Bibliography

This bibliography contains items directly cited in the chapters, as well as some related items of special interest. To keep length manageable, I generally list only the earliest publication together with the most recent or most easily accessible publication for each concept.

Abelson, Harold, and Andrea diSessa, *Turtle Geometry*, MIT Press, Cambridge, MA, 1981.

Aikins, Janice, "A Theory and Methodology of Inductive Learning," *Artificial Intelligence*, vol. 20, no. 3, 1983.

Allen, James F. and C. Raymond Perrault, "Analyzing Intention in Utterances," *Artificial Intelligence*, vol. 15, 1980.

Allen, James F., "Towards a General Theory of Action and Time," *Artificial Intelligence*, vol. 23, 1984.

Allen, James F., "Maintaining Knowledge About Temporal Intervals," *Communications of the ACM*, vol. 26, no. 11, 1983.

Allen, James, "Recognizing Intentions from Natural Language Utterances," in *Computational Models of Discourse*, edited by J. Michael Brady and Robert C. Berwick, MIT Press, Cambridge, MA, 1983.

Altay, Güvenir, H. and G. W. Ernst, "Learning Problem Solving Strategies Using Refinement and Macro Generation," *Artificial Intelligence*, vol. 44, 1990.

Amarel, Saul, "On Representation of Problems of Reasoning about Actions," in *Machine Intelligence 3*, edited by Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1968.

Ambler, A. P., H. G. Barrow, C. M. Brown, R. M. Burstall, and R. J. Popplestone, "A Versatile System for Computer Controlled Assembly," *Artificial Intelligence*, vol. 6, no. 2, 1975.

Anderson, James A. and Edward Rosenfeld, *Neurocomputing: Foundations of Research*, MIT Press, Cambridge, MA, 1989.

Antonisse, Jim, "A New Interpretation of Schema Notation that Overturns the Binary Encoding Constraint," *Proceedings of the Third International Conference on Genetic Algorithms*, 1989.

Atkeson, Christopher G., "Memory-Based Approaches to Approximating Continuous Functions," *Proceedings of the Workshop on Nonlinear Modeling and Forecasting*, 1990.

Bailey, David Lee, "Similarity Networks as a Means of Indexing and Retrieving Descriptions," BS Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1986.

Bajcsy, Ruzena (editor), *Representation of Three-Dimensional Objects*, Springer-Verlag, New York, 1982.

Ballard, Dana H., and Christopher Brown, *Computer Vision*, Prentice-Hall, Englewood Cliffs, NJ, 1982.

Barlow, H. B., "Summation and Inhibition in the Frog's Retina," *Journal of Physiology*, vol. 119, 1953.

Barr, Avron, Edward A. Feigenbaum, and Paul R. Cohen, *The Handbook of Artificial Intelligence* (Three Volumes), William Kaufman, Los Altos, CA, 1981.

Barrow, Harry G. and Jay M. Tenenbaum, "Interpreting Line Drawings as Three-Dimensional Surfaces," *Artificial Intelligence*, vol. 17, 1981.

Barrow, Harry G., and Jay M. Tenenbaum, "Recovering Intrinsic Scene Characteristics from Images," in *Computer Vision Systems*, edited by A. Hanson and E. Riseman, Academic Press, New York, 1978.

Barrow, Harry G., and Jay M. Tenenbaum, "Computational Vision," *Proceedings of the IEEE*, vol. 69, no. 5, 1981.

Barrow, Harry G., "VERIFY: A Program for Proving Correctness of Digital Hardware Designs," *Artificial Intelligence*, vol. 24, 1984.

Barry, M., D. Cyrluk, D. Kapur, J. L. Mundy and V.-D. Nguyen, "A Multi-Level Geometric Reasoning System for Vision," *Artificial Intelligence*, vol. 37, 1988.

Barton, G. Edward, Jr., Robert C. Berwick, and Eric Sven Ristad, *Computational Complexity and Natural Language*, MIT Press, Cambridge, MA, 1987.

Barton, G. Edward, Jr., "Toward a Principle-Based Parser," Report 788, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1984.

Basri, Ronen, "The Recognition of Three-Dimensional Objects from Two-Dimensional Images," PhD Thesis, Weizmann Institute of Science, 1990.

