Obituary: Inman Harvey (1948–2026)

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Inman Harvey, a leading figure in the field of Artificial Life for more than three decades and a frequent contributor to the pages of this journal, died suddenly on Friday, 5th June 2026.

Inman was the sort of person who, once met, was never forgotten. The combination of his unique mind – brilliant, combative, irreverent – and his warm, gently humorous personality made him a very popular and highly regarded figure on the international scene, as well as a much-valued mentor to countless postgraduate students at the University of Sussex. He was a key player in the emergence of Sussex as a major centre for research in Artificial Life and new approaches to AI in the 1990s, and he did much to help the nascent field of Alife to grow and establish itself.

While at school in Bristol, Inman became great friends with Geoffrey Hinton (Nobel Prize in Physics 2024 for foundational work on artificial neural networks). Geoff recalled, "I first met Inman when we were 7. He was always smarter than me. When we were teenagers, he told me that a memory might be distributed across many brain cells, and each brain cell might be involved in storing many different memories. That idea drove my research for the next 60 years."[1]

It was at about this time that Inman discovered cybernetics and became interested in brain processes and the possible relationships between biological mechanisms and machines. He tried – reasonably successfully – to build a version of Grey Walter's famous robot tortoise (*Machina speculatrix*) using an old windscreen wiper motor and various discarded components he gathered together.[2]

In 1966, Inman entered Trinity College, Cambridge University, to study Mathematics. His interests shifted toward philosophy, and he graduated in 1969 with a BA in Mathematics and Moral Sciences. He stayed on at Cambridge for a year to complete a postgraduate certificate in social anthropology, setting the tone for the highly interdisciplinary approach to research he would later take. Following university, Inman travelled, first hitting the hippy trail through South Asia and then further afield. He built a successful import–export business, which he ran for twenty years from 1973, centred around trade with Afghanistan. This whole period gave him a huge fund of entertaining tales about his escapades and near misses.[3]

Hence, when Inman re-entered academia in 1988, as a mature student on the MSc in Knowledge Based Systems at the School of Cognitive and Computational Sciences (COGS), University of Sussex, he came with an extraordinarily rich hinterland. The highly interdisciplinary and relaxed nature of COGS suited him very well, and Sussex became his permanent academic home.

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1 Geoff Hinton, quoted in the Sussex obituary of Inman Harvey https://staff.sussex.ac.uk/news/article/70903-obituary-inman-harvey.

2 Inman Harvey to Phil Husbands in conversation, circa 1990.

3 See https://staff.sussex.ac.uk/news/article/70903-obituary-inman-harvey for a flavour of these.

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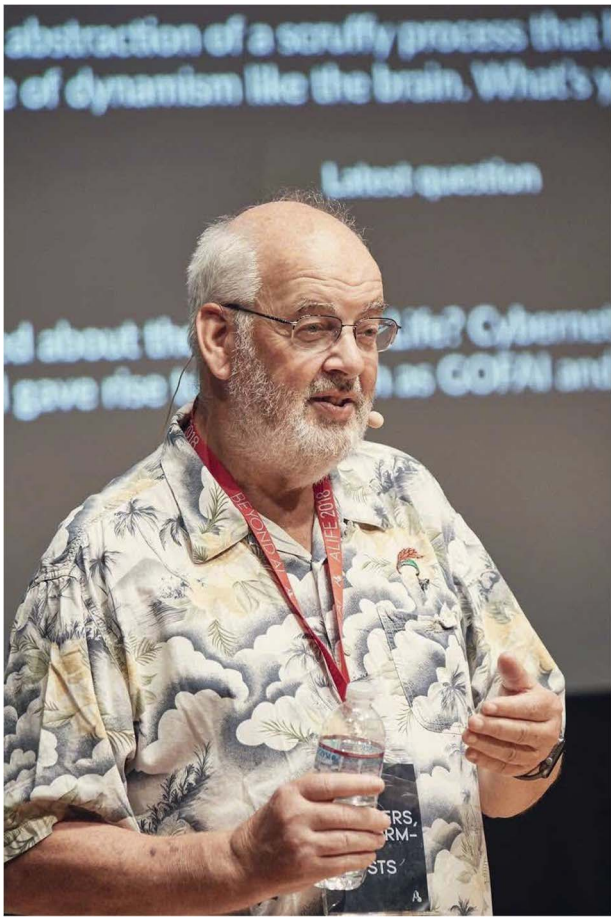


Image: Inman Harvey, delivering a keynote talk, Artificial Life Conference, Tokyo, 2018. Credit: Alife Lab, official photographs Alife'18, with permission.

