

References

- Abeles, M. 1984. *Local Cortical Circuits*. Berlin: Springer Verlag.
- Ackley, D., & Litman, M. 1991. Interactions between learning and evolution. *Pages 487–509 of:* (Langton *et al.* 1992).
- Agre, P.E., & Chapman, D. 1987. Pengi: An Implementation of a Theory of Activity. *Pages 268–272 of: Proceedings of AAAI-87*. Morgan Kaufman Publishers Inc.
- Agree, Ph. 1988. *The Dynamic Structures of Everyday Life*. Report Number AI-TR 1085. MIT Artificial Intelligence Lab., Cambridge.
- Allman, J., Meizen, F., & McGuiness, E. 1985. Non-classical receptive field properties. *Annual Review of Neuroscience*, **8**, 407–430.
- Anderson, J. A., & Rosenfeld, E. (eds). 1988. *Neurocomputing*. Vol. 1. Cambridge, MA: MIT Press.
- Anderson, J. A., Pellionisz, A., & Rosenfeld, E. (eds). 1990. *Neurocomputing*. Vol. 2. Cambridge, MA: MIT Press.
- Arbib, M.A. 1987. Levels of Modelling of Mechanisms of Visually Guided Behaviour. *Behavioural and Brain Sciences*, **10**, 407–465.
- Arbib, Michael A. 1969. *Theories of Abstract Automata*. Prentice-Hall Series in Automatic Computation. Englewood Cliffs, New Jersey: Prentice-Hall Inc.
- Baeza, I., Ibañez, M., Lazcano, A., Santiago, C., Arguello, C., Wong, C., & Oró, J. 1987. Liposomes with polyribonucleotides as models of precellular systems. *Origins of Life*, **17**, 187–199.
- Barlow, H. B. 1972. Single units and sensation: a neuron doctrine for perceptual psychology? *Perception*, **1**, 371–94.
- Beer, Stafford. 1973. Preface to ‘Autopoiesis: The Organization of the Living’. *Pages 63–72 of:* (Maturana & Varela 1973b).
- Bennett, J.G. 1956. The Dramatic Universe. *In: The Foundations of Natural Philosophy*, revised edn., vol. 1. Charles Town, West Virginia: Claymont Communications. ISBN 0 934254 15 X.
- Bennett, J.G. 1956–1966. *The Dramatic Universe*, Vols. 1 - 4. Hodder & Stoughton. Vol. 1:1956, Vol. 2:1961, Vols. 3,4:1966; Claymont Communications, 1987 edition, ISBN 0 934254 15 X (Vol.1); 0 934254 17 6 (Vol.2); 0 934254 19 2 (Vol.3); 0 934254 21 4 (Vol.4).
- Berlekamp, E. R., Conway, J. H., & Guy, R. K. 1982. What is Life? *Chap. 25, pages 817–850 of: Winning Ways for your Mathematical Plays*, vol. 2. London: Academic Press.
- Black, I.B. 1988. *Information in the Brain: A Molecular Perspective*. Cambridge MA: MIT Press.
- Bleloch, G., & Rosenberg, C.R. 1988. *Network Learning on the Connection Machine. Connectionist Models and Their Implications*. Norwood, NJ: Ablex.
- Boden, Margaret A. 1988. *Computer Models of Mind*. Cambridge: Cambridge University Press.
- Bohm, D. 1980. *Wholeness and the Implicate Order*. London: Ark Paperbacks.
- Bonner, J. T. 1988. *The Evolution of Complexity*. Princeton: Princeton University Press.
- Booker, L. B., Goldberg, D. E., & Holland, J. H. 1989. Classifier Systems and Genetic Algorithms. *Artificial Intelligence*, **40**, 235–282.
- Bortoft, H. 1986. *Goethe’s Scientific Consciousness*. Institute for Cultural Research. Monograph Series No 22, ISBN 0 904674.
- Bourgine, P., & Varela, F. J. 1992. Towards a Practice of Autonomous Systems. *Pages xi–xvii of:* (Varela & Bourgine 1992). Series Advisors: John H. Holland, Christopher Langton and Stewart W. Wilson.

- Braitenberg, Valentino. 1984. *Vehicles. Experiments in Synthetic Psychology*. Cambridge, MA: MIT Press.
- Brooks, R. 1991a. Intelligence Without Representation. *Artificial Intelligence*, **47**, 139–161.
- Brooks, Rodney A. 1986 (May). *Achieving Artificial Intelligence Through Building Robots*. A.I. Memo 899. Massachusetts Institute of Technology, Artificial Intelligence Laboratory.
- Brooks, Rodney A. 1987. *Intelligence without representation*. MIT Artificial Intelligence Report. Cambridge, MA.
