

Curriculum Vitae

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Name Prof. Murray Patrick Shanahan
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Date of Birth 3rd July 1964
Nationality British
Current Position Professor of Cognitive Robotics

Employment

- Postdoctoral researcher (Imperial College Dept. of Computing) from Oct 1987 to Sept 1991
- EPSRC (formerly SERC) Advanced Research Fellowship at Imperial College (Dept. of Computing) from Oct 1991 to Sept 1995
- EPSRC Advanced Research Fellowship at Queen Mary & Westfield College (Dept. Computer Science) from Oct 1995 to Sept 1996
- Senior Research Fellow (RA3) at Queen Mary & Westfield College (Dept. Computer Science) from Oct 1995 to Aug 1998
- Lecturer (Imperial College Dept. Electrical Engineering) from Sept 1998 to Sept 2000
- Senior Lecturer (Imperial College Dept. Electrical Engineering) from Oct 2000 to Sept 2003
- Reader in Computational Intelligence (Imperial College Dept. Electrical Engineering) from Oct 2003 to Aug 2005
- Reader in Computational Intelligence (Imperial College Dept. of Computing) from Sept 2005 to Oct 2006
- Professor of Cognitive Robotics (Imperial College Dept. of Computing) from Oct 2006

Higher Education

- Joined Imperial College London in October 1981. Graduated in July 1984 with First Class Honours in Computer Science (BSc (Eng)).
- Matriculated at King's College Cambridge in October 1984 and registered for Ph.D. with the University of Cambridge Computer Laboratory, supervised by William

Clocks in. Thesis submitted in September 1987. Passed oral exam in December 1987. Degree conferred in July 1988.

Grants

- Author of Imperial College's proposal for Esprit project EQUATOR (1989-1992)
- Holder of SERC starter grant "Logic for Knowledge Representation" (1991-1992)
- Principal Investigator for SERC (EPSRC) project "Logic for Commonsense Reasoning about Continuous Change" (1994-1996, £100,000)
- Principal Investigator for EPSRC project "Cognitive Robotics" (1997-1999, £200,000)
- Principal Investigator for EPSRC project "Cognitive Robotics II" (2000-2003, £250,000)
- Principal Investigator for EPSRC project "Spatial Reasoning and Perception in a Humanoid Robot" (2003-2004, £290,000)
- Principal Investigator for EPSRC project "Abductive Robot Perception" (2004-2006, £330,000)
- Principal Investigator for EPSRC project "Robot Perception Using a Global Workspace Architecture" (2005-2008, £300,000)
- Principal Investigator for EPSRC project "Modular Neural Simulation with Reconfigurable Hardware" (2008-2011, £630,000)

Teaching

- M.Sc. (FAIT) course "Introduction to Artificial Intelligence," Imperial College, Dept. of Computing (1992-1994)
- M.Sc. course "Cognitive Robotics," Queen Mary & Westfield College (1996 and 1997)
- 1st and 2nd year undergraduate course "Principles of Computers and Software Engineering," Imperial College, Dept. Electrical Engineering (1998-2005)
- M.Sc. (Computer science) course "Logic and Declarative Programming," Imperial College, Dept. of Computing (2005)
- 2nd year undergraduate course "Introduction to Artificial Intelligence," Imperial College, Dept. of Computing (2006)
- 4th year undergraduate course "Cognitive Robotics," Imperial College, Dept. of Computing (2007-2010)
- Ph.D. students
 - Rob Miller (started 1991, degree awarded 1995)
 - Nawwaf Kharmah (joint supervisor, degree awarded 1999)
 - Hisashi Hayashi (started 1996, degree awarded 2001)
 - Paulo Santos (started October 2000, degree awarded 2003)
 - Tim Guhl (started July 2003, degree awarded 2007)
 - Alexandros Bouganis (started October 2004, degree awarded 2009)

- Dustin Connor (started October 2006)
- Richard Newcombe (started April 2009)

Administration

- Departmental Senior Tutor (Elec. Eng.) from October 2000 to August 2005
- Organiser of departmental non-professorial “awayday” (2004)
- Elected non-professorial member of departmental appointments committee (2003-2004)
- Deputy postgraduate tutor (Dept. of Computing) (2005-2006)