Inman's DPhil research was focused around a philosophical and methodological framework he developed for the design of complex adaptive systems through artificial evolution. He argued that long-term artificial evolution is the best approach when the task domain is ill-defined and can increase in complexity indefinitely, and that this required a rather different approach from that used in the standard application of genetic algorithms to well-defined, fixed-dimensional optimisation problems. His Species Adaptation Genetic Algorithms (SAGA) involve variable-length genotypes which are able to grow indefinitely, with evolution generally taking place in a genetically converged population, where forces such as neutral genetic drift become important (Harvey, 1991, 1992a, 1992b). This work was typically original and challenging to the orthodoxy. His early experiments involved elegant, abstract mathematical models (he maintained a love of highly minimal models throughout his career), but he hankered to try out the idea in the real world, applied to the design of autonomous mobile robots, a problem that had intrigued him since his early attempts to build a Walter-esque tortoise.

Hence, in collaboration with Phil Husbands, Dave Cliff, Nick Jakobi, and others, he was central to the pioneering work on evolutionary robotics that began at Sussex in the early 1990s, becoming one of the founders of this new field. This involved the application of his ideas to the evolution of (dynamic recurrent) neural network robot controllers, along with properties of the robot sensors, including their morphology (Cliff et al., 1993; Harvey et al., 1997, 2005; Husbands & Harvey, 1992;

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Jakobi et al., 1995). That work quickly became very high profile and led to the rapid growth of our research group (Evolutionary and Adaptive Systems), which attracted elite students from all over the world. Inman, by now a postdoctoral research fellow, was a pivotal figure in the ensuing explosion of creativity.

In 1999, he became a member of faculty in COGS. His idiosyncratic style, insight-packed lectures and highly original mind made him very popular with students, particularly those on the MSc in Evolutionary and Adaptive Systems, which he directed from 2000–2011, and the many PhD candidates he successfully supervised to completion.

Inman's research style was tenacious and unconventional. He had little time for academic formalities and followed ideas and questions with determination, without paying too much attention to disciplinary boundaries or institutional pressures. His enquiries merged insights from evolutionary biology, ecology, neuroscience, cognitive science, cybernetics, and complex adaptive systems, and he always took the opportunity to add a philosophical gloss to even his most technical work.

Inman was prolific. Most of his research output first appeared in conferences and workshops. He rarely missed regular meetings such as the *Simulation of Adaptive Behavior* (*SAB*) or *Artificial Life* (*ECAL* and *ALife*) conferences, which he continued to attend after retirement. These meetings and their communities were the natural venue for his research; he relished the discovery of novel ideas and enjoyed personal and professional conversations above all else. His interventions, always provocative, humorous, and insightful, became an indispensable part of these meetings; his talks, always very well attended, never failed to engage and surprise participants, both regular and new.

After the seminal 1990s work, a good part of Inman's research continued to focus on robotics, which he saw as a way of doing "philosophy of mind with a screwdriver" (Harvey, 2000; Harvey et al., 2005). He maintained a preference for minimalism and parsimony, avoiding over-complicated architectures and entrenched ideas about cognition and adaptive behavior that, in his opinion, were utterly misguided, such as the notion of internal representations (Harvey, 2008). He adopted a dynamical systems perspective to the design and study of autonomous robots, much in line with the rise of embodied theories in the 1990s, and contributing to their development. He supervised several projects in wider aspects of robotics, such as the design of "programmable springs," actuators with programmable compliance able to exploit morphological dynamics and environmental coupling (Bigge & Harvey, 2007), the evolution of controllers for tethered airfoils or kites (Furey & Harvey, 2007), and humanoid, omnidirectional, minimally actuated passive–dynamic walkers (Vaughan et al., 2014).