- Brooks, Rodney A. 1991b. *Intelligence Without Reason*. A.I. Memo 1293. Massachusetts Institute of Technology, Artificial Intelligence Laboratory.
- Brooks, Rodney A. 1991c. Intelligence without representations. *International Journal of Cognitive Science*. Guest Editor: L. Steels. In Press.
- Brown, H.I. 1979. *Perception, Theory and Commitment—The New Philosophy of Science*. The University of Chicago Press. ISBN 0 226 07618.
- Bunge, M. 1979. *Causality and Modern Science*. 3rd edn. New York: Dover.
- Burks, Arthur W. 1960. Computation, Behavior and Structure in Fixed and Growing Automata. *Pages 282–311 of:* Yovits, Marshall C., & Cameron, Scott (eds), *Self-Organizing Systems*. Oxford: Pergamon Press.
- Burks, Arthur W. 1966a. Automata Self-Reproduction. *Pages 251–296 of:* (Burks 1966b).
- Burks, Arthur W. (ed). 1966b. *Theory of Self-Reproducing Automata [by] John von Neumann*. Urbana: University of Illinois Press.
- Burks, Arthur W. (ed). 1970a. *Essays on Cellular Automata*. Urbana: University of Illinois Press.
- Burks, Arthur W. 1970b. Introduction to ‘Essays on Cellular Automata’. *Pages xi–xxvi of:* (Burks 1970a).
- Buss, L. 1987. *The Evolution of Individuality*. Princeton: Princeton University Press.
- Cairns-Smith, A. G. 1982. *Genetic Takeover and the Mineral Origins of Life*. Cambridge: Cambridge University Press.
- Campbell, Donald T. 1974a. Evolutionary Epistemology. *Pages 413–463 (Book I) of:* (Schilpp 1974). Also reprinted as *Chap. II, pages 47–89 of:* (Radnitzky & Bartley 1987).
- Campbell, Donald T. 1974b. Unjustified Variation and Selective Retention in Scientific Discovery. *Chap. 9, pages 139–161 of:* Ayala, Francisco Jose, & Dobzhansky, Theodosius (eds), *Studies in the Philosophy of Biology*. London: The Macmillan Press Ltd.
- Cariani, P. 1991. *Structural adaptability and emergence of modelling relations in organisms, devices and neural networks*. Personal Manuscript.
- Caruana, Richard A., & Schaffer, J. David. 1988. Representation and Hidden Bias: Gray vs. Binary Coding for Genetic Algorithms. *In: Proceedings of the 5th Conference on Machine Learning*.
- Castoriadis, C. 1987. L’état du sujet aujourd’hui. *Topique*, **38**, 7–39.
- Cliff, Dave. 1991. The Computational Hoverfly: A Study in Computational Neuroethology. *Pages 87–96 of:* Meyer, & Wilson (eds), *From Animals to Animats. Proceedings of the First International Conference on Simulation of Adaptive Behavior*. Cambridge, MA: The MIT Press/Bradford Books.
- Codd, E. F. 1968. *Cellular Automata*. ACM Monograph Series. New York: Academic Press, Inc.
- Collins, Robert J., & Jefferson, David R. 1992. Antfarm: Towards Simulated Evolution. *Pages 579–601 of:* (Langton et al. 1992).
- Conrad, M. 1988. Quantum Mechanics and Molecular Computing: Mutual Implications. *International Journal of Quantum Chemistry: Quantum Biology Symposium*, **15**, 287–301.
- Davis, Martin (ed). 1965. *The Undecidable*. New York: Raven Press.
- Davis, M.D., & Weyuker, E.J. 1983. *Computability, Complexity and Languages, Fundamentals of Theoretical Computer Science*. New York: Academic Press.
- Deamer, D., & Barchfeld, G. 1982. Encapsulation of macromolecules by lipid vesicles under simulated prebiotic conditions. *Journal of Molecular Evolution*, **18**, 203–206.

- Deamer, D. W. 1986. Role of amphillic compounds in the evolution of membrane structure on the early Earth. *Origins of Life*, **17**, 3–25.
- Dennett, Daniel C. 1984. Cognitive Wheels: The Frame Problem of AI. Pages 129–151 of: Hookway, C. (ed), *Minds, Machines, and Evolution: Philosophical Studies*. Cambridge University Press.
- Dennett, Daniel C. 1987. *The Intentional Stance*. Cambridge, Massachusetts: The MIT Press.
- Dewdney, A. K. 1987. Computer Recreations: A Program Called MICE Nibbles its Way to Victory at the First Core Wars Tournament. *Scientific American*, **256**(1), 8–11.