Miscellaneous

- Keynote speaker for 17th Irish Conference on Artificial Intelligence and Cognitive Science (AICS 06)
- Keynote speaker for euCognition workshop on Cognitive Architectures (2007)
- Chair for UKCRC / BCS Grand Challenge 5 “Architecture of Mind and Brain”
- ECAI 96 Best Paper Award for “Robotics and the Common Sense Informatic Situation”
- Elected to EPSRC peer review college (2002)
- Invited articles for the *Macmillan Encyclopedia of Cognitive Science* and the *Stanford Encyclopedia of Philosophy*
- Invited exhibitor at the Science Museum (2004) and the Royal Institution (2004)
- Reviewer for EU FP6 project *Mathesis*
- International programme committee memberships
 - International Workshop on Cognitive Robotics (1998, 2000, 2002, 2004)
 - International Symposium on Logical Formalizations of Commonsense Reasoning (1996, 1998, 2001, 2003, 2005)
 - KR 2006
 - Humanoids 2004, Humanoids 2006
 - AAI 2000
 - ECAI 2000
 - KR 2000
 - ECAI 1998
 - KR 1998
 - AAI 1997
- Reviewer for journals *Artificial Intelligence*, *Journal of Artificial Intelligence Research*, *Journal of Logic and Computation*, *Consciousness and Cognition*, *Journal of Consciousness Studies*, *Synthese*, *NeuroImage*

Publications

Conference Acronym Key

IJCAI – *International Joint Conference on Artificial Intelligence*

AAAI – *American Association for Artificial Intelligence*

ECAI – *European Conference on Artificial Intelligence*

Books

M.P.Shanahan & R.W.Southwick, *Search, Inference and Dependencies in Artificial Intelligence*, Ellis Horwood (1989).

M.P.Shanahan, *Solving the Frame Problem: A Mathematical Investigation of the Common Sense Law of Inertia*, MIT Press (1997).

M.P.Shanahan, *Embodiment and the Inner Life: Cognition and Consciousness in the Space of Possible Minds*. Oxford University Press, forthcoming (2010).

Journals

A.Bouganis & M.P.Shanahan, A Vision Based Intelligent System for Packing 2-D Irregular Shapes, *IEEE Transactions on Automation Science and Engineering*, vol. 4, no. 3 (2007), pages 382–394.

R.S.Miller & M.P.Shanahan, Narratives in the Situation Calculus, *The Journal of Logic and Computation*, vol. 4, no. 5 (1994), pages 513-530.

S.Ozen, A.Bouganis, & M.P.Shanahan, A Fast Evaluation Criterion for the Recognition of Occluded Shapes, *Robotics and Autonomous Systems*, to appear (2007).

M.P.Shanahan, Default Reasoning about Spatial Occupancy, *Artificial Intelligence*, vol. 74, no. 1 (1995), pages 147-163.

M.P.Shanahan, A Circumscriptive Calculus of Events, *Artificial Intelligence*, vol. 77 (1995), pages 249-284.

M.P.Shanahan, A Logical Account of the Common Sense Informatic Situation for a Mobile Robot, *Electronic Transactions on Artificial Intelligence*, vol. 2 (1998), pages 69-104.

R.S.Miller and M.P.Shanahan, The Event Calculus in Classical Logic – Alternative Axiomatisations, *Electronic Transactions on Artificial Intelligence*, vol. 3 (1999), Section A, pages 77-105.

M.P.Shanahan, An Abductive Event Calculus Planner, *The Journal of Logic Programming*, vol. 44 (2000), pages 207–239.

M.P.Shanahan, An Attempt to Formalise a Non-Trivial Benchmark Problem in Common Sense Reasoning, *Artificial Intelligence*, vol. 153 (2004), pages 141–165.

M.P.Shanahan & M.Witkowski, Event Calculus Planning Through Satisfiability, *Journal of Logic and Computation*, vol. 14, no. 5 (2004), pages 731–745.

M.P.Shanahan, Perception as Abduction: Turning Sensor Data into Meaningful Representation, *Cognitive Science*, vol. 29 (2005), pages 103–134.

- M.P.Shanahan & B.J.Baars, Applying Global Workspace Theory to the Frame Problem, *Cognition*, vol. 98, no. 2 (2005), pages 157–176.
- M.P.Shanahan, Global Access, Embodiment, and the Conscious Subject, *Journal of Consciousness Studies*, vol.12, no. 12 (2005), pages 46–66.
- M.P.Shanahan, A Cognitive Architecture that Combines Internal Simulation with a Global Workspace, *Consciousness and Cognition*, vol. 15 (2006), pages 433–449.
- M.P.Shanahan, A Spiking Neuron Model of Cortical Broadcast and Competition, *Consciousness and Cognition*, vol. 17 (2008), pages 288-303.
- M.P.Shanahan, Dynamical Complexity in Small-World Networks of Spiking Neurons, *Physical Review E*, vol. 78 (2008), 041924.
- M.P.Shanahan, Metastable Chimera States in Community-Structured Oscillator Networks, *Chaos*, to appear (2010).

