at the 2009 IEEE International Conference on Robotics and Automation (ICRA2009), Workshop on Roboethics, May 17, Kobe, Japan.

Bringsjord, S. (presenter), Arkoudas, K., Li, J., Taylor, J., Shilliday, A., & Clark, M. (2009). *Creativity and Automatic Programming*. Presentation at the NSF Workshop for CreativeIT Program, January 15, Arlington VA.

Bringsjord, S., Arkoudas, K., Shilliday, A., Taylor, J., Clark, M. (presenter), Charpetier, E., & Bringsjord, A. (2008). *Toward Engineering Doppelgängers*. Invited presentation at the "Insight / Outlook" public lecture exhibit, Curtis R. Priem Experimental Media and Performing Arts Center (EMPAC) Opening Gala, October 5, Rensselaer Polytechnic Institute, Troy, NY.

Taylor, J., Shilliday, A. (presenter), Bringsjord, S., Clark, M., & Werner, D. (2007). *Provability-Based Semantic Interoperability via Translation Graphs*. Refereed presentation at the 26th International Conference on Conceptual Modeling (ER 2007), Workshop on Ontologies and Information Systems for the Semantic Web (ONISW), November 6, Auckland, New Zealand.

Bringsjord, S., Clark, M. (presenter), Werner, D., & Shilliday, A. (2007). *The Solomon System: New Directions in QA*. Presentation at IARPA/DTO AQUAINT Principal Investigator Meeting, October 31, San Antonio, TX.

Clark, M. (2007). *Lies, Damn Lies, & Damn Persuasive Lies*. Internal presentation at Issues in Cognitive Science, October 24, Rensselaer Polytechnic Institute, Troy, NY.

Clark, M. (presenter), Khemlani, S., & Bringsjord, S. (2007). *Toward the Lying Machine*. Refereed presentation at the 2007 North American Computing and Philosophy Conference (NA-CAP 2007), Cognitive Science, AI and Robotics session, July 26, Loyola University, Chicago, IL.

Clark, M. (presenter), Houston, T. (presenter), & Bringsjord, S. (2006). *micro-PsyPre: Toward Computing the Future in Wargaming*. Internal presentation at Issues in Cognitive Science, November 15, Rensselaer Polytechnic Institute, Troy, NY.

Bringsjord, S. (presenter), & Clark, M. (presenter) (2006). *AI Has Ignored Academic Learning: To the Rescue Comes A New Form of Machine Learning: Poised-For Learning*. Invited presentation at the Institute for Logic and Security Studies, March 3, State University of New York, Albany, NY.

Clark, M. (2003). *Deep Impact: Automatic Source Code Generation for Spacecraft Fault Protection*. Presentation at the 5th JPL/GSFC Quality Mission Software Workshop (QMSW 2003), May 14, Rehoboth Beach, DE.