Inman was driven by the exploration of unintuitive ideas, particularly concerning what dynamic, embodied, and situated agents can do, which is often more than we can guess. He was also motivated by a drive to debunk dogmas that lodge themselves in research communities without enough criticism. These two motivations were often hard to tell apart. One example involving both was his exploration of learning, particularly its interactions with evolutionary processes (Harvey, 1995, 1997b), the dynamic coupling between unrelated learning tasks (Harvey & Stone, 1996), and learning in robots without "structural plasticity," robots controlled by neural networks with fixed weights, but embedded in ecological settings (Izquierdo et al., 2008; Ochoa et al., 2000; Tuci et al., 2003). The latter line questioned the dogma that learning always implies internal structural change.

Following his SAGA work, Inman was very keen on understanding evolutionary dynamics, both at a broad theoretical level that encompasses natural and artificial evolution (Harvey, 2001, 2013a) and at a practical level for improving the methodologies of evolutionary algorithms, which for many years had relied on artisanal knowledge and trial and error (Harvey, 2011a; Harvey & Di Paolo, 2014; Harvey & Tomko, 2010; Ochoa et al., 2000; Shipman et al., 2000; Tuci et al., 2003). Minimalism informed his Microbial Genetic Algorithm (Harvey, 2011b), a conventional GA stripped down to basics that could be interpreted in terms of horizontal gene transfer in bacteria, providing a practical algorithm that was very easy to code and teach (it fits neatly into one line of C code[4]).

4 `for (W=(evaluate(a=POP*drand48())>evaluate(b=POP*drand48())?a:b),L=(W==a?b:a),i=0;i<LEN;i++) if ((r=drand48())<REC+MUT) gene[L][i]=(r<REC?gene[W][i]:gene[L][i]^1);`.

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Biological regulation was a source of inspiration for Inman, both at the physiological and ecological scales, where he saw similar principles of homeostasis and rein control at play (Harvey, 2004). He was keenly interested in models of ecological regulation, particularly different versions of James Lovelock's `Daisyworld` model, showing a stable, life-supporting planetary temperature emerging from ecosystem dynamics, according to the Gaia theory (Dyke & Harvey, 2006). In his typical fashion, Inman reduced Daisyworld to its minimal logic, simplifying its mathematics and uncovering the necessary factors behind emergent environmental stability (Harvey, 2015). This minimalist approach was further tested in models of ecosystem regulation without predefined stable points (McDonald-Gibson et al., 2008), and a thermodynamic model showing the relation between the rate of chemical processes in an ecosystem and its rate of entropy production (Virgo & Harvey, 2007).

Inman always regarded "established" results with a bit of suspicion whenever complex systems were involved. An influential mathematical model by Robert May (1972) suggested that ecosystems tend to become unstable as they increase in size and connectance. Inman showed that the result itself was fragile and relied on linear interactions among species. Ecosystem complexity does not necessarily lead to instability when interactions are nonlinear and take forms frequently found in nature (Harvey, 2011a).

Inman saw his research – and the field of Artificial Life as a whole – as a continuation of the work and ethos of early cybernetics. He would admit as much for his own case, especially in connection with creative British cyberneticians such as W. Ross Ashby and Gordon Pask, who sought to understand complex systems, life, and mind from basic principles (Harvey, 2013b; Virgo & Harvey, 2008). This attitude informed his wider philosophical concerns, especially his worries when models in biology and cognition adopted a logic of optimisation and were by default framed in computational rather than dynamical terms (Harvey, 1997a). For him, these were unwarranted assumptions, inherited from a perspective that attempted to simplify relations for the sake of understanding them in human-like terms. Evolution is not optimisation; cognition is not computation, was one of his favourite slogans. His constant targets were mereological fallacies, discourses that attributed agent-like properties to internal mechanisms, often expressed in apparently innocent terms, such as "the brain perceives" or "the brain predicts". Unfortunately, fallacies based on mereological mistakes continue to plague biology and the sciences of mind.