Refereed International Conferences

- M.P.Shanahan, An Incremental Theorem Prover, *Proceedings IJCAI 87*, Morgan Kaufmann (1987), pages 987-989.
- M.P.Shanahan, Prediction Is Deduction but Explanation Is Abduction, *Proceedings IJCAI 89*, Morgan Kaufmann (1989), pages 1055-1060.
- M.P.Shanahan, Representing Continuous Change in the Event Calculus, *Proceedings ECAI 90*, Wiley (1990), pages 598-603.
- M.P.Shanahan, Explanation in the Situation Calculus, *Proceedings IJCAI 93*, Morgan Kaufmann (1993), pages 160-165.
- M.P.Shanahan, Evolutionary Automata, *Proceedings A-Life IV*, MIT Press (1994), pages 388-393.
- R.S.Miller & M.P.Shanahan, Reasoning about Discontinuities in the Event Calculus, *Proceedings 1996 Knowledge Representation Conference (KR 96)*, Morgan Kaufmann (1996) pages 63-74.
- M.P.Shanahan, Robotics and the Common Sense Informatic Situation, *Proceedings ECAI 96*, Wiley (1996), pages 684–688.
- M.P.Shanahan, Noise and the Common Sense Informatic Situation for a Mobile Robot, *Proceedings AAAI 96*, MIT Press (1996), pages 1098–1103.
- M.P.Shanahan, Noise, Non-Determinism and Spatial Uncertainty, *Proceedings AAAI 97*, MIT Press (1997), pages 153-158.
- M.P.Shanahan, Event Calculus Planning Revisited, *Proceedings 4th European Conference on Planning (ECP 97)*, Springer-Verlag Lecture Notes in Artificial Intelligence no. 1348, Springer-Verlag (1997), pages 390-402.
- M.P.Shanahan, The Ramification Problem in the Event Calculus, *Proceedings IJCAI 99*, pages 140-146.
- M.P.Shanahan & M.Witkowski, High-Level Robot Control Through Logic, *Intelligent Agents VII*, Springer-Verlag (2001), pages 104-121.
- D.Randell, M.Witkowski & M.P.Shanahan, From Images to Bodies: Modelling and Exploiting Spatial Occlusion and Motion Parallax, *Proceedings IJCAI 2001*, Morgan Kaufmann (2001), pages 57-63.

- P.Santos & M.P.Shanahan, Hypothesising Object Relations from Image Transitions, *Proceedings ECAI 2002*, Wiley (2002), pages 292–296.
- M.P.Shanahan, A Logical Account of Perception Incorporating Feedback and Expectation, *Proceedings 2002 Knowledge Representation Conference (KR 2002)*, pages 3–13.
- P.Santos & M.P.Shanahan, A Logic-Based Algorithm for Image Sequence Interpretation and Anchoring, *Proceedings IJCAI 2003*, pages 1408–1410.
- M.P.Shanahan & D.Randell, A Logic-Based Formulation of Active Visual Perception, *Proceedings 2004 Knowledge Representation Conference (KR 2004)*, pages 64–72.
- J.Forth & M.P.Shanahan, Indirect and Conditional Sensing in the Event Calculus, *Proceedings ECAI 2004*, pages 900–904.
- M.P.Shanahan & D.Connor, Modeling the Neural Basis of Cognitive Integration and Consciousness, *Proceedings ALife XI*, MIT Press (2008), pages 553–560.

Book Chapters

- M.P.Shanahan, Incrementality, Selectivity and Reason Maintenance, in *Reason Maintenance Systems and their Applications*, ed. B.Smith and G.Kelleher, Ellis Horwood Ltd (1988), pages 21-34.
- M.P.Shanahan, Folk Psychology and Naïve Physics, in *Connectionism, Concepts and Folk Psychology*, ed. A.Clark and P.Millican, Oxford University Press (1996), pages 169-180.
- M.P.Shanahan, What Sort of Computation Mediates Best Between Perception and Action?, in *Logical Foundations for Cognitive Agents: Contributions in Honor of Ray Reiter*, eds. H.J.Levesque & F.Pirri, Springer-Verlag (1999), pages 352-368.
- M.P.Shanahan, The Event Calculus Explained, in *Artificial Intelligence Today*, eds. M.J.Wooldridge & M.Veloso, Springer-Verlag Lecture Notes in Artificial Intelligence no. 1600, Springer-Verlag (1999), pages 409-430.
- M.P.Shanahan, Reinventing Shakey, in *Logic-Based Artificial Intelligence*, ed. J.Minker, Kluwer Academic Press (2000), pages 233–253.
- R.S.Miller & M.P.Shanahan, Some Alternative Formulations of the Event Calculus, in *Computational Logic: Logic Programming and Beyond: Essays in Honour of Robert A. Kowalski*, Lecture Notes in Artificial Intelligence no. 2408, Springer-Verlag (2002), pages 452–490.
- M.P.Shanahan, The Frame Problem, in *The Macmillan Encyclopedia of Cognitive Science*, Macmillan (2003), vol. 2, pages 144–150.
- M.P.Shanahan, The Frame Problem, in *The Stanford Encyclopedia of Philosophy (Spring 2004 edition)*, ed. E.N.Zalta, URL = <http://plato.stanford.edu/archives/spr2004/entries/frame-problem/>.