Baudet, Gerard M., "On the Branching Factor of the Alpha–Beta Pruning Algorithm," *Artificial Intelligence*, vol. 10, no. 2, 1978.

Beckman, Lennart, Anders Haraldson, Osten Oskarsson, and Erik Sandewall, "A Partial Evaluator, and Its Use as a Programming Tool," *Artificial Intelligence*, vol. 7, no. 4, 1976.

Berliner, H. J., G. Goetsch, M. S. Campbell and C. Ebeling, "Measuring the Performance Potential of Chess Programs," *Artificial Intelligence*, vol. 43, 1990.

Berliner, Hans J. and Murray S. Campbell, "Using Chunking to Solve Chess Pawn Endgames," *Artificial Intelligence*, vol. 23, 1984.

Berliner, Hans J., "An Examination of Brute-Force Intelligence," *Seventh International Joint Conference on Artificial Intelligence*, Vancouver, Canada, 1981.

Berliner, Hans J., "Some Necessary Conditions for a Master Chess Program," *Third International Joint Conference on Artificial Intelligence*, Stanford, CA, 1973.

Berliner, Hans J., "A Chronology of Computer Chess and Its Literature," *Artificial Intelligence*, vol. 10, no. 2, 1978.

Berliner, Hans J., "Computer Backgammon," *Scientific American*, vol. 242, no. 9, 1980.

Berliner, Hans J., "Chess as Problem Solving: The Development of a Tactics Analyzer," PhD Thesis, Carnegie–Mellon University, Pittsburgh, PA, 1975.

Berliner, Hans J., "Backgammon Computer Program Beats World Champion (Performance Note)," *Artificial Intelligence*, vol. 14, 1980.

Berliner, Hans J., "The B* Tree Search Algorithm: A Best-First Proof Procedure," *Artificial Intelligence*, vol. 12, 1979.

Berwick, Robert C., and Amy Weinberg, *The Grammatical Basis of Linguistic Performance*, MIT Press, Cambridge, MA, 1983.

Berwick, Robert C., "Introduction: Computational Aspects of Discourse," in *Computational Models of Discourse*, edited by J. Michael Brady and Robert C. Berwick, MIT Press, Cambridge, MA, 1983.

Berwick, Robert C., *The Acquisition of Syntactic Knowledge*, MIT Press, Cambridge, MA, 1985. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Bibel, Wolfgang, "A Comparative Study of Several Proof Procedures," *Artificial Intelligence*, vol. 18, 1982.

Binford, Thomas O., "Survey of Model-Based Image Analysis Systems," *International Journal of Robotics Research*, vol. 1, no. 1, 1982.

Binford, Thomas O., "Inferring Surfaces from Images," *Artificial Intelligence*, vol. 17, 1981.

Binford, Thomas O., "Visual Perception by Computer," *Proceedings of the IEEE Conference on Systems Science and Cybernetics, Miami*, 1971.

Bledsoe, W. W., "Non-Resolution Theorem Proving," *Artificial Intelligence*, vol. 9, no. 1, 1977.

Bledsoe, Woodrow W., K. Kunen and R. E. Shostak, "Completeness Results for Inequality Provers," *Artificial Intelligence*, vol. 27, 1985.

Bobrow Daniel G., Ronald M. Kaplan, Martin Kay, Donald A. Norman, Henry Thompson, and Terry Winograd, "GUS, A Frame-Driven Dialog System," *Artificial Intelligence*, vol. 8, no. 2, 1977.

Bobrow, Daniel G. and Patrick J. Hayes, "Artificial Intelligence: Where Are We," *Artificial Intelligence*, vol. 25, 1985.

Bobrow, Daniel G., and Allan Collins, *Representation and Understanding*, Academic Press, New York, 1975.

Bobrow, Daniel G., and Bruce Fraser, "An Augmented State Transition Network Analysis Procedure," *First International Joint Conference on Artificial Intelligence*, Washington, D. C., 1969.

Bobrow, Daniel G., and Terry Winograd, "An Overview of KRL, a Knowledge Representation Language," *Cognitive Science*, vol. 1, no. 1, 1977.

