

Dr Paul R. Smart

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Career History

Senior Research Fellow

Southampton, UK

ELECTRONICS AND COMPUTER SCIENCE, UNIVERSITY OF SOUTHAMPTON

Nov. 2019 – PRESENT

- Developing a conceptual and methodological framework for trust evaluation in data sharing contexts.
- Investigating the forces and factors that influence public perceptions of trustworthiness.
- Exploring the theoretical and empirical links between research in cyber-physical systems and mechanism-based approaches in the social sciences.
- Developing a free energy framework for social processes based on recent work in (deep) machine learning and theoretical neuroscience.

Cognitive Science Consultant

Southampton, UK

SELF-EMPLOYED

Feb. 2018 – Nov. 2019

- Co-edited an academic text on the philosophy of *Blade Runner 2049*.
- Developed mixed reality solutions using a combination of Microsoft HoloLens and deep machine learning.
- Developed a simulation platform to support studies in computational situated cognition.
- Authored a report on global cyber-governance frameworks, with a specific focus on China's approach to artificial intelligence, personal data, and technology-mediated social governance.

Visiting Researcher

Lisbon, Portugal

INSTITUTE OF PHILOSOPHY, NEW UNIVERSITY OF LISBON

Nov. 2017 – PRESENT

- Exploring the philosophical implications of predictive processing and deep learning systems.
- Exploring the links between generative models and phenomenal experience.
- Developing conceptual engineering techniques to support the nascent sub-discipline of computational philosophy.

Senior Research Fellow

Southampton, UK

ELECTRONICS AND COMPUTER SCIENCE, UNIVERSITY OF SOUTHAMPTON

Nov. 2004 – Jan. 2018

- Undertook fundamental and applied research into intelligent systems, Web technologies, and human-machine systems.
- Developed novel philosophical concepts (e.g., mandevillian intelligence, the Web-extended mind, human-extended machine cognition, etc.).
- Designed and developed applications to support cognitive science research (e.g., the ACT-R-Unity Integration Framework).
- Implemented large-scale computational ontologies to support the development of knowledge-based systems.
- Designed and developed .NET code libraries to support the implementation of Web-based AI systems.
- Acted as project lead for the US/UK International Technology Alliance research programme (2012–2015).
- Acted as University of Southampton technical lead for the UK Defence Technology Centre research programme (2004–2009).
- Developed and tested machine learning technologies to support US/UK counter-terrorism initiatives.
- Completed a government risk assessment of cyber-security threats to UK national infrastructure.
- Established collaborative research links with the University of Edinburgh, Cardiff University, IBM UK, the U.S. Army Research Laboratory, the U.K. Defence Science and Technology Laboratory, Carnegie Mellon University, the New University of Lisbon, Airbus, and La Trobe University.
- Presented research results to government, corporate, and academic stakeholders.
- Managed multiple research projects, ranging in size from 2–40 people.
- Co-supervised PhD students in computer science.

Senior Knowledge Engineer

Nottingham, UK

EPISTEMICS LTD

Jan. 2000 – Nov. 2004

- Developed formal models of human expertise using knowledge elicitation techniques and conceptual modelling languages.
- Designed and developed AI systems for government and commercial client organizations.
- Acted as lead engineer for the Royal Navy's Future Organic Airborne Early Warning (FOAEW) system—a knowledge-based system providing decision support in respect of radar tracking, target identification, and mission planning.
- Managed small-medium sized knowledge engineering projects (2–10 people).

Research Assistant

DEPARTMENT OF PHYSIOLOGY, DEVELOPMENT AND NEUROSCIENCE,
UNIVERSITY OF CAMBRIDGE

Cambridge, UK
May 1999 – Nov. 1999

- Investigated the role of prefrontal cortical mechanisms in emotional decision making.
- Designed behavioural experiments to test neuropsychological hypotheses (e.g., Damasio's somatic marker hypothesis).
- Curated large scientific datasets and developed technologies to support data visualization.
- Performed statistical analysis of experimental data.
- Programmed laboratory equipment.