- Dijksterhuis, E.J. 1986. *The Mechanization of the World Picture*. Princeton University Press. ISBN 0 691 08403.
- Dreyfus, Hubert L. 1979. *What Computers Can't Do: The Limits of Artificial Intelligence*. Revised edn. New York: Harper & Row.
- Dyer, M. G. 1991. Symbolic Neuro-engineering for Natural Language Processing: A Multi-level Research Approach. In: Barnden, J., & Pollack, J. (eds), *Advances in Connectionist Neural Computation*. Norwood, NJ: Ablex.
- Eckhorn, R., et al. 1988. Coherent Oscillations—A Mechanism of Feature Linking in the Visual Cortex—Multiple Electrode and Correlation Analyses in the Cat. *Biological Cybernetics*, **60**(2), 121–130.
- Edelman, G. M. 1989. *Neural Darwinism, the Theory of Neuronal Group Selection*. Oxford: Oxford.
- Elman, J. 1990. Finding Structure in Time. *Cognitive Science*, **14**, 215–239.
- Farmer, J., Lapedes, A., Packard, N., & Wendroff, B. (eds). 1986. *Evolution, Games and Learning*. Amsterdam: North-Holland.
- Farmer, J. Doyne, & d'A. Belin, Alleta. 1992. Artificial Life: The Coming Evolution. Pages 815–838 of: (Langton et al. 1992).
- Fleischaker, G. 1988. *Autopoiesis: System logic and the origin of life*. Ph.D. Dissertation, Boston University, Boston, MA.
- Fodor, Jerry A. 1976. *The Language of Thought*. Hassocks, Sussex: The Harvester Press Limited. First published in the United States of America by Thomas Y. Crowell Company, Inc.
- Fodor, Jerry A., & Pylyshyn, Zenon W. 1988. Connectionism and Cognitive Architecture: A Critical Analysis. *Cognition*, **28**, 3–71.
- Fogel, Lawrence J., Owens, Alvin J., & Walsh, Michael J. 1966. *Artificial Intelligence Through Simulated Evolution*. New York: John Wiley & Sons, Inc.
- Forrest, Stephanie. 1990. Emergent Computation: Self-Organizing, Collective, and Cooperative Phenomena in Natural and Artificial Computing networks. In: Forrest, Stephanie (ed), *Emergent Computation*. London: MIT/North Holland.
- Freeman, W. J. 1991. The Physiology of Perception. *Scientific American*, Feb., 34–41.
- Friedberg, R. M. 1958. A Learning Machine: Part I. *IBM Journal*, Jan., 2–13.
- Friedberg, R. M., Dunham, B., & North, J. H. 1959. A Learning Machine: Part II. *IBM Journal*, July, 282–287.
- Furlong, D. 1986. *On The Problem of Structure in Perception*. Technical Report. Department of Microelectronic and Electrical Engineering, Trinity College, Dublin.
- Furth, Hans G. 1969. *Piaget and Knowledge. Theoretical Foundations*. Englewood Cliffs, N.J.: Prentice-Hall.
- Gardner, Howard. 1985. *The Mind's New Science*. New York, NY: Basic Books.
- Gelman, S.A. 1988. The Development of Induction Within Natural Kind and Artefact Categories. *Cognitive Psychology*, **20**, 65–95.
- Ginsburg, H., & Opper, S. 1969. *Piaget's Theory of Intellectual Development*. NJ: Prentice Hall.
- Goethe, J.W. von. 1988. *Goethe—Scientific Studies*. Suhrkamp Publishers. Ed. Douglas Miller, ISBN 3 51802969.
- Greenfield, P. 1992. Language, Tools, and Brain: The Development and Evolution of Hierarchically Organised Sequential Behaviour. *Behavioural and Brain Sciences*. Target Article. Forthcoming.

- Grey, C. M., König, P., Engel, A. K., & Singer, W. 1989. Oscillatory Responses in Cat Visual Cortex Exhibit Inter-columnar Synchronization which Reflects Global Stimulus Properties. *Nature*, **338**, 334–337.
- Hansson, P. A. 1991. Nanotechnology Prospects and Policies. *Futures*, Oct., 849–859.
- Harnad, S. 1991. The symbol grounding problem. In: S. Forrest (ed), *Emergent Computation*. MIT Press.
- Harnad, S. 1992. Connecting Object to Symbol in Modelling Cognition. In: Clark, A., & Lutz, R. (eds), *Connectionism in context*. Springer Verlag. Forthcoming.
- Harré, R. 1983. *Personal Being. A Theory for Individual Psychology*. Oxford: Basil Blackwell.
- Hinton, G. 1985. Learning in Parallel Networks. *Byte*, 265.