Based on his years of research, Inman produced sharp, often dissident interventions in philosophical debates, such as the question of robot consciousness (Harvey, 2002), the origins of rationality (Harvey, 2005), autopoiesis (Harvey, 2018b; Harvey, 2019), circular causation (Harvey, 2015, 2017), and the links among meaning, motivation, and existence in contemporary AI systems (Harvey, 2024). Keenly sensitive to category mistakes and the pervasive habits of language that often do the thinking for us, he found affinities with philosophers such as Gilbert Ryle and Ludwig Wittgenstein (Harvey, 2023).

These were not the musings of an opinionated scholar but interventions from someone whose outsider gaze could easily spot the odd omissions, unspoken assumptions, and habits of thought that bias a debate, sometimes leading to apparently unsolvable pseudo-problems. Inman confronted complex systems as a naturalist, aware of his own epistemic biases, but methodologically inclined to minimise them as much as possible and open to being surprised by what he found out in the process. He relished those "a-ha!" moments of realisation and spread this enthusiasm among colleagues and students. His explorations gave him a practical wisdom few philosophers demonstrate when thinking about complex systems and relational phenomena.

Unusual obsessions would easily grab Inman's attention, and whenever he could, he would turn them into models. Only a fraction of these obsessions were eventually published or presented at conferences, as in the case of traditional Pacific wave navigation by Polynesians and Micronesians, who could navigate vast distances in small boats across the Pacific using wave patterns (Harvey, 2018a, 2018b, 2022) or the question of wind-propelled machines that move faster than the wind (Harvey, 2017), a mechanical form of circular causation that he viewed as analogous to the circularities of life and mind.

There was no sharp boundary between Inman, the researcher, and Inman, the teacher. His Artificial Life lectures at Sussex – and the rest of the EASy MSc programme – put students in direct

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contact with the excitement of ongoing research. Inman had an unusual perspective on admitting students to this program: he didn't just seek a mix of relevant disciplinary backgrounds but explicitly included unusual components, such as artists and social science students. He encouraged students to learn from one another, and every year, this unlikely approach somehow worked. He took a similar relaxed and encouraging attitude to supervising doctoral projects and mentoring young colleagues. He was a strong supporter of women in science and, for somebody so busy, was incredibly generous with his time.

As well as his prolific contributions to research and scholarship, which led to numerous keynote talks at international conferences and workshops, and invited lectures all over the globe, he also made significant contributions to the field of Artificial Life in terms of administration and coordination. He helped to organise multiple international conferences and workshops, including ECAL'97 of which he was co-chair. He served as Vice-President of the International Society for Artificial Life (ISAL) from 2001–2015.

Inman was an inescapable feature of the Artificial Life landscape, an intellectual and social galvaniser who bridged across multiple and diverse interests and helped to glue them into a community. In 2015, he received the Lifetime Achievement Award from the ISAL for his profound contributions to the field. He accepted it somewhat grudgingly – he was no believer in such honours, at least not when applied to him. Never falsely modest, he was nevertheless unassuming.

Inman was not interested in conventions or formalities or career ladders – ideas and people were what mattered to him. He took great pleasure in lively conversation and debate, whether in his office, in departmental seminars, in conference bars or in the more relaxed setting of the many social events he organised, often at the home he shared with his partner, Shirley Kitts.

His influence is as wide as it is deep. He inspired so many, in so many different ways. He was a remarkable individual who will be greatly missed. Our thoughts are with Shirley and with Inman's daughter Melissa, son Rupert, and grandson Hamish.

References

Bigge, W. T., & Harvey, I. (2007). Programmable springs: Developing actuators with programmable compliance for autonomous robots. *Journal of Robotics and Autonomous Systems*, *5*(9), 728–734. https://doi.org/10.1016/j.robot.2007.05.013

Cliff, D., Husbands, P., & Harvey, I. (1993). Explorations in evolutionary robotics. *Adaptive Behavior*, *2*(1), 71–104. https://doi.org/10.1177/105971239300200104

Dyke, J. G., & Harvey, I. (2006). Pushing up the daisies. In L. M. Rocha, L. S. Yager, M. A. Bedau, D. Floreano, R. L. Goldstone, & A. Vespignani (Eds.), *Artificial life X, Proceedings of the Tenth International Conference on the Simulation and Synthesis of Living Systems* (pp. 426–431). Cambridge, MA: MIT Press.