Teaching Fellow

SCHOOL OF SOCIAL SCIENCES AND CULTURAL STUDIES, UNIVERSITY OF
SUSSEX

Falmer, UK
Oct. 1996 – Jun. 1997

- Undertook sole responsibility for the organization, delivery, and assessment of a first-year undergraduate module titled "Biological, Psychological and Sociological Approaches to the Explanation of Gender Differences."

Research Assistant

SCHOOL OF PSYCHOLOGY, UNIVERSITY OF NOTTINGHAM

Nottingham, UK
Jun. 1993 – Oct. 1993

- Investigated the reasoning strategies used by expert physicists in solving a variety of physics problems.
- Implemented psychological experiments.
- Performed statistical analysis of experimental data.

Education

D.Phil Experimental Psychology

DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF SUSSEX

Falmer, UK
Oct. 1994 – Oct. 1998

- Investigated the functional contribution of telencephalic neural circuits to appetitive and emotional behaviours.
- Explored the interaction between serotonergic and dopaminergic neural systems using a combination of neurosurgical and pharmacological techniques.
- Designed and implemented research experiments.
- Performed statistical analysis of experimental data.
- Programmed laboratory equipment.
- Completed surgical courses run by the Royal Veterinary College.
- Delivered undergraduate courses in neuroscience, statistics, experimental psychology, and evolutionary theory.

BA (Hons) Psychology—I (First Class)

SCHOOL OF PSYCHOLOGY, UNIVERSITY OF NOTTINGHAM

Nottingham, UK
Oct. 1991 – Jul. 1994

- Winner of the 1994 Pumphrey Prize—awarded each year for outstanding work by a psychology finalist.
- Completed additional undergraduate modules in sociology (sociological perspectives and British social history) and philosophy (moral philosophy and epistemology).

A-Levels

ISLE OF ELY COLLEGE

Wisbech, UK
Oct. 1989 – Jul. 1991

- Biology (A).
- English (B).
- Sociology (B).

Expertise

KNOWLEDGE & DATA TECHNOLOGIES

- Data Technologies** I have practical experience of using Semantic Web technologies. This includes the development of large-scale computational ontologies for scientific and defence-related purposes. I am also familiar with research pertaining to the use of linked and open data.
- Machine Learning** I am familiar with concepts in deep learning, and I have practical experience of implementing deep belief networks and variational autoencoders as part of my work on socially-oriented generative models (i.e., generative models of social data).
- Network Analysis** I have used network analytic techniques for the purpose of cultural modelling and the analysis of online/real-world social networks.

AI, PHILOSOPHY, AND COGNITIVE SCIENCE

- Artificial Intelligence** I have practical experience of developing a variety of AI systems for government and commercial clients. Many of the systems I have developed rely on the use of symbolic computation techniques, such as Lisp engines and expert system shells; however, I am also familiar with artificial neural networks and deep learning techniques. At a theoretical level, I have argued that the Internet/Web provides something in the way of socio-ecological niche that is apt to support the emergence of advanced AI systems. By allowing AI systems to be situated in the human social environment, I have argued that AI systems are exposed to some of the social forces and factors that shape the human mind.
- Philosophy of Science** Much of my recent research focuses on the nature of explanation and understanding. I am particularly interested in the kinds of explanation that exist (e.g., computational explanation, mechanistic explanation, nomological explanation, etc.), and the way in which these explanations relate to the notion of understanding in different disciplines. I have suggested that the kinds of explanation required for an ‘understanding’ of AI systems (e.g., deep neural networks) is not compatible with the forms of explanation that tell us how such systems work. More speculatively, I have suggested that the notion of explanation tells us something important about the computational anatomy of the biological brain and the mechanistic origins of (human) conscious experience. This serves as the basis for work that seeks to build self-aware, conscious machines.
- Epistemology** I have made a number of contributions to the epistemological literature. For example, I have explored the extent to which active externalism is compatible with virtue-theoretic conceptions of knowledge. I have also explored the extent to which the social aspects of the Internet yield an epistemically safe environment for would-be knowers. Finally, I have spearheaded a new strand of epistemological research that goes by the name of mandevillian intelligence. Research in this area explores the claim that individual cognitive and epistemic vices can sometimes play a productive role in boosting the collective cognitive performance of teams, groups, and other collectives.
- Cognitive Science** I have extensive experience of using the ACT-R cognitive architecture to perform multi-agent simulation experiments. This has allowed me to study cognition in a social context, providing insights into issues of collective intelligence. As a result of this research, I have discovered a new form of collective intelligence (i.e., the aforementioned notion of mandevillian intelligence). I have also championed research into a new field of cognitive scientific research called computational situated cognition. Research in this area seeks to situate or embed cognitive agents in 3D virtual environments (implemented using contemporary game engines). Recent extensions of this approach seek to explore the effect of deep learning techniques on the behaviour of virtual embodied cognitive agents.