- Holland, John H. 1975. *Adaptation in Natural and Artificial Systems*. Ann Arbor: The University of Michigan Press.
- Holland, John H. 1976. Studies of the Spontaneous Emergence of Self-Reproducing Systems Using Cellular Automata and Formal Grammars. Pages 385–404 of: Lindenmayer, A., & Rozenberg, G. (eds), *Automata, Languages, Development*. New York: North-Holland.
- Holland, John H. 1986. Escaping Brittleness: The Possibilities of General-Purpose Learning Algorithms Applied to Parallel Rule-Based Systems. Chap. 20, pages 593–623 of: Michalski, Ryszard S., Carbonell, Jaime G., & Mitchell, Tom M. (eds), *Machine Learning: An Artificial Intelligence Approach: Volume II*. Los Altos, California: Morgan Kaufman Publishers Inc.
- Holland, John H., Holyoak, Keith J., Nisbett, Richard E., & Thagard, Paul R. 1986. *Induction*. Series: Computational Models of Cognition and Perception. Cambridge: The MIT Press. Series Editors: Jerome A. Feldman, Patrick J. Hayes, and David E. Rumelhart. First MIT Press paperback edition, 1989.
- Hubel, D. H., & Wiesel, T. N. 1977. Functional architecture of macaque monkey visual cortex. *Proceedings of the Royal Society of London, series B*, **198**, 1–59.
- Jefferson, David, et al. 1992. Evolution as a Theme in Artificial Life: The Genesys/Tracker System. Pages 549–578 of: (Langton et al. 1992).
- John, E., Tang, Y., Brill, A., Young, R., & Ono, K. 1986. Double-labeled Metabolic Maps of Memory. *Science*, **233**, 1167–1175.
- Judd, J.S. 1990. *Neural Network Design and the Complexity of Learning*. Cambridge MA: MIT Press.
- Kampis, G., & Csányi, V. 1987. Replication in Abstract and Natural Systems. *BioSystems*, **20**, 143–152.
- Kauffman, Stuart A. 1990. Requirements for Evolvability in Complex Systems: Orderly Dynamics and Frozen Components. *Physica*, **42D**, 135–152.
- Kemeny, John G. 1955. Man Viewed as a Machine. *Scientific American*, **192**(4), 58–67.
- Koshland, D., Goldbeter, A., & Stock, J.B. 1982. Amplification and Adaptation in Regulatory and Sensory Systems. *Science*, **217**, 220–225.
- Kremen, A. 1992. Biological molecular energy machines as measuring devices. *Journal of Theoretical Biology*, **154**, 405–413.
- Lacy, A. R. 1986. *A Dictionary of Philosophy*. London: Routledge & Kegan Paul.
- Laing, Richard A. 1975 (Aug.). Artificial Molecular Machines: A Rapprochement Between Kinematic and Tessellation Automata. Pages 73–80 of: *Proceedings of the International Symposium on Uniformly Structured Automata and Logic*, Tokyo.
- Lakoff, G. 1987. *Women, Fire, and Dangerous Things: What Categories Reveal About the Mind*. Chicago: University of Chicago Press.
- Langton, Christopher G. 1984. Self-Reproduction in Cellular Automata. *Physica*, **10D**, 135–144.
- Langton, Christopher G. 1986. Studying Artificial Life with Cellular Automata. *Physica*, **22D**, 120–149.
- Langton, Christopher G. (ed). 1989a. *Artifical Life*. Series: Santa Fe Institute Studies in the Sciences of Complexity, vol. VI. Redwood City, California: Addison-Wesley Publishing Company, Inc. Proceedings of an interdisciplinary workshop on the synthesis and simulation of

- living systems held September, 1987, in Los Alamos, New Mexico.
- Langton, Christopher G. 1989b. Artificial Life. *Pages 1–47 of:* (Langton 1989a).
- Langton, Christopher G. 1992. Preface to Artificial Life II. *Pages xiii–xviii of:* (Langton *et al.* 1992).
- Langton, Christopher G., Taylor, Charles, Farmer, J. Doyne, & Rasmussen, Steen (eds). 1992. *Artificial Life II*. Series: Sante Fe Institute Studies in the Sciences of Complexity, vol. X. Redwood City, California: Addison-Wesley Publishing Company, Inc. Proceedings of the workshop on Artificial Life held February, 1990, in Sante Fe, New Mexico.
- Laudan, L. 1990. *Science and Relativism—Some Key Controversies in the Philosophy of Science*. Chicago: The University of Chicago Press.
- Lazcano, A. 1986. Prebiotic evolution and the origin of cells. *Treballs Societat Catal. Biol.*, **39**, 73–103.
