

Nicole Carey

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RESEARCH INTERESTS

Developing bio-inspired robotic solutions for challenging environments. Morphological control and compliant design, design and control of under-actuated systems. Robotics and society, human-robot interaction. Swarm robotics, biomimetic navigation and control.

RESEARCH EXPERIENCE

- 2015 - pres **Wyss Institute for Biologically Inspired Engineering** HARVARD UNIVERSITY, MA
Postdoctoral Fellow, Designing Emergence Laboratory
Principal Investigator: Justin Werfel
- 2009–2012 **Centre of Excellence in Cognitive Interaction Technology** UNIVERSITY OF BIELEFELD
Postdoctoral Fellow
Faculty Mentor: Martin Egelhaaf, DFG Project BIONA
- 2007–2009 **Australian National University** ACT, AUSTRALIA
Technical and Research Assistant, Centre for Visual Sciences
Principal Investigator: Gert Stange
Research Associate, Centre of Excellence in Vision Science
Principal Investigator: Jochen Zeil
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PROFESSIONAL EXPERIENCE

- 2012–2015 **Engineered Arts Ltd** PENRYN, UK
Engineered Arts is a UK robotics firm specializing in the design and manufacture of hybrid pneumatic-electric humanoid robots for research and communication.
- Senior Control Engineer**
Control engineer for novel hybrid passive-dynamic systems. Nonlinear design, mechanical design, modelling, sensor fusion.
- Senior Grant Writer**
Multi-institutional project grants under the H2020, FP7, EPSRC, ECHORD++ funding programs.
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EDUCATION

- PhD in Biorobotic Systems, Centre of Excellence in Vision Science ACT, AUSTRALIA
Australian National University 2003 – 2007
Dissertation: *Biomimetic Algorithms for Motion Camouflage*
Faculty Mentor: Professor Jochen Zeil
- University of Adelaide** ADELAIDE, AUSTRALIA
BEng (Mechatronics) Hons 1998 – 2002
- BSc (Mathematics and Computer Science)** 1998 – 2002
Pure Mathematics

RESEARCH GRANTS

- 2017 ANZSOG Grant HC171025, **Robots and the delivery of care services: What is the role for government in stewarding disruptive innovations?**, (with H Dickinson and G Carey, UNSW) \$AUD 92,280
- 2013 GBI ERDF Award P2, **Advancing the interactive abilities of humanoid and social robots**, £220,000
- 2012 Technology Strategy Board UK Smart Grant 720239, **Dynamic Movement For Humanoid Entertainment Robots** £177,000
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PROFESSIONAL IMPACT

Commercial product development:

Socibot Mini 2.0 (A desktop robot for social inclusion)

Robothespian 4.0 (A dexterous multimodal communication robot and research platform)

Prototyping and demonstration platforms

Byrun (Passive-dynamic bipedal prototype, London Science Museum)

Bespoke development for Pipeline Theatre: Edinburgh festival 2015 (first full-sized humanoid deployed on stage in the UK)

PUBLICATIONS

In preparation

- Bardunias, P.(*), **Carey, N.E.(*)**, Calovi, D., Soar, R., Turner, J.S., Nagpal, R., Werfel, J. "Collective construction in mound-building termites is governed by a humidity template.", *under submission*
- **Carey, N.E.**, Bardunias, P., Nagpal, R., Werfel, J. "Splattodea: an autonomous robot for humidity-based stigmergic construction", *in preparation*
- **Carey, N.E.**, Pfeiffer, K. "Neuromorphically-guided attitude control via naturally occurring polarisation patterns", *in preparation*

Peer-reviewed

9. **Carey, N.E.**, Althaus, C., Dickinson, H., Carey, G.E., "Care robots in Australia and New Zealand: developing an ethical research roadmap", *to appear*, Paladyn, Journal of Behavioral Robotics
8. Calovi, D.(*), Bardunias, P.(*), **Carey, N.E.**, Werfel, J., Turner, J.S., Nagpal, R., "Surface curvature guides early construction activity in mound-building termites", *To appear* Phil. Trans. R. Soc. B, DOI: 10.1098/rstb.2018-0374, arXiv:1812.07047
7. **Carey, N.E.**, Nagpal, R., Werfel, J., "Fast, Accurate, Small-Scale 3D Scene Capture Using a Low-Cost Depth Sensor." *Applications of Computer Vision (WACV)*, 2017 IEEE Winter Conference on, Pp. 1268-1276
6. Carey, G.E., Crammond, B., Malbon, E., **Carey, N.E.**, "Adaptive Policies for Reducing Inequalities in the Social Determinants of Health", *International Journal of Health Policy Management.*, 2015
5. Carey, G.E., Malbon, E., **Carey, N.E.**, Joyce, A., Crammond, B., Carey, A., "Systems science and systems thinking for public health: a systematic review of the field", *BMJ Open*, doi:10.1136/bmjopen-2015-009002, 2015
4. Stuerzl, W., **Carey, N.E.**, "A Fisheye Camera System for Polarisation Detection on UAVs", *ECCV 2012, Lecture Notes in Computer Science* Volume 7584, pp 431-440, 2012
3. **Carey, N.E.**, Stuerzl, W. 2011 "An Insect-Inspired Omnidirectional Vision System including UV-Sensitivity and Polarisation", *IEEE International Conference on Computer Vision*. IEEE, 2011.
2. **Carey, N.E.**, Chahl, J.S., "A Force-Based Controller for a Bank-to-Turn Autopilot", *AIAA Infotech at Aerospace Proc*. AIAA-2005-7040, 2005
1. **Carey, N.E.**, Ford, J.J., Chahl, J.S. "Biologically Inspired Guidance for Motion Camouflage", *IEEE Proc. Asian Control Conference* Vol. 3 1793-1799, 2004

Other Published Work

- Dickinson, H., Althaus, C., Carey, N.E., Carey, G.E., “Robots and the delivery of care services: What is the role for government in stewarding disruptive innovations?”, 2018, Melbourne: ANZSOG (Australia and New Zealand School of Government)
 - Dickinson, H., Carey, N.E., Smith, C., Carey, G.E., “ ‘You don’t know what you’ve got ‘til it’s gone’: the implications of expanding the use of robots in care services”, *ANZSOG Research Blog* Feb. 2018
 - Carey, N.E., “Can robots tighten the bolts on a rickety care sector?”, *Scientific American*, 2018
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PRESENTATIONS

Conferences

- Dickinson, H., Carey, N.E., Althaus, C., Carey, G.E., “Exploring governance dilemmas of disruptive technologies: the case of care robots in Australia”, *to appear*, Conference of the International Research Soc. for Public Management, 2019.
- Bardunias, P., Carey, N.E., Calovi, D., Soar, R., Turner, J.S., Nagpal, R., Werfel, J. “ Construction in the Macrotermitinae is governed by a stigmergically created humidity template.”, *Proceedings of the International Union for the Study of Social Insects*. Guarujá, Brazil 2018
- Gutierrez E., Hernandez J., McLendon R., Paterson A.C., Engelstad, K., Carey N.E., Dusek J., Nagpal R., “A Low Cost Agile Robot for Outdoor Collectives.” SCCUR 2017. *Southern California Conferences for Undergraduate Research*
- Calovi, D., Green, B., Carey, N.E., Bardunias, P., Nagpal, R., Werfel, J. “Characterizing cues for collective construction of *Macrotermes* termites”, *Behaviour* 2017
- Carey, N.E., Stuerzl, W., Vukanovic, S., Pfeiffer, K., Elbrechter, C. “An insect-inspired biomimetic polarisation sensor and sky compass”, *Tenth International Congress of Neuroethology*, University of Maryland 2012
- Carey, N.E., Stuerzl, W., Egelhaaf, M., Moeller, R. “Navigating using the polarised sky compass - a biomimetic approach”, *Workshop on Insect Homing: Mechanisms and Models*, ZiF, Bielefeld 2011
- Zeil, J., Boeddeker, N, Carey, N.E., Gilbert, C. “Stealthy tracking in satellite flies”. *Flying Insects and Robots Symposium*, Monte Verita, 2007 Switzerland, Aug

Invited Talks

- University of Technology Sydney, Magic Lab, 2016 & 2017
 - Australian National University, Research School of Biology, 2015
 - NIH Trust Research Conference on Social Robotics, 2013
 - Australian National University, Centre of Excellence in Vision Science, 2012
 - University of Marburg, Department of Neurobiology, 2012
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Teaching and Advisory roles

Co-Lecturer

Responsibilities included developing a lecture series, supervising labs, leading discussions, mentoring students individually, and evaluating all assignments

- SEAS, Harvard University, Cambridge, MA ‘Research Experience for Undergraduates: Building an Outdoor Robotics Collective’ (2017)
- Department of Neurobiology, Bielefeld University, ‘Aktuelle Themen in Neurobiologie’ (2010/2011)

Advisor: Centre of Excellence in Cognitive Interaction Technology, Bielefeld 2011-2012

- Advisor to graduate and undergraduate research candidates
- Supervision of Ph.D. thesis 2011-2012

Guest lecturer: Autonomous Multi-Robot Systems, Computer Science Department, Harvard University, 2017
Undergraduate lecture on ‘Creating engaging social robots’

Coursework development: Engineered Arts Ltd, 2013-2015

Created an all-inclusive set of coursework materials, including lecturer materials and practical modules on pneumatics, electro-mechanical systems, analog and digital sensors, signal processing, advanced Python scripting and code parallelization, principles of robot architectures, state-space control theory, and other related subjects.

Fellowships and Awards

Fellowships

- Kavli Foundation Fellow, Alan Alda Center for Communicating Science, 2017
- Deutsche Forschungsgemeinschaft Research Fellowship 2009-2012
- ARC Discovery Postgraduate Fellowship Award, 2003-2007

Awards

- Arts Council UK, **Spillikin: A robot love story**, (with Pipeline Theatre Company), June 2015, £14,650
 - Australian National University Excellence Award, 2004-2007
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PROFESSIONAL SERVICE

Memberships and Advisory Roles

- Member: Engineers Without Borders (Boston Professionals Chapter)
- Advisor, Deutsche Forschungsgemeinschaft Grant No: HO 950/25-1 *Sky compass signaling of central-complex neurons in locusts exposed to the natural sky*
- External Advisor, Centre for Audio, Acoustics and Vibration, University of Technology Sydney

Committees

- Program Committee: International Symposium on Multi-Robot and Multi-Agent Systems 2019
- Co-organizer: IRSPM Conference Panel on 'Disruptive Technologies: Governance, Public Services and Regulation', 2019
- Program Committee: IJCAI Workshop on Human-Robot Engagement 2017
- Invited Participant: Berkman Center Roundtable on the law, regulation, and ethics of emerging robotics and automation technologies (2016)
- Program Committee: International Joint Conference on Artificial Intelligence 2016
- Organizing Committee: CITEC Summer School Series 2010-2011

Reviewing

Reviewer for IEEE Transactions on Automation Science and Engineering, PeerJ, Australian Journal of Public Administration, IEEE International Conference on Intelligent Robots and Systems, International Joint Conference on Artificial Intelligence.

Publons link: <https://publons.com/author/1446993/nicole-carey>

Outreach and Media

- Communicating themes, challenges, and goals of robotics to students and the general public through bespoke modules and programs (e.g. Bethel Math and Science Scholars Program, National Robotics Week).
- Developing interactive and educational exhibits for museums, universities, and demonstration arenas (eg. Phaeno Science Centre, London Science Museum, Heinz-Nixdorf Museum, Oxford-Brookes University).

Interview: *Wired* How Real are Extant's Robots? (Jul 2014)

Interview: The Guardian *Socibot: The social robot that knows how you feel* (Apr 2014)

Interview: FoxNY The rapid progress of artificial intelligence (Feb 2014)