Furey, A., & Harvey, I. (2007). Evolution of neural networks for active control of tethered airfoils. In F. Almeida e Costa, L. M. Rocha, E. Costa, I. Harvey, & A. Coutinho (Eds.), *Advances in Artificial Life, 9th European Conference, ECAL 2007* (pp. 746–755). Lisbon, Portugal: Springer. https://doi.org/10.1007/978-3-540-74913-4_75

Harvey, I. (1991). The artificial evolution of behaviour. In J.-A. Meyer & S. W. Wilson (Eds.), *From Animals to Animats: Proceedings of The First International Conference on Simulation of Adaptive Behavior* (pp. 400–408). MIT Press. https://doi.org/10.7551/mitpress/3115.003.0054

Harvey, I. (1992a). Species adaptation genetic algorithms: A basis for a continuing SAGA. In F. J. Varela & P. Bourgine (Eds.), *Toward a Practice of Autonomous Systems: Proceedings of the First European Conference on Artificial Life* (pp. 346–354). MIT Press.

Harvey, I. (1992b). The SAGA cross: The mechanics of recombination for species with variable length genotypes. In R. Manner & B. Manderick (Eds.), *Parallel Problem Solving from Nature* (pp. 269–278). North-Holland.

Harvey, I. (1995). Relearning and evolution in neural networks. *Adaptive Behavior*, *4*(1), 79–82. https://doi.org/10.1177/105971239500400105

Harvey, I. (1997a). Cognition is not computation: Evolution is not optimisation. In W. Gerstner, A. Germond, M. Hasler, & J.-D. Nicoud (Eds), *Artificial Neural Networks - ICANN97, Proceedings of 7th International*

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Conference on Artificial Neural Networks (pp. 685–690). LNCS 1327. Heidelberg: Springer-Verlag. https://doi.org/10.1007/BFb0020233

Harvey, I. (1997b). Is there another new factor in evolution? *Evolutionary Computation*, *4*(3), 311–327. https://doi.org/10.1162/evco.1996.4.3.313

Harvey, I. (2000). Robotics: Philosophy of mind using a screwdriver. In T. Gomi (Ed.), *Evolutionary Robotics: From Intelligent Robots to Artificial Life, Vol. III* (pp. 207–230). Ontario, Canada: AAI Books.

Harvey, I. (2001). Artificial evolution: A continuing SAGA. In T. Gomi (Ed.), *Evolutionary Robotics: From Intelligent Robots to Artificial Life, Proceedings of 8th Intl. Symposium on Evolutionary Robotics* (pp. 94–109). Berlin: Springer. https://doi.org/10.1007/3-540-45502-7_5

Harvey, I. (2002). Evolving robot consciousness: The easy problems and the rest. In J. H. Fetzer (Ed.), *Evolving consciousness* (pp. 205–219). Amsterdam: John Benjamins. https://doi.org/10.1075/aicr.34.16har

Harvey, I. (2004). Homeostasis and rein control: From Daisyworld to active perception. In J. Pollack, M. Bedau, P. Husbands, T. Ikegami, & R. A. Watson (Eds), *Proceedings of the Ninth International Conference on the Simulation and Synthesis of Living Systems, ALIFE'9* (pp. 309–314). Cambridge, MA: MIT Press. https://doi.org/10.7551/mitpress/1429.003.0052

Harvey, I. (2005). Evolution and the origins of the rational. In A. Zilhão (Ed.), *Cognition, evolution, and rationality: A cognitive science for the twenty-first century* (pp. 113–131). London: Routledge.

Harvey, I. (2008). Misrepresentations. In S. Bullock, J. Noble, R. A. Watson, & M. A. Bedau (Eds.), *Proceedings of the Eleventh International Conference on Artificial Life* (pp. 227–233). Cambridge, MA: MIT Press.

Harvey, I. (2011a). Opening stable doors: Complexity and stability in nonlinear systems. In T. Lenaerts, M. Giacobini, H. Bersini, P. Bourgine, M. Dorigo, & R. Doursat (Eds.), *Advances in Artificial Life, ECAL 2011, Proceedings of 11th European Conference on the Synthesis and Simulation of Living Systems* (pp. 318–325). Cambridge, MA: MIT Press.

