

Curriculum Vitae

George E. Mobus

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Education

- **Ph.D.** Computer Science, University of North Texas, 1994
 - **M.B.A.** Information Systems and Management Science, San Diego State University, 1983
 - **B.A.** Zoology, University of Washington, 1973
 - **Upsilon Pi Epsilon** Honor society member
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Professional Experience Summary

- **Associate Professor**, Computing Science and Computer Engineering & Systems, [Institute of Technology, University of Washington, Tacoma](#), 2001 to present.
 - **Assistant Professor**, [Dept. of Computer Science, Western Washington University](#), 1998 to 2001.
 - **Interim Director**, Internet Studies Center, Western Washington University, 1999 to present.
 - **Visiting Assistant Professor**, Dept. of Computer Science, Western Washington University, 1995 to 1998.
 - **Research Scientist and Adjunct Assistant Professor**, Dept. of Computer Science, Western Washington University, 1994 to 1995.
 - **Lecturer**, Dept. of Computer Science, University of North Texas, 1989 to 1994
 - **Associate**, Center for Research in Parallel and Distributed Computing, University of North Texas, 1990 to 1994
 - **Vice President**, R & D, Chandas Corporation, Escondido, CA, 1987 to 1989.
 - **Executive Vice President & General Manager**, Technetics, Inc., El Cajon, CA, 1983 to 1987.
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Academic Experience

- **Courses Taught**
 - *Undergraduate*

Introduction to Computer Science, Systems Software, Data Structures, Data Communications and Internetworking, Algorithms Analysis, Systems Architecture, Mobile Autonomous Robotics, Operating

systems, Microcontroller interfacing.

- **Graduate**

Pattern Recognition, Neural Networks, Survey of Computing Problems in Internetworking, Autonomous Internet Agents, Mobile Autonomous Robotics, Applied Distributed Computing, Seminar in Computer Science Research.

- **Achievements**

- Named Mentor for 1998-99 Outstanding Graduate, Jennifer Gregor (WWU)
- Voted Outstanding Faculty, 1999-00, by the Student Chapter of the Association for Computing Machinery (ACM - WWU)

- **Curriculum Development**

- CS1 & 2
- Practicum in Computer Programming
- Computer Architecture & Organization
- Internet Studies
- Software Engineering with Java
- Behavior-based Robotics (using Lego's Mindstorm kits)
- Embedded Systems design and implementation

- **Undergraduate Research**

- NSF RUI IIS-9907102 *Foraging Search in a Mobile Robot*, supporting four undergraduate research assistants
- Independent Studies: *Personal Web Search Agent*, three students

- **Outreach and Development Service**

- Organized a departmental Industry Board of Advisors (WWU)
 - Coordinated organization of the Internet Studies Center (WWU) with half of the funding from non-state sources
 - Coordinated receipts of scholarship funds from various companies
 - Coordinated alumni events
 - Coordinated alumni newsletter production
 - Conduct a Programming Clinic for beginning programmers in CS
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Research Interests

- **Biophysical Economics**

My research in this arena involves the development of a biophysical computer model of something I call an abstract economy. The main feature of the model is that it deals very explicitly with the physics of extracting energy from a fixed, finite reserve of fuel and the increasing energy cost of doing so. The EROEI associated with oil production has been in steady decline for the past one hundred years due to the increasing costs associated with finding and pumping more oil from exotic (e.g. continental shelves) locations. Far more energy is used up producing the infrastructure for obtaining this harder to reach oil. Today, for every BTU of oil that is obtained from these locations, we use up 1/20th of a BTU of previously pumped oil. Oil pumped from shallow wells in Pennsylvania or West Texas, nearly 100 years ago only required about 1/100th of a BTU for each BTU we obtained.

- **Systems Science**

Systems science is the collection of highly interrelated subjects that taken together form a kind of meta-science, or a general science of science! Systems science includes subjects such as cybernetics, information theory, complexity theory, the universal theory of evolution (including sub-topics like emergence), network theory, and many more. What is unique about systems science is that its concepts broadly apply to every other science discipline. Indeed, many of the traditional disciplines have developed sub-branches named "systems ...", where the ellipsis can be filled in with names like 'biology', 'sociology', 'psychology', 'ecology', etc.

I have co-authored an introductory book on Systems Science published by Springer (Nov. 2014).

- **Evolutionary, Cognitive Neuro-Psychology**

Over the last few years I have rekindled one of my first loves in science — neurobiology — to explore the nature of real intelligence. This follows naturally from my work on autonomous agents (below) but has led me into a rather interesting realm that would not be obvious to those who have come to cognitive science strictly from the field of artificial intelligence.

The Search for Sapience — The Cognitive Basis of Wisdom

Many disciplines are converging on the workings of the human mind. From psychology we continue to refine probes of behavior and decision making/problem solving. From neurobiology, especially with the advent of dynamic imaging techniques, we have begun to map control functions to specific areas of the brain. And from Evo-Devo (evolution and development taken together) we are beginning to understand how the modern human brain came into existence and how it helped Homo sapiens emerge as the dominant hominid as well as a symbol manipulating (language and signs) sentience. These are extraordinarily exciting times in brain research.

Neurobiologists are determining the capabilities of the prefrontal cortex in its role of providing so-called executive functions in guiding the reasoning and problem solving abilities of the mind. Recently attention has turned to the prefrontal cortex, particularly the extreme pole patch of tissue (right behind the eyes!) in processing judgment. My interest is in determining if this processing, which I have labeled sapience in order to distinguish the cognitive aspect from the performance and knowledge-base aspects of wisdom, is, indeed, the basis of what we recognize as

wisdom.

- **Real-time, on-line, life-time learning algorithms.**

This work has led to the development of a learning algorithm that provides a solution to the *destructive interference* problem in life-long learning systems. A patent for the Adaptrade mechanism has been issued. The work was funded, in part, by Caterpillar, Inc. and the patent is held jointly with that company.

- **Autonomous agents in dynamic, nonstationary environments.**

I have been investigating the application of the above learning algorithm to improve the search performance of agents in highly dynamic and indeterminate environments. The research program is investigating how agents can encode causal relations between object cues and sought resources so that the cues can act as heuristic guides in future searches. Both physical and software agents have been the subject of investigations. This work has been funded, in part, by grants from Caterpillar, IBM and Ark Interfaces, a subsidiary of Packard-Bell NEC. A grant from the National Science Foundation is being used to extend the work using a robot platform.

Grants and Consulting Contracts, etc.

Collecting Data Regarding Student Participation in a Systems Course, Milgard Center for Leadership and Social Responsibility, \$1,250

Internet Studies Center, Higher Education Coordinating Board, State of Washington, \$250,000+, 9/99

Internet Studies Center, Microsoft (\$83,000), US WEST (\$50,000) and NetManage Inc. (\$25,000), 9/99

Foraging Search in a Mobile Autonomous Robot, National Science Foundation, Robotics and Human Augmentation Division, \$56,000, 9/1/1999

Startup Funding, College of Arts & Sciences, Western Washington University, \$32,000

Application of Neural Networks to the Control of Heavy Equipment, Caterpillar, Inc., \$67,000, 6/1/1990

Pattern Recognition Using Adaptrade-based Neural Networks, Caterpillar, Inc., \$13,500, 6/1/1991

Digital Signal Processing Equipment, Texas Instruments, Inc., \$2,000, 9/1/1992

Transputer Parallel Processing Equipment and System Software, IBM, \$7,500, 2/20/1994

An Adaptive, Mobile Agent, IBM, \$15,000, 3/1/1994

Application of Machine Learning to Profile Link Usage Patterns, Ark Interfaces - a subsidiary of Packard-Bell NEC., \$32,000, 5/1/1996

Impact of the Internet on Securities Registered Agents, Pacific Harbor Securities, Seattle, WA., \$5,000, 9/27/1996

Feasibility of Adaptive Bookmark Management, Exodus Technologies, Bellevue WA, \$5,000, 6/1/97

Visiting Scholar, Pacific Northwest College of Arts, Portland OR. Sept. 20-22. Seminars in energy and biophysical economics – limits to growth. Public lecture on the same topic. Honorarium. <http://cal.pnca.edu/e/467>

Radio Interview, Wayne Britenden's Counterpoint, Radio New Zealand National, 30 April 2013 (11:41). Discussed the limits to growth and impact on economy, civilization, and the environment.