COMPUTING

Programming	C#, VB.NET, VBA (Microsoft Office Automation), Visual Studio, CLIPS, JavaScript, Lisp.
Database	SQL Server, MySQL, Access, SQL, ADO.NET.
Web Technologies	XML, DTD, XSD, XSLT, XHTML, DHTML, CSS, ASP.NET, XML Web Services, JavaScript, JSON, Ajax, WordPress.
Knowledge Technologies	CommonKADS, Protégé, OWL, RDF, RDF(S), RDQL, SPARQL, CLIPS, Knowledge Elicitation Techniques, Ontology Engineering.
Applications	Microsoft Office Suite (Word, Excel, PowerPoint, Access, Outlook), Expression Studio, EndNote, SPSS, Camtasia Studio, Adobe Creative Suite (Acrobat, Photoshop, Dreamweaver, Illustrator).
Software Development	UI Design, OO Analysis & Design, UML, CML (Conceptual Modelling Language), Requirements Elicitation, GitHub.
Typesetting	LaTeX.
Cross Reality	Unity, HoloLens.
Machine Learning	Unity ML-Agents Toolkit (deep reinforcement learning).

RESEARCH MANAGEMENT & LEADERSHIP

Research Leadership	I am a former project champion in the International Technology Alliance (ITA) research programme. I have also provided technical leadership across a range of research and development projects in both academic and commercial settings.
Research Management	From 2004 to 2009 I managed a portfolio of research projects associated with the Data and Information Fusion Defence Technology Centre initiative. I have also managed research staff (at post-doctoral and undergraduate levels) across a range of research projects.
Revenue Generation	I have helped to secure funding for University research projects with a total value exceeding £2.3 million.
Event Organization	I have served as a Technical Program Committee (TPC) member for a variety of conferences. I was TPC co-chair for the ITA Annual Conference in 2012 and a Special Track Chair for the 9th International Conference on Advanced Cognitive Technologies and Applications in 2017.
Scientific Review	I have reviewed academic papers for a variety of journals, including Intelligent Systems, the Semantic Web Journal, Review of Philosophy and Psychology, Minds and Machines, Phenomenology and the Cognitive Sciences, Artificial Intelligence Review, Entropy, Biologically Inspired Cognitive Architectures, Social Epistemology, Philosophical Psychology, Synthese, Patterns, PLOS ONE, the Journal of Web Semantics, and the Journal of Experimental & Theoretical Artificial Intelligence. I have also acted as a reviewer for research proposals submitted to The Royal Society, the Medical Research Council (MRC), and the Social Sciences and Humanities Research Council of Canada (SSHRC).

PRESENTATION, TEACHING & MENTORING

Conference Presentations I have presented in excess of 30 papers at international academic conferences.

Teaching I was responsible for the organization and delivery of an undergraduate module on multidisciplinary approaches to understanding human gender differences as part of my doctoral training at the University of Sussex. I have also delivered courses on knowledge acquisition and modelling to academic (e.g., University of Manchester) and corporate clients (e.g., Scottish Amicable). Finally, I have completed University accredited courses on how to design and deliver lectures to undergraduate students.

Student Supervision I have completed University accredited training courses relating to the supervision of doctoral students. I have also acted as co-supervisor for doctoral students in computer science.

Listening Skills I have a diploma in listening skills, and I have also attended courses on counselling techniques.