- Lenat, D.B., & Feigenbaum, E.A. 1991. On the Thresholds of Knowledge. *Artificial Intelligence*, **47**, 185–250.
- Lewis, Harry R., & Papadimitriou, Christos H. 1981. *Elements of the Theory of Computation*. Prentice-Hall Software Series. London: Prentice-Hall International. Brian W. Kernighan, advisor.
- Lewontin, R. 1983. The organism as the subject and object of evolution. *Scientia*, **118**, 63–82.
- Lighthill, Sir James. 1973. Artificial Intelligence: A General Survey. In: *Artificial Intelligence: A Paper Symposium*. London: Science Research Council.
- Lindsay, Robert K. 1968. Artificial Evolution of Intelligence. *Contemporary Psychology*, **13**(3), 113–116. Review of (Fogel *et al.* 1966).
- Luisi, L., & Varela, F. 1989. Self replicating micelles: A minimal version of a chemical autopoietic system. *Origins of Life*, **19**.
- Maes, Pattie (ed). 1990a. *Designing Autonomous Agents—Theory and Practice from Biology to Engineering and Back*. MIT Press.
- Maes, Pattie. 1990b. Situated Agents Can Have Goals. In: (Maes 1990a).
- Margulis, L. 1981. *Symbiosis in Cell Evolution*. San Francisco: W. H. Freeman.
- Margulis, L., & Schwartz, K. 1988. *Five Kingdoms: An Illustrated Guide to the Phyla of Life on Earth*. New York: W. H. Freeman.
- Marr, D. 1982. *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information*. San Francisco: W.H. Freeman and Co.
- Martinez, Hugo M. 1979. An Automaton Analog of Unicellularity. *BioSystems*, **11**, 133–162.
- Maturana, H., & Varela, F. 1973a. *De Máquinas y Seres Vivos: Una teoría de la organización biológica*. Santiago de Chile: Editorial Universitaria.
- Maturana, Humberto R. 1974. Cognitive Strategies. *Pages 457–469 of:* von Foerster, Heinz (ed), *Cybernetics of Cybernetics*. Biological Computer Laboratory, University of Illinois.
- Maturana, Humberto R. 1978. Biology of Language. *Pages 27–63 of:* Miller, & Lenneberg (eds), *Psychology and Biology of Language and Thought*. Academic Press.
- Maturana, Humberto R., & Varela, Francisco J. 1973b. Autopoiesis: The Organization of the Living. *Pages 59–138 of:* (Maturana & Varela 1980). Dated 1973. First published 1972 in Chile under the title *De Maquinas y Seres Vivos*, Editorial Universitaria S.A.
- Maturana, Humberto R., & Varela, Francisco J. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Series: Boston Studies in the Philosophy of Science, vol. 42. Dordrecht, Holland: D. Reidel Publishing Company. With a preface to ‘Autopoiesis’ by Stafford Beer. Series editors: Robert S. Cohen and Marx W. Wartofsky.
- Maturana, Humberto R., & Varela, Francisco J. 1987. *The Tree of Knowledge: The Biological Roots of Human Understanding*. Boston: New Science Library (Shambhala).
- Maynard Smith, John. 1970. Natural Selection and the Concept of a Protein Space. *Nature*, **225**(February 7), 563–564.
- McCulloch, W.S., & Pitts, W. 1943. A Logical Calculus of the Ideas Immanent in Nervous Activity. *Bulletin of Mathematical Biophysics*, **9**,

- 127–147. Reprinted in (Anderson & Rosenfeld 1988).
- McMullin, Barry. 1992a (Mar.). *Essays on Darwinism. 1: Ontological Foundations*. Technical Report bmc9201. School of Electronic Engineering, Dublin City University, Dublin 9, Ireland.
- McMullin, Barry. 1992b (Apr.). *Essays on Darwinism. 2: Organismic Darwinism*. Technical Report bmc9202. School of Electronic Engineering, Dublin City University, Dublin 9, Ireland.
- McMullin, Barry. 1992c (May). *Essays on Darwinism. 3: Genic and Organismic Selection*. Technical Report bmc9203. School of Electronic Engineering, Dublin City University, Dublin 9, Ireland.
- McMullin, Barry. 1992d. The Holland α -Universes Revisited. *Pages 317–326 of:* (Varela & Bourgine 1992). The preliminary results reported in this paper were subsequently elaborated in much more detail in (McMullin 1992e, Chapter 5).
- McMullin, Finbarr (Barry) Vincent. 1992e. *Artificial Knowledge: An Evolutionary Approach*. Ph.D. thesis, Ollscoil na hÉireann, The National University of Ireland, University College Dublin, Department of Computer Science.
- Mead, C. 1989. *Analog VLSI and Neural Systems*. Reading, MA: Addison Wesley.