Harvey, I. (2011b). The microbial genetic algorithm. In G. Kampis, I. Karsai, E. Szathmáry (Eds.), *Advances in Artificial Life: ECAL 2009, Part II, LNCS 5778* (pp. 126–133). Heidelberg: Springer. https://doi.org/10.1007/978-3-642-21314-4_16

Harvey, I. (2013a). How fast can we evolve something? In P. Lio, O. Miglino, G. Nicosia, S. Nolfi, & M. Pavone (Eds.), *Artificial Life, European Conference on Artificial Life, ECAL 2013* (pp. 1170–1171). Cambridge, MA: MIT Press. https://doi.org/10.1162/978-0-262-31709-2-ch179

Harvey, I. (2013b). Standing on the broad shoulders of Ashby. *Constructivist Foundations*, *9*(19), 102–104.

Harvey, I. (2015). The circular logic of Gaia: Fragility and fallacies, regulation and proofs. In P. Andrews, L. Caves, R. Doursat, S. Hickinbotham, F. Polack, S. Stepney, T. Taylor, & J. Timmis (Eds.), *Advances in Artificial Life, ECAL 2015* (pp. 90–97). Cambridge, MA: MIT Press.

Harvey, I. (2017). Going round in circles. In C. Knibbe, G. Beslon, D. Parsons, D. Misevic, J. Rouzaud-Cornabas, N. Bredèche, S. Hassas, O. Simonin, & H. Soula (Eds.), *Proceedings of ECAL 2017, the fourteenth European conference on artificial life* (pp. 198–199). Cambridge, MA: MIT Press.

Harvey, I. (2018a). An artificial life perspective on traditional Pacific wave navigation. In T. Ikegami, N. Virgo, O. Witkowski, M. Oka, R. Suzuki, & H. Iizuka (Eds.), *Proceedings of the 2018 Conference on Artificial Life* (pp. 359–360). Cambridge, MA: MIT Press. https://doi.org/10.1162/isal_a_00067

Harvey, I. (2018b). Parallel paths across the Pacific: A speculative explanation for the *dilep* in Marshallese navigation. ArXiv. https://doi.org/10.48550/ARXIV.1802.09151

Harvey, I. (2019). Habeas corpus: The ins and outs of autopoiesis. *Adaptive Behavior*, *28*(1), 39–40. https://doi.org/10.1177/1059712319836401

Harvey, I. (2022). Navigating blind without a map: Models of active wayfinding. In S. Holler, R. Löffler, & S. Bartlett (Eds.), *Proceedings of the Artificial Life Conference 2022* (pp. 456–465). Cambridge, MA: MIT Press.

Harvey, I. (2023). Dispelling ghosts: Observations on life and mind. In H. Iizuka, K. Suzuki, R. Uno, L. Damiano, N. Spychalav, M. Aguilera, E. Izquierdo, R. Suzuki, & M. Baltieri (Eds), *Ghost in the machine: Proceedings of the 2023 Conference on Artificial life*. Cambridge, MA: MIT Press. https://doi.org/10.1162/isal_a_00575

Harvey, I. (2024). Motivations for artificial intelligence, for deep learning, for ALife: Mortality and existential risk. *Artificial Life*, *30*(1), 48–64. https://doi.org/10.1162/artl_a_00427, PubMed: 38346273

Harvey, I., & Di Paolo, E. A. (2014). Evolutionary pathways. In P. A. Vargas, E. A. Di Paolo, I. Harvey, & P. Husbands (Eds.), *The horizons of evolutionary robotics* (pp. 77–92). Cambridge, MA: MIT Press. https://doi.org/10.7551/mitpress/8493.003.0005

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Harvey, I., Di Paolo, E., Wood, R., Quinn, M., & Tuci, E. (2005). Evolutionary robotics: A new scientific tool for studying cognition. *Artificial Life*, *11*(1–2), 79–98. https://doi.org/10.1162/1064546053278991, PubMed: 15811221

Harvey, I., Husbands, P., Cliff, D., Thompson, A., & Jakobi, N. (1997). Evolutionary robotics: The Sussex approach. *Robotics and Autonomous Systems*, *20*, 205–224. https://doi.org/10.1016/S0921-8890(96)00067-X