Honors & Awards

- 2017 **Fellowship**. Appointed Fellow of the Royal Society of Arts (FRSA).
- 2015 **Fellowship**. Appointed Fellow of the British Computer Society (FBCS).
- 2010 **Staff Achievement Award**. University of Southampton Staff Achievement Award—awarded for my role in securing research grants worth £1,000,000.
- 2009 **Best Paper**. Winner of the Best Paper Award at the Knowledge Systems for Coalition Operations Conference.
- 2006 **Staff Achievement Award**. University of Southampton Staff Achievement Award—awarded for my role in securing research grants worth £900,000.
- 1994 **Pumphrey Prize**. Winner of the 1994 Pumphrey Prize—awarded by the University of Nottingham for outstanding work by a psychology undergraduate.

Research Funding

The following table highlights the results of funding acquisition efforts I have been involved in for the period 2006 to 2021.

Project	Date	Funding Source	Value
PETRAS-DSF	2021–2022	EPSRC	£112,442
Trusted Digital Infrastructure for Identity Systems	2020–2021	The Alan Turing Institute	£75,410
International Technology Alliance (ITA)	2009–2016	U.K. Defence Science and Technology Laboratory	£842,220
Future Internet Landscape	2013	Cyber-Protection of National Infrastructure	£20,000
IEXTREME	2010–2012	U.S. Office of Naval Research	£198,713
Pathfinder II	2008	IBM UK	£7,794
SEMIOTIKS	2006–2009	U.K. Ministry of Defence	£618,585
MIMEX	2006–2009	U.K. Ministry of Defence	£333,635
ONTOMEDIATE	2006–2009	U.K. Ministry of Defence	£279,411
Total			£2,488,210

Recent Talks

See my website (<http://paulsmart.cognosys.co.uk/community.html>) for a full list of recent presentations.

Mixed Realities, Hybrid Minds

Lisbon, Portugal

RESEARCH SEMINAR, NEW UNIVERSITY OF LISBON

Aug. 2020

- Presentation of research relating to the use of AI-based cloud computing services to support human cognition in mixed reality environments.

Designer Environments

Southampton, UK

WORKSHOP PANEL PRESENTATION, WEB SCIENCE CONFERENCE

Jul. 2020

- Discussion of evolutionary concepts and their application to Web science.

Reflections on *Blade Runner 2049*

Hursley, UK

INVITED SPEAKER, IBM UK

Mar. 2020

- Discussion of ethical and philosophical issues raised by the movie *Blade Runner 2049*.

Limitless 'Me': Internet-Extended Minds and the Nature of Epistemic Inflationism

Madrid, Spain

KEYNOTE PRESENTATION: SELF AND KNOWLEDGE CONFERENCE

Nov. 2019

- Presentation of a theoretical framework for Internet-extended knowledge.

Constitutive Relevance from an Engineering Perspective: Implications for Extended Cognition

Lisbon, Portugal

RESEARCH SEMINAR, NEW UNIVERSITY OF LISBON

Sep. 2019

- Review of research relating to extended cognitive mechanisms.
- Presentation of criteria to distinguish between extended, non-extended, and distributed cognitive mechanisms.

Generative Mechanisms and Predictive Processing

Lisbon, Portugal

INVITED SPEAKER, PHILOSOPHY OF PREDICTIVE PROCESSING WORKSHOP

Dec. 2018

- Overview of generative models in machine learning, computer gaming, network science, and social science.
- Presentation of computer simulation research relating to generative models and the self.

Web-Extended Minds

London, UK

INVITED SPEAKER, THECUBE RESEARCH SEMINAR

Jun. 2018

- Presentation of the Web-extended mind hypothesis.

A Predictive View of Generative Learning

Edinburgh, UK

KEYNOTE PRESENTATION, ONLINE PEDAGOGY CONFERENCE

May. 2018

- Review of predictive processing and generative learning research.
- Presentation of human-extended machine cognition research.

The Shape of the Social: Socially-Oriented Generative Models

Southampton, UK

INVITED SPEAKER, ARTIFICIAL ETHICS SYMPOSIUM

Dec. 2017

- Presentation of mind of society hypothesis.
- Review of implications for machine ethics.

Mandevillian Intelligence

London, UK

INVITED SPEAKER, THE HUMAN MIND PROJECT

Dec. 2017

- Presentation of empirical evidence for mandevillian intelligence.
- Review of implications for cognitive science, AI, social policy, and government legislation.