<http://www.radionz.co.nz/national/programmes/sunday/20121202>

Publications, Scholarly Works and Patents

- **Mobus, G.E.** & Kalton, M. (2014). *Principles of Systems Science*, Springer, New York. ISBN 978-1-4939-1919-2
- **Mobus, G.E.** (2012). "The Role of Money in a Biophysical Economy", *Fourth Annual Biophysical Economics Meeting*, Burlington VT. Oct. October 26-28. Panel member.
- **Mobus, G.E.** (2012). "The Evolution of Wisdom", *SCIENCE, WISDOM, AND THE FUTURE: Humanity's Quest for a Flourishing Earth*, Collins Foundation Press, Santa Margarita, CA. pp 83-89.
- **Mobus, G.E.** (2010). Energy and the Economic Outlook: The Good, the Bad, and the Ugly, Invited talk, *The Institute for the Future — Ten-year Forecast Retreat*, April 26-27, 2010, Sausalito CA.
- **Mobus, G.E.** (2009). The Evolution of Sapience, Past and Future, *SCIENCE, WISDOM, AND THE FUTURE: Humanity's Quest for a Flourishing Earth*, June 24 — 28, San Luis Obispo, California, Organized by the Collins Family Foundation and the Orion Institute. [Invited talk at the conference.]
- **Mobus, G.E.** (2011). Net Energy and the Economy: A Primer, *The Third International Biophysical Economics Meeting*, April 15-16, 2011, SUNY-ESF, Syracuse New York.
- **Mobus, G.E.** (2009). Peak Energy, EROI, and the Economy: Modeling Contraction in the Flow of Net Energy and Its Impact on Economic Activity, *The Second International Biophysical Economics Meeting*, Oct. 2009, SUNY-ESF, Syracuse New York.
- **Mobus, G.E.** (2008). Money and Energy, *The First International Biophysical Economics Meeting*, Oct. 2008, SUNY-ESF, Syracuse New York.
- **Mobus, G.E.**, (2002). Lessons Learned from MAVRIC's Brain: An Anticipatory Artificial Agent and Proto-consciousness, *Computing Anticipatory Systems*, D. Dubois (Ed.), in press. This paper is an expanded version of the invited talk below.
- **Mobus, G.E.**, (2001). *Lessons Learned from MAVRIC's Brain: An Anticipatory Artificial Agent and Proto-consciousness*, Invited Talk: *5th Intl. Conf. on Computing Anticipatory Systems, CASYS'01*, Liege, Belgium
- **Mobus, G.E.**, (2000). Adapting Robot Behavior to a Nonstationary Environment: A Deeper Biologically Inspired Model of Neural Processing. Accepted for presentation: *International Society for Optical Engineering, Photonics East, Sensor Fusion and Decentralized Control in Robotic Systems III*, Boston, MA. [Refereed]
- **Mobus, G.E.** and Fisher, P., (2000). Edge-of-chaos search. In D.S. Levine, V. Brown and V.S. Shirey (Eds.), *Oscillations in Neural Systems*, Chapter 16, pp 309-325, Lawrence Erlbaum Associates, Publishers.
- **Mobus, G.E.**, (2000). Foraging Search: Prototypical Intelligence, in *Computing Anticipatory Systems*, D. Dubois (Ed.), American Institute of Physics 517, pp 592-605.
- **Mobus, G.E.**, (1999). *Foraging Search: Prototypical Intelligence*, Invited Talk: 3rd Intl. Conf. on Computing Anticipatory Systems, Liege, Belgium, [selected as Best Paper for the Symposium].
- **Mobus, G.E.** and Caterpillar, Inc., (1995). A patent, #5,504,839, "Processor and Processing Element for Use in a Neural Network", has been awarded for the Adaptrade leaning mechanism and a neuromimic processor in which it is used.
- **Mobus, G.E.**, (1994). Toward a theory of learning and representing causal inference in neural networks. In *Neural Networks for Knowledge Representation and Inference*, D.S. Levine and M. Aparicio (Eds.), Lawrence Erlbaum Associates, Publishers.
- **Mobus, G.E.**, (1994). *A multi-time scale learning mechanism for neuromimic processing*. Ph.D. Dissertation (unpublished), University of North Texas, Denton, TX.
- **Mobus, G.E.** and Aparicio, M. (1994). Foraging agents. In *Proc. Center for Advanced Systems Conf.*, IBM Toronto Laboratory, Toronto, Canada. [Refereed]
- **Mobus, G.E.** and Fisher, P. (1994). MAVRIC's Brain. In *Proc. Seventh Intl. Conf. on Industrial & Engineering Applications of Artificial Intelligence & Expert Systems*, Austin, TX. [Refereed]
- **Mobus, G.E.** and Fisher, P. (1991). Conditioned response training of robots using adaptrade-based neural networks.

- In *Proc. Intl. Joint Conf. on Neural Networks*, IEEE & Intl. Neural Networks Society, Seattle, WA. [Refereed]
- **Mobus, G.E.** and Fisher, P. (1991). Conditioned response training for robot control: I - Continuous adaptive learning. In *AMSE Proc. Intl. Conf. on Neural Networks.*, San Diego, CA.
 - **Mobus, G.E.** and Fisher, P. (1991). Conditioned response training for robot control: II - Simulation results. In *AMSE Proc. Intl. Conf. on Neural Networks.*, San Diego, CA.
 - **Mobus, G.E.** and Fisher, P. (1990). *The adaptrode neuristor: a spatio-temporal memory encoding mechanism for neurocomputing*. Technical Report CRPDC-90-5, University of North Texas, Dept. of Computer Science, Denton, TX.
 - **Mobus, G.E.** (1990). *The adaptrode learning model: applications in neural network computing*. Technical Report CRPDC-90-6, University of North Texas, Dept. of Computer Science, Denton, TX.
 - **Mobus, G.E.** (1983). *A cybernetic model for use in the development of formal information systems*. Master's Thesis (unpublished), San Diego State University, San Diego, CA.
 - **Mobus, G.E.** (1982). The hierarchical control model basis for structured analysis. In, *Proc. Joint National Meeting, ORSA and IMS.*, San Diego, CA. [Refereed]
 - **Mobus, G.E.** (1981). Harvesting the sun's energy. *Byte*.

Textbook

- **Mobus, George & Kalton, M.** (2014). *The Principles of Systems Science*, Springer, NY.
- **Mobus, George** (in process). *Sapience: How the Brain Produces Wisdom*.

Personal Blog: [Question Everything](http://questioneverything.typepad.com/) (<http://questioneverything.typepad.com/>)

Opinions expressed in this blog are my own and do not represent views or positions held by the University of Washington.

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