- Merelo, J., Moreno, A., & Moran, F. 1992. *Cognition and Perception in Artificial Life*. Contributed paper admitted to SAB92 (Hawaii, Dec 7–11, 1992).
- Merleau-Ponty, M. 1964. *The Primacy of Perception*. Northwestern University Press. Translated by Edie, J.M.
- Minsky, M. 1987. *The Society of Mind*. New York: Simon and Schuster.
- Minsky, M., & Papert, S. 1969. *Perceptrons*. Cambridge, MA: MIT Press.
- Minsky, Marvin L. 1967. *Computation: Finite and Infinite Machines*. Prentice-Hall Series in Automatic Computation. Englewood Cliffs, New Jersey: Prentice-Hall Inc.
- Moreno, A., & Etxeberria, A. 1992. Self-reproduction and representation. The continuity between biological and cognitive phenomena. *Uroboros*, II(1), 131–151.
- Newell, Allen, & Simon, Herbert A. 1976. Computer Science as Empirical Enquiry: Symbols and Search. *Communications of the ACM*, 19(Mar.), 113–126.
- Packard, Norman H. 1989. Intrinsic Adaptation in a Simple Model for Evolution. *Pages 141–155 of:* (Langton 1989a).
- Pattee, H. 1982. Cell Psychology: An evolutionary Approach to the Symbol-Matter Problem. *Cognition and Brain Theory*, 5(4), 325–341.
- Pellionisz, A., & Llinas, R. 1985. Tensor Network Theory of the Metaorganisation of Functional Geometries in the Central Nervous System. *Neuroscience*, 16, 245–273. Reprinted in (Anderson *et al.* 1990).
- Peschl, Markus F. 1991. A Multimodal Model of Cognition—Neural Networks and Cognitive Modeling. *Pages 1755–1758 of:* Kohonen, *et al.* (eds), *Artificial Networks (ICANN '91)*, vol. 2. Amsterdam, New York: North-Holland.
- Piaget, Jean. 1954. *The Construction of Reality in the Child*. New York: Ballantine.
- Piaget, Jean. 1970. *Genetic epistemology*. New York: Columbia University Press.
- Piaget, Jean, & Inhelder, Bärbel. 1969. *The psychology of the Child*. New York: Basic Books.
- Pierce, C. S. 1960. *Collected Papers*. Vol. 3. Cambridge, Massachusetts: Harvard University Press.
- Popper, Karl R. 1974. Autobiography of Karl Popper. *Pages 1–181 (Book I) of:* (Schilpp 1974). See also (Popper 1976).
- Popper, Karl R. 1976. *Unended Quest*. Glasgow: Fontana/William Collins Sons & Co. Ltd. First edition published as (Popper 1974). This revised edition first published 1976 by Fontana.
- Popper, Karl R., & Eccles, John C. 1977. *The Self and its Brain: An Argument for Interactionism*. London: Routledge & Kegan Paul plc. First published 1977, Berlin: Springer-Verlag. This edition first published 1983.
- Putnam, H. 1981. *Reason, Truth, and History*. Cambridge: Cambridge University Press.
- Radnitzky, Gerard, & Bartley, III, W. W. (eds). 1987. *Evolutionary Epistemology, Rationality, and the Sociology of Knowledge*. La Salle, Illinois: Open Court.

- Rasmussen, Steen, Knudsen, Carsten, Feldberg, Rasmus, & Hindsholm, Morten. 1990. The Coreworld: Emergence and Evolution of Cooperative Structures in a Computational Chemistry. *Physica*, **42D**, 111–134.
- Ray, Thomas S. 1991. Tierra Update. *Alife Digest*, November 5th. *Alife Digest* is an electronic newsletter distributed over Internet; for information contact:
alife-request@cognet.ucla.edu.
- Ray, Thomas S. 1992. An Approach to the Synthesis of Life. *Pages 371–408 of:* (Langton *et al.* 1992).
- Riegler, Alexander. 1991. *TKW—Plädoyer für eine technische Kognitionswissenschaft. [Pleading for a Constructivist Technical Cognitive Science]*. Master's Thesis, Technical University of Vienna, Austria.
- Rizki, Mateen M., & Conrad, Michael. 1985. Evolve III: A Discrete Events Model of an Evolutionary Ecosystem. *BioSystems*, **18**, 121–133.
- Rosch, E. 1981. Prototype Classification and Logical Classification. The Two Systems. *Pages 73–86 of:* Scholnick, E. (ed), *New Trends in Cognitive Representation: Challenges to Piaget's Theory*. Hillsdale, N.J: Lawrence Erlbaum Associates.