Active Externalism, Virtue Reliabilism and Extended Knowledge

Edinburgh, UK

RESEARCH SEMINAR, UNIVERSITY OF EDINBURGH

Mar. 2017

- Presentation of new ideas regarding the compatibility of active externalism and virtue reliabilism.

Recent Publications

See my website (<http://paulsmart.cognosys.co.uk/publications.html>) for a full list of publications.

SUBMITTED/IN PREP

- Smart, P. R. (submitted) **Shedding Light on the Extended Mind: HoloLens, Holograms, and Internet-Extended Knowledge**. *Frontiers in Psychology*.

2021

- Smart, P. R. (in press) **Predicting Me: The Route to Digital Immortality?** In R. W. Clowes, K. Gärtner & I. Hipólito (Eds.), *The Mind–Technology Problem: Investigating Minds, Selves and 21st Century Artifacts*. Springer, Berlin, Germany.
- Smart, P. R. & Clowes, R. W. (2021) **Intellectual Virtues and Internet-Extended Knowledge**. *Social Epistemology Review and Reply Collective*, 10(1), 7–21.

2020

- Smart, P. R. (2020) **Planet Braitenberg: Experiments in Virtual Psychology**. *Cognitive Systems Research*, 64, 73–95.
- Smart, P. R. (2020) **The Joi of Holograms**. In T. Shanahan & P. R. Smart (Eds.), *Blade Runner 2049: A Philosophical Exploration*. Routledge, Abingdon, Oxon, UK.
- Smart, P. R. (2020) **Artificial Economics**. In T. Shanahan & P. R. Smart (Eds.), *Blade Runner 2049: A Philosophical Exploration*. Routledge, Abingdon, Oxon, UK.
- Shadbolt, N. R. & Smart, P. R. (2020) **The Eyes of God**. In T. Shanahan & P. R. Smart (Eds.), *Blade Runner 2049: A Philosophical Exploration*. Routledge, Abingdon, Oxon, UK.
- Shanahan, T. & Smart, P. R. (Eds.) (2020) **Blade Runner 2049: A Philosophical Exploration**. Routledge, Abingdon, Oxon, UK.
- Smart, P., O'Hara, K., Cox, A., & Hall, W. (2020) **Cyber-Physical Systems and Social Machines**. Available at SSRN: <https://ssrn.com/abstract=3705252> (doi:dx.doi.org/10.2139/ssrn.3705252)

2019

- Smart, P. R., Madaan, A., & Hall, W. (2019) **Where the Smart Things Are: Social Machines and the Internet of Things**. *Phenomenology and the Cognitive Sciences*, 18(3), 551–575.
- Smart, P. R., Chu, M.-c. M., O'Hara, K., Carr, L., & Hall, W. (2019) **Geopolitical Drivers of Personal Data: The Four Horsemen of the Datapocalypse**. University of Southampton, Southampton, UK.

2018

- Smart, P. R. (2018) **Knowledge Machines**. *The Knowledge Engineering Review*, 33(e11), 1–26.
- Smart, P. R. (2018) **Mandevillian Intelligence**. *Synthese*, 195(9), 4169–4200.
- Smart, P. R. (2018) **Mandevillian Intelligence: From Individual Vice to Collective Virtue**. In A. J. Carter, A. Clark, J. Kallestrup, O. S. Palermos & D. Pritchard (Eds.), *Socially Extended Epistemology*. Oxford University Press, Oxford, UK.
- Smart, P. R., & Shadbolt, N. R. (2018) **The World Wide Web**. In J. Chase & D. Coady (Eds.), *The Routledge Handbook of Applied Epistemology*. Routledge, New York, New York, USA.
- Smart, P. R. (2018) **Human-Extended Machine Cognition**. *Cognitive Systems Research*, 49, 9–23.
- Smart, P. R. (2018) **(Fake?) News Alert: Intellectual Virtues Required for Online Knowledge!** *Social Epistemology Review and Reply Collective*, 7(2), 45–55.
- Smart, P. R. (2018) **Emerging Digital Technologies: Implications for Extended Conceptions of Cognition and Knowledge**. In A. J. Carter, A. Clark, J. Kallestrup, O. S. Palermos & D. Pritchard (Eds.), *Extended Epistemology*. Oxford University Press, Oxford, UK.