Bobrow, Daniel G., "Qualitative Reasoning About Physical Systems: An Introduction," *Artificial Intelligence*, vol. 24, 1984.

Boden, Margaret A., *Artificial Intelligence and Natural Man*, Basic Books, New York, 1977.

Boley, Harold, "Directed Recursive Labelnode Hypergraphs: A New Representation-Language," *Artificial Intelligence*, vol. 9, no. 1, 1977.

Booker, L. B., D. E. Goldberg and John H. Holland, "Classifier Systems and Genetic Algorithms," *Artificial Intelligence*, vol. 40, 1989.

Brachman, Ronald J., "On the Epistemological Status of Semantic Networks," in *Associative Networks: Representation and Use of Knowledge by Computers*, edited by Nicholas V. Findler, Academic Press, New York, 1979.

Brady, J. Michael (editor), *Computer Vision*, North-Holland, Amsterdam, 1981.

Brady, J. Michael, and Robert C. Berwick (editors), *Computational Models of Discourse*, MIT Press, Cambridge, MA, 1983.

Brady, J. Michael, John M. Hollerbach, Timothy L. Johnson Tomás Lozano-Pérez, and Matthew T. Mason (editors), *Robot Motion: Planning and Control*, MIT Press, Cambridge, MA, 1982.

Brady, J. Michael, "Representing Shape," in *Robotics*, edited by Lester Gerhardt and J. Michael Brady, Springer-Verlag, New York, 1983.

Brady, Michael, "Artificial Intelligence and Robotics," *Artificial Intelligence*, vol. 26, 1985.

Brand, D., "Analytic Resolution in Theorem Proving," *Artificial Intelligence*, vol. 7, no. 4, 1976.

Bratko, Ivan, PROLOG *Programming for Artificial Intelligence* (second edition), Addison-Wesley, Reading, MA, 1990.

Brooks, Rodney A., and Tomás Lozano-Pérez, "A Subdivision Algorithm in Configuration Space for Findpath with Rotation," *Eighth International Joint Conference on Artificial Intelligence*, Karlsruhe, Germany, 1983.

Brooks, Rodney A., "Planning Collision Free Motions for Pick and Place Operations," *International Journal of Robotics Research*, vol. 2, no. 4, 1983.

Brooks, Rodney A., "Solving the Find-Path Problem by Good Representation of Free Space," *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-13, 1983.

Brooks, Rodney A., "Intelligence Without Representation," *Artificial Intelligence*, vol. 47, 1991.

Brooks, Rodney A., "Symbolic Reasoning Among Three-Dimensional Models and Two-Dimensional Images," *Artificial Intelligence*, vol. 17, 1981. Based on a PhD thesis, Stanford University, Stanford, CA, 1981.

Brou, Philippe, "Finding the Orientation of Objects in Vector Maps," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1983.

Brown, Malloy F., "Doing Arithmetic without Diagrams," *Artificial Intelligence*, vol. 8, no. 2, 1977.

Buchanan, Bruce G. and Edward A. Feigenbaum, "Dendral and Meta-Dendral: Their Applications Dimension," *Artificial Intelligence*, vol. 11, 1978.

Buchanan, Bruce G., and Edward H. Shortliffe, *Rule-Based Expert Programs: The* MYCIN *Experiments of the Stanford Heuristic Programming Project*, Addison-Wesley, Reading, MA, 1984.

Buchanan, Bruce G., and Richard O. Duda, "Principles of Rule-Based Expert Systems," *Advances in Computers*, vol. 22, 1983.

Bundy, Alan, Bernard Silver and Dave Plummer, "An Analytical Comparison of Some Rule-Learning Programs," *Artificial Intelligence*, vol. 27, 1985.

Bundy, Alan, "Will It Reach the Top? Prediction in the Mechanics World," *Artificial Intelligence*, vol. 10, no. 2, 1978.

Campbell, A. N., V. F. Hollister, Richard O. Duda, and Peter E. Hart, "Recognition of a Hidden Mineral Deposit by an Artificial Intelligence Program," *Science*, vol. 217, no. 3, 1982.