- Rosen, R. 1978. *Fundamentals of Measurement and Representation of Natural Systems*. New York: North-Holland.
- Rosen, Robert. 1985a. *Anticipatory Systems*. IFSR International Series on Systems Science and Engineering, vol. 1. Oxford: Pergamon Press. Editor-in-Chief: George J. Klim.
- Rosen, Robert. 1985b. Organisms as Causal Systems Which Are Not Mechanisms: An Essay into the Nature of Complexity. *Chap. 3, pages 165–203 of:* Rosen, Robert (ed), *Theoretical Biology and Complexity*. Orlando: Academic Press, Inc. See also Chapter 7 (Appendix) of (Rosen 1985a).
- Rosenblat, F. 1958. The Perceptron: a Probabilistic Model for Information Storage and Organisation in the Brain. *Psychological Review*, **65**, 386–408. Reprinted in (Anderson & Rosenfeld 1988).
- Rumelhart, D. E., Hinton, G.E., & Williams, R. J. 1986a. Learning Internal Representations by Error Propagation. *In:* Rummelhart, D. E., & McClelland, J. L. (eds), *Parallel Distributed Processing*, vol. 1. Cambridge MA: MIT Press.
- Rumelhart, D.E., Smolensky, P., McClelland, J.L., & Hinton, G.E. 1986b. Schemata and Sequential Thought Processes in PDP Models. *In:* Rummelhart, D.E., & McClelland, J.L. (eds), *Parallel Distributed Processing*, vol. 2. Cambridge MA: MIT Press.
- Rummelhart, D. E., & McClelland, J. L. 1986. *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*. MIT Press.
- Schilpp, Paul Arthur (ed). 1974. *The Philosophy of Karl Popper*. The Library of Living Philosophers, vol. XIV. Illinois: Open Court.
- Searle, J. 1990. Is the brain a digital computer? *Proceedings of the American Philosophical Association*, **64**, 21–37.
- Searle, John R. 1980. Minds, Brains, and Programs. *The Behavioral and Brain Sciences*, **3**, 417–424.
- Segal, L. 1986. *The Dream of Reality. Heinz von Foerster's Constructivism*. New York, London: W. W. Norton & Co.
- Sepper, D.L. 1988. *Goethe contra Newton*. Cambridge University Press. ISBN 0 521 34254.
- Smith, B.C. 1991. The Owl and the Electric Encyclopaedia. *Artificial Intelligence*, **47**, 251–288.
- Spencer-Brown, G. 1969. *The Laws of Form*. London: George, Allen, and Unwin.
- Stary, C., Peschl, M., Mayer, C., & Riegler, A. 1992. Providing Epistemological Context for Conventional Machine Learning, Parallel Distributed Processing, and Artificial Life. *Complex Systems*. Submitted.
- Steels, Luc. 1990. Exploiting Analogical Representations. *In:* (Maes 1990a).
- Stillings, N. A., Feinstein, M.H., Garfield, J.L., Rissland, E.L., Rosenbaum, D.A., Weisler, S.E., & Baker-Ward, L. 1987. *Cognitive Science: An Introduction*. Cambridge, MA: MIT Press.
- Taub, A. H. (ed). 1961. *John von Neumann: Collected Works. Volume V: Design of Computers, Theory of Automata and Numerical Analysis*. Oxford: Pergamon Press.
- Taylor, Charles E., Jefferson, David R., Turner, Scott R., & Goldman, Seth R. 1989. RAM: Artificial Life for the Exploration of Complex Biological Systems. *Pages 275–295 of:* (Langton 1989a).

- Thatcher, J. W. 1970. Universality in the von Neumann Cellular Model. *Pages 132–186 (Essay Five) of:* (Burks 1970a).
- Thompson, E., Palacios, A., & Varela, F. 1992. Ways of coloring: Comparative color vision as a case study in cognitive science. *Behavioral and Brain Sciences*, **15**, 1–75.
- Touretsky, D.S. 1990. BoltzCONS: Dynamic Symbol Structures in a Connectionist Network. *Artificial Intelligence*, **46**, 5–46.
- Turing, Alan. 1936. On Computable Numbers, with an Application to the Entscheidungsproblem. *Proceedings of the London Mathematical Society, Series 2, Vol. 42*, 230–265. Also reprinted, including corrections, as *pages 116–154 of:* (Davis 1965).
- Turing, Alan M. 1950. Computing Machinery and Intelligence. *Mind*, **LIX**(236), 433–460.
- van de Vijver, G. 1991. The emergence of meaning and the antinomy of naturalism. *Uroboros*, **I**(2), 153–175.
- van Gelder, T. 1990. Compositionality: A Connectionist Variation on a Classical Theme. *Cognitive Science*, **14**, 335–384.