2017

- Smart, P. R., & Madaan, A. (2017) **The Social Scaffolding of Machine Intelligence**. *International Journal On Advances in Intelligent Systems*, 10(3&4), 261–279.
- Smart, P. R. (2017) **Situating Machine Intelligence within the Cognitive Ecology of the Internet**. *Minds and Machines*, 27(2), 357–380.
- Smart, P. R. (2017) **Extended Cognition and the Internet: A Review of Current Issues and Controversies**. *Philosophy & Technology*, 30(3), 357–390.
- Smart, P. R. (2017) **Machine Intelligence and the Social Web: How to Get a Cognitive Upgrade**. *9th International Conference on Advanced Cognitive Technologies and Applications (COGNITIVE'17)*, Athens, Greece.
- Smart, P. R. (2017) **COGWEB-Cognition and the Web: Social Minds, Distributed Brains, and Talkative Technologies**. *9th International Conference on Advanced Cognitive Technologies and Applications (COGNITIVE'17)*, Athens, Greece.
- Smart, P. R., Clowes, R., & Heersmink, R. (2017) **Minds Online: The Interface between Web Science, Cognitive Science and the Philosophy of Mind**. *Foundations and Trends in Web Science*, 6(1-2), 1–232.
- Smart, P. R., Heersmink, R., & Clowes, R. W. (2017) **The Cognitive Ecology of the Internet**. In S. J. Cowley & F. Vallée-Tourangeau (Eds.), *Cognition Beyond the Brain: Computation, Interactivity and Human Artifice* (2nd ed.). Springer International Publishing, Cham, Switzerland.

2016

- Smart, P. R. (2016) **The Rise of the (Social) Machines**. *17th IFIP Working Conference on Virtual Enterprises*, Porto, Portugal.
- Smart, P. R., O'Hara, K., & Hall, W. (2016) **Predicting Me, Experiencing Us: Predictive Processing, Big Data and the Mind of Society**. *Minds, Selves and 21st Century Technology*, Lisbon, Portugal.
- Smart, P. R., Scutt, T., Sycara, K., & Shadbolt, N. R. (2016) **Integrating ACT-R Cognitive Models with the Unity Game Engine**. In J. O. Turner, M. Nixon, U. Bernardet & S. DiPaola (Eds.), *Integrating Cognitive Architectures into Virtual Character Design*. IGI Global, Hershey, Pennsylvania, USA.
- Tang, Y., Lebiere, C., Sycara, K., Morrison, D., Lewis, M., & Smart, P. R. (2016) **Information Sharing for Collective Sensemaking**. *Hawaii International Conference on System Sciences (HICSS)*, Kauai, Hawaii, USA.

2015

- Shadbolt, N. R., & Smart, P. R. (2015) **Knowledge Elicitation: Methods, Tools and Techniques**. In J. R. Wilson & S. Sharples (Eds.), *Evaluation of Human Work* (4th ed., pp. 163–200). CRC Press, Boca Raton, Florida, USA.
- Smart, P. R., & Sycara, K. (2015) **Place Recognition and Topological Map Learning in a Virtual Cognitive Robot**. *17th International Conference on Artificial Intelligence*, Las Vegas, Nevada, USA.
- Smart, P. R., & Sycara, K. (2015) **Situating Cognition in the Virtual World**. *6th International Conference on Applied Human Factors and Ergonomics*, Las Vegas, Nevada, USA.
- Smart, P. R., & Sycara, K. (2015) **Using a Cognitive Architecture to Control the Behaviour of Virtual Robots**. *EuroAsianPacific Joint Conference on Cognitive Science*, Turin, Italy.
- Tang, Y., Lebiere, C., Sycara, K., Morrison, D., & Smart, P. R. (2015) **Cognitive and Probabilistic Models of Group Decision Making**. *24th Conference on Behavior Representation in Modeling and Simulation*, Washington D.C., USA.