Harvey, I., & Stone, J. V. (1996). Unicycling helps your French: Spontaneous recovery of associations by learning unrelated tasks. *Neural Computation*, *8*(4), 697–704. https://doi.org/10.1162/neco.1996.8.4.697

Harvey, I., & Tomko, N. (2010). Binomics: Where metagenomics meets the binary world. In H. Fellermann, M. Dörr, M. Hanczyc, L. Laursen, S. Maurer, D. Merkle, P.-A. Monnard, K. Stoy, & S. Rasmussen (Eds.), *Artificial Life XII, Proceedings of the Twelfth International Conference on the Synthesis and Simulation of Living Systems* (pp. 370–377). Cambridge, MA: MIT Press.

Husbands, P., & Harvey, I. (1992). Evolution versus design: Controlling autonomous robots. In *Integrating Perception, Planning and Action: Proceedings of 3rd Annual Conference on Artificial Intelligence, Simulation and Planning* (pp. 139–146). IEEE Press.

Izquierdo, E., Harvey, I., & Beer, R. (2008). Associative learning on a continuum in evolved dynamical networks. *Adaptive Behavior*, *16*, 361–384. https://doi.org/10.1177/1059712308097316

Jakobi, N., Husbands, P., & Harvey, I. (1995). Noise and the reality gap: The use of simulation in evolutionary robotics. In F. Moran, A. Moreno, J. Merelo, & P. Chacon (Eds.), *Advances in Artificial Life: Proceedings of 3rd European Conference on Artificial Life* (pp. 704–720). Lecture Notes in Artificial Intelligence 929. Springer-Verlag. https://doi.org/10.1007/3-540-59496-5_337

May, R. M. (1972). Will a large complex system be stable? *Nature*, *238*, 413–414. https://doi.org/10.1038/238413a0, PubMed: 4559589

McDonald-Gibson, J., Dyke, J. G., Di Paolo, E. A., & Harvey, I. R. (2008). Environmental regulation can arise under minimal assumptions. *Journal of Theoretical Biology*, *251*(4), 653–666. https://doi.org/10.1016/j.jtbi.2007.12.016

Ochoa, G., Harvey, I., & Buxton, H. (2000). Optimal mutation rates and selection pressure in genetic algorithms. In L. D. Whitley, D. E. Goldberg, E. Cantú-Paz, L. Spector, & I. C. Parmee (Eds.), *Proceedings of the 2nd Annual Conference on Genetic and Evolutionary Computation (GECCO'00)* (pp. 315–322). San Francisco, CA, USA: Morgan Kaufmann.

Tuci, E., Quinn, M., & Harvey, I. (2003). An evolutionary ecological approach to the study of learning behaviour using a robot based model. *Adaptive Behavior*, *10*(3–4), 201–222. https://doi.org/10.1177/1059712302919993004

Shipman, R., Shackleton, M., & Harvey, I. (2000). The use of neutral genotype-phenotype mappings for improved evolutionary search. *BT Technology Journal*, *18*(4), 103–111. https://doi.org/10.1023/A:1026714927227

Vaughan, E., Di Paolo, E. A., & Harvey, I. (2014). Incremental evolution of an omni-directional biped for rugged terrain. In P. A. Vargas, E. A. Di Paolo, I. Harvey, & P. Husbands (Eds.), *The horizons of evolutionary robotics* (pp. 237–278). Cambridge, MA: MIT Press. https://doi.org/10.7551/mitpress/8493.003.0012

Virgo, N., & Harvey, I. (2007). Entropy production in ecosystems. In F. A. e. Costa, L. M. Rocha, E. Costa, I. Harvey, & A. Coutinho (Eds.), *Advances in Artificial Life, 9th European Conference, ECAL 2007* (pp. 123–132). September 10-14, 2007, Proceedings. Lecture Notes in Computer Science 4648). Lisbon, Portugal: Springer.

Virgo, N., & Harvey, I. (2008). Adaptive growth processes: A model inspired by Pask's ear. In S. Bullock, J. Noble, R. A. Watson, & M. A. Bedau (Eds.), *Proceedings of the Eleventh International Conference on Artificial Life* (pp. 656–661). Cambridge, MA: MIT Press.

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