Refereed Workshop Proceedings

- M.P.Shanahan, Abductive Solutions to Temporal Projection Problems, *Working Notes of the 1990 AAAI Spring Symposium on Automated Abduction*, pages 101-105.

- M.P.Shanahan, Towards a Calculus for Temporal and Qualitative Reasoning, *Working Notes of the 1991 AAI Spring Symposium on Logical Formalizations of Commonsense Reasoning*, pages 145-157.
- M.P.Shanahan, Foundations for a Calculus of Shape, *Working Papers of Common Sense 93, The Second Symposium on Logical Formalizations of Commonsense Reasoning*, pages 197-207.
- M.P.Shanahan, Context-Sensitive Event Occurrence Minimisation, *Working Notes of the 1995 AAI Spring Symposium on Extending Theoris of Action*, pages 174-179.
- M.P.Shanahan, Robotics and the Common Sense Informatic Situation, *Working Papers of Common Sense 96, The Third Symposium on Logical Formalizations of Commonsense Reasoning*, pages 186-198, also *Working Notes of the 1996 AAI Spring Symposium on Planning with Incomplete Information for Robot Problems*, pages 95-106.
- M.P.Shanahan, What Sort of Computation Mediates Best between Perception and Action? *Working Notes of the 1996 AAI Fall Symposium on Embodied Cognition*, pages 107-112.
- M.P.Shanahan, Event Calculus Planning Revisited, *Working Notes of the AAI 97 Workshop on Robots, Softbots, Immobiles: Theories of Action, Planning and Control*, pages 96-104.
- M.P.Shanahan, Reinventing Shakey, *Working Notes of the 1998 AAI Fall Symposium on Cognitive Robotics*, pages 125-135.
- M.P.Shanahan & M.Witkowski, Robot Navigation and Map Building with the Event Calculus, *Working Notes of the IJCAI 99 Workshop on Robot Action Planning*, pages 37-46.
- P.Santos & M.P.Shanahan, From Stereoscopic Vision to Symbolic Representation, *Working Notes of the 2001 AAI Fall Symposium on Anchoring Symbols to Sensor Data in Single and Multiple Robot Systems*, pages 37-43.
- M.P.Shanahan, Using Reactive Rules to Guide a Forward-Chaining Planner, *Proceedings 6th European Conference on Planning (ECP 2001)*, Springer-Verlag.
- M.Witkowski, D.Randell, & M.P.Shanahan, Deriving Fluents from Sensor Data for Mobile Robots, *Working Notes of the 2001 AAI Fall Symposium on Anchoring Symbols to Sensor Data in Single and Multiple Robot Systems*, pages 44-51.
- P.Santos & M.P.Shanahan, From Regions to Transitions, from Transitions to Objects, *Working Notes of the AAI 2002 Workshop on Cognitive Robotics*, pages 103-109.
- M.P.Shanahan, Shakey and the Turtle: Cognitive Robotics Finds Biological Inspiration, *Proceedings WGW 02: Biologically Inspired Robotics – The Legacy of W.Grey Walter*, pages 256-263.
- M.P.Shanahan, Consciousness, Emotion, and Imagination: A Brain-Inspired Architecture for Cognitive Robotics, *Proceedings AISB 2005 Symposium on Next Generation Approaches to Machine Consciousness*, pages 26-35.
- M.P.Shanahan, Cognition, Action Selection, and Inner Rehearsal, *Proceedings IJCAI 2005 Workshop on Modelling Natural Action Selection*, pages 92-99.
- M.P.Shanahan, Towards a Computational Account of Reflexive Consciousness, *Proceedings AISB 2006 Symposium on Integrative Approaches to Machine Consciousness*, pages 165-170.