- Varela, F. J. 1992. Whence perceptual meaning? A cartography of current ideas. *Pages 235–263 of:* Varela, F. J., & Dupuy, Jean-Pierre (eds), *Understanding Origins*. The Netherlands: Kluwer.
- Varela, Francisco J. 1979. *Principles of Biological Autonomy*. New York: North-Holland.
- Varela, Francisco J. 1988. Structural coupling of simple cellular automata: On the origin of meaning. *Pages 151–161 of:* Secarz, E., Celada, F., Mitchinson, N. A., & Tada, T. (eds), *The Semiotics of Cellular Communication in the Immune System*. NATO ASI Series, vol. H23. New York: Springer-Verlag.
- Varela, Francisco J. 1990. *Kognitionswissenschaft—Kognitionstechnik*. Frankfurt a. M.: Suhrkamp. German translation of Varela, Francisco J. (1988) *Cognitive Science: A Cartography of Current Ideas*.
- Varela, Francisco J. 1991. Organism: A meshwork of selfless selves. *Pages 79–107 of:* Tauber (ed), *Organism and the Origin of Self*. Dordrecht: Kluwer Assoc.
- Varela, Francisco J., & Bourgine, Paul (eds). 1992. *Toward a Practice of Autonomous Systems: Proceedings of the First European Conference on Artificial Life*. Series: Complex Adaptive Systems. Cambridge: MIT Press. Series Advisors: John H. Holland, Christopher Langton and Stewart W. Wilson.
- Varela, Francisco J., & Coutinho, A. 1991. Second generation immune networks. *Immunology Today*, **12**, 159–167.
- Varela, Francisco J., Maturana, Humberto R., & Uribe, R. 1974. Autopoiesis: The Organization of Living Systems, its Characterization and a Model. *BioSystems*, **5**, 187–196.
- Varela, Francisco J., Dupire, B., & Coutinho, A. 1988. Cognitive networks: Immune, neural and otherwise. *Pages 359–375 of:* Perelson, A. (ed), *Theoretical Immunology*. SFI Series on Complexity, vol. 2. New Jersey: Addison Wesley.
- von Foerster, Heinz. 1973. On Constructing a Reality. *Pages 35–46 of:* Preiser (ed), *Environmental Research Design*, vol. 2. Stroudsburg: Dowden, Hutchinson & Ross.
- von Glaserfeld, Ernst. 1988. An Exposition of Radical Constructivism. In: Donaldson (ed), *Texts in Cybernetic Theory*. American Society for Cybernetics.
- von Neumann, John. 1951. The General and Logical Theory of Automata. *Chap. 9, pages 288–328 of:* (Taub 1961). First published 1951 as *pages 1–41 of:* L. Jeffress, A. (ed), *Cerebral Mechanisms in Behavior—The Hixon Symposium*, New York: John Wiley.
- von Neumann, John. 1966a. Theory and Organization of Complicated Automata. *Pages 29–87 (Part One) of:* (Burks 1966b). Based on transcripts of lectures delivered at the University of Illinois, in December 1949. Edited for publication by A.W. Burks.
- von Neumann, John. 1966b. The Theory of Automata: Construction, Reproduction, Homogeneity. *Pages 89–250 of:* (Burks 1966b). Based on an unfinished manuscript by von Neumann. Edited for publication by A.W. Burks.
- Watanabe, S. 1985. *Pattern Recognition: human and mechanical*. Wiley.
- Williams, B. 1972. Rationalism. In: Edwards, P. (ed), *Encyclopaedia of Philosophy*, vol. 7. New York: Macmillian.

Wilson, R., & Knutsson, H. 1988. Uncertainty and Inference in the Visual System. *IEEE Trans. System, Man & Cybernetics*, **18**(2).

Winograd, Terry, & Flores, Fernando. 1986. *Understanding Computers and Cognition: A New Foundation for Design*. Norwood, NJ: Ablex.

Zecevic, D., Wu, J., Cohen, L., London, J., Höpp, H., & Falk, C. 1989. Hundreds of neurons in the Aplysia abdominal ganglion are active during the gill-withdrawal reflex. *Journal of Neuroscience*, **9**, 3681–3689.

Zelany, Milan, & Pierre, Norbert A. 1976. Simulation of Self-Renewing Systems. *Chap. 7, pages 150–165 of:* Jantsch, Erich, & Waddington, Conrad H. (eds), *Evolution and Consciousness: Human Systems in Transition*. Reading, Massachusetts: Addison-Wesley Publishing Company.

Zeleny, Milan. 1977. Self-Organization of Living Systems: A Formal Model of Autopoiesis. *International Journal of General Systems*, **4**, 13–28.