Carbonell, Jaime G., "Learning by Analogy: Formulating and Generalizing Plans from Past Experience," in *Machine Learning: An Artificial Intelligence Approach*, edited by Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Tioga Publishing Company, Palo Alto, CA, 1983.

Card, Stuart, Thomas P. Moran, and Allen Newell, *The Psychology of Human–Computer Interaction*, Lawrence Erlbaum Associates, Hillsdale, NJ, 1983.

Chapman, David, "Planning for Conjunctive Goals," *Artificial Intelligence*, vol. 32, 1987.

Charniak, Eugene, Christopher K. Riesbeck, and Drew V. McDermott, *Artificial Intelligence Programming*, Lawrence Erlbaum Associates, Hillsdale, NJ, 1980.

Charniak, Eugene, "Toward a Model of Children's Story Comprehension," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1972.

Charniak, Eugene, "Motivation Analysis, Abductive Unification, and Nonmonotonic Equality," *Artificial Intelligence*, vol. 34, 1988.

Charniak, Eugene, "A Common Representation for Problem-Solving and Language-Comprehension Information," *Artificial Intelligence*, vol. 16, 1981.

Charniak, Eugene, "On the Use of Framed Knowledge in Language Comprehension," *Artificial Intelligence*, vol. 11, 1978.

Chester, Daniel, "The Translation of Formal Proofs into English," *Artificial Intelligence*, vol. 7, no. 3, 1976.

Chomsky, Noam, *Syntactic Structures*, Mouton, The Hague, 1957.

Chomsky, Noam, *Lectures on Government and Binding*, Foris, Dordrecht, Holland, 1981.

Clancey, William J., "The Epistemology of a Rule-Based Expert System: A Framework for Explanation," *Artificial Intelligence*, vol. 20, 1983.

Clancey, William J., "Heuristic Classification," *Artificial Intelligence*, vol. 27, 1985.

Clark, Keith L., and Sten-Åke Tärnlund, *Logic Programming*, Academic Press, New York, 1982.

Clarke, M. R. B. (editor), *Advances in Computer Chess 1*, Edinburgh University Press, Edinburgh, Scotland, 1977.

Clarke, M. R. B. (editor), *Advances in Computer Chess 2*, Edinburgh University Press, Edinburgh, Scotland, 1980.

Clocksin, William F., and Christopher S. Mellish, *Programming in Prolog*, Springer-Verlag, New York, 1981.

Clowes, Maxwell, "On Seeing Things," *Artificial Intelligence*, vol. 2, no. 1, 1971.

Cohen, Brian L., "A Powerful and Efficient Structural Pattern Recognition System," *Artificial Intelligence*, vol. 9, no. 3, 1977.

Cohen, Brian L., "The Mechanical Discovery of Certain Problem Symmetries," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Colmerauer, A., H. Kanoui, R. Pasero, and P. Roussel, "Un Système de Communication Homme-Machine en Français," Report II, Groupe d'Intelligence Artificielle, Université Aix-Marseille, 1973.

Colmerauer, Alain, "Prolog and Infinite Trees," in *Logic Programming*, edited by Keith L. Clark and Sten-Åke Tärnlund, Academic Press, New York, 1982.

Connell, Jonathan H. and Brady, Michael, "Generating and Generalizing Models of Visual Objects," *Artificial Intelligence*, vol. 31, 1987.

Cormen, Thomas H., Charles E. Leiserson, and Ronald L. Rivest, *Introduction to Algorithms*, MIT Press, Cambridge, MA; and McGraw-Hill, New York, 1990.

Darwin, Charles, *The Origin of Species*, John Murray, 1859.

Davis, Ernest, "Constraint Propagation with Interval Labels," *Artificial Intelligence*, vol. 32, 1987.

Davis, Larry S., and Azriel Rosenfeld, "Cooperative Processes for Low-level Vision: A Survey," *Artificial Intelligence*, vol. 17, 1981.

Davis, Martin, "The Mathematics of Non-Monotonic Reasoning," *Artificial Intelligence*, vol. 13, 1980.

Davis, Randall and Douglas B. Lenat, *Knowledge-Based Systems in Artificial Intelligence*, McGraw-Hill, New York, 1982.

Davis, Randall and Jonathan King, "An Overview of Production Systems," in *Machine Intelligence 8*, edited by Edward W. Elcock and Donald Michie, John Wiley and Sons, New York, 1977.

Davis, Randall and Reid G. Smith, "Negotiation as a Metaphor for Distributed Problem Solving," *Artificial Intelligence*, vol. 20, no. 1, 1983.

Davis, Randall, Bruce G. Buchanan, and Edward H. Shortliffe, "Production Rules as a Representation for a Knowledge-Based Consultation Program," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Davis, Randall, Howard Austin, Ingrid Carlbom, Bud Frawley, Paul Pruchnik, Rich Sneiderman, and Al Gilreath, "The Dipmeter Advisor: Interpretation of Geological Signals," *Seventh International Joint Conference on Artificial Intelligence*, Vancouver, Canada, 1981.

Davis, Randall, "Expert Systems: Where Are We? And Where Do We Go from Here?," Report AIM-665, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Davis, Randall, "Teiresias: Applications of Meta-Level Knowledge," in *Knowledge-Based Systems in Artificial Intelligence*, edited by Randall Davis and Douglas B. Lenat, McGraw-Hill, New York, 1982. Based on a PhD thesis, Stanford University, Stanford, CA, 1976.

Davis, Randall, "Diagnostic Reasoning Based on Structure and Behavior," *Artificial Intelligence*, vol. 24, 1984.

de Kleer, Johan and Brian C. Williams, "Diagnosing Multiple Faults," *Artificial Intelligence*, vol. 32, 1987.

de Kleer, Johan and John S. Brown, "Theories of Causal Ordering," *Artificial Intelligence*, vol. 29, 1986.

de Kleer, Johan and John S. Brown, "A Qualitative Physics Based on Confluences," *Artificial Intelligence*, vol. 24, 1984.

de Kleer, Johan, "Causal and Teleological Reasoning in Circuit Recognition," Report TR-529, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1979.

de Kleer, Johan, "Qualitative and Quantitative Knowledge in Classical Mechanics," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1975.

de Kleer, Johan, "An Assumption-Based TMS," *Artificial Intelligence*, vol. 28, 1986.

de Kleer, Johan, "How Circuits Work," *Artificial Intelligence*, vol. 24, 1984.

de Kleer, Johan, "Using Crude Probability Estimates to Guide Diagnosis," *Artificial Intelligence*, vol. 45, 1990.

de la Maza, Michael and Bruce Tidor, "Increased Flexibility in Genetic Algorithms: The Use of Variable Boltzmann Selective Pressure to Control Propagation," *Proceedings of the ORSA CSTS Conference: Computer Science and Operations Research: New Developments in Their Interfaces*, 1991.

Dean, Thomas L. and Drew V. McDermott, "Temporal Data Base Management," *Artificial Intelligence*, vol. 32, 1987.

Dean, Thomas L. and Mark Boddy, "Reasoning About Partially Ordered Events," *Artificial Intelligence*, vol. 36, 1988.

Dechter, R. and J. Pearl, "Network-Based Heuristics for Constraint-Satisfaction Problems," *Artificial Intelligence*, vol. 34, 1988.

Dechter, Rina, Itay Meiri and Judea Pearl, "Temporal Constraint Networks," *Artificial Intelligence*, vol. 49, 1991.

DeJong, Gerald F., II, "A New Approach to Natural Language Processing," *Cognitive Science*, vol. 3, no. 3, 1979.

Dennett, Daniel C., "Recent Work in Philosophy of Interest to AI," *Artificial Intelligence*, vol. 19, 1982.

Dennett, Daniel C., "Recent Work in Philosophy II," *Artificial Intelligence*, vol. 22, 1984.

Dietterich, Thomas G. and Ryszard S. Michalski, "Inductive Learning of Structural Descriptions," *Artificial Intelligence*, vol. 16, no. 3, 1981.

Dietterich, Thomas G. and Ryszard S. Michalski, "Discovering Patterns in Sequences of Events," *Artificial Intelligence*, vol. 25, 1985.

Donald, B. R., "A Search Algorithm for Motion Planