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Profile summary

Research interests

My theoretical research investigates the computational principles underlying learning and intelligent behaviour. I am particularly interested in how internal state, architecture and feedback shape what biological and artificial systems can represent, learn and compute. Specific interests include latent-state representations, pre-structured neural architectures, credit assignment, reward, abstraction and hierarchy, and the distinction between computational expressivity and learnability.

A central aim is to translate theoretical understanding into computational mechanisms, architectures and learning methods that can extend the capabilities of artificial intelligence. This includes investigating how architectural structure and learning interact, how systems maintain and use information over time, and how intelligent behaviour can be achieved under constraints on information and computation. Biological intelligence provides important evidence and inspiration, but its particular mechanisms need not define the limits of artificial systems.

Sensorimotor control provides an experimental route into these questions. My work encompasses human motor learning, speech motor control, haptic interaction and movement assessment. I use behavioural experiments and computational models to investigate state estimation, adaptation, feedback control and stabilising variables, and to test explanations of how biological systems acquire and maintain skilled behaviour.

I also design and build haptic and robotic interfaces and real-time embedded control systems. These provide experimental platforms for investigating learning and interaction, and for testing computational principles in physically meaningful tasks. Embodied, closed-loop control is an important perspective within this work, connecting theoretical questions with measurable behaviour in biological and artificial systems.

Employment

Associate Professor Computational Neuroscience

Associate Professor

School of Engineering, Computing and Mathematics

University of Plymouth

1 Nov 2012 → present

Research outputs

Speech Motor Control and Its Role in Stuttering

Howard, I. S. & Howell, P., 28 Sept 2026, (E-pub ahead of print) *The Routledge International Handbook of Stuttering.* 1st ed. Hemisphere (Taylor and Francis), p. 301-345 45 p.

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A Servo-Motor-Actuated Artificial Lung for Robotic Speech Production

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The impact of dwell time on the contextual effect of visual and passive lead-in movements
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Behavioral Motor Performance
Leib, R., Howard, I. S., Millard, M. & Franklin, D. W., 29 Dec 2023, In: Comprehensive Physiology. 14, 1, p. 5179-5224 46 p.

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Human Evaluation of Robotic Grippers for Berry Picking
Alvarez-Hidalgo, L. & Howard, I., 14 Sept 2023.

Design and Kinematic Analysis of a 3D-Printed 3DOF Robotic Manipulandum
Howard, I. S., 9 Sept 2023, *Towards Autonomous Robotic Systems - 24th Annual Conference, TAROS 2023, Proceedings.* Springer Science and Business Media Deutschland GmbH, p. 227-239 13 p. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); vol. 14136 LNAI).

In silico prediction of acute chemical toxicity of biocides in marine crustaceans using machine learning
Krishnan, R., Howard, I. S., Comber, S. & Jha, A. N., 20 Aug 2023, In: Science of the Total Environment. 887, 0, 164072.

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Howard, I. S., 28 Jun 2019, *Host publication not specified in Elements.* Vol. 0. p. 413-424

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Characterization of Neural Tuning: Visual Lead-in Movements Generalize in Speed and Distance
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A Single-Rate Context-Dependent Learning Process Underlies Rapid Adaptation to Familiar Object Dynamics
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Ingram, J. N., Howard, I. S., Flanagan, J. R. & Wolpert, D. M., 13 Apr 2010, In: Current Biology. 20, 7, p. 618-623

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Walliker, J. R., Daley, J., Faulkner, A. & Howard, I., 1991, In: Final Program and Paper Summaries 1991 IEEE ASSP Workshop on Applications of Signal Processing to Audio and Acoustics. 0, 0

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Howard, D., Faulkner, A. & Howard, I., 1 Jan 1987, In: European Conference on Speech Technology, ECST 1987. p. 1318-1321

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Quantitative comparisons between time domain speech fundamental frequency estimation algorithms,
Howard, I. & Howard, D., 30 Sept 1966.

Qualifications

Engineering and technology, Doctorate, Speech Fundamental Period Estimation using Pattern Recognition, University College London
Award Date: 1 Apr 1991

Engineering and technology, First Degree, Electrical and Electronic Engineering, B.Sc.(Eng.)
Award Date: 1 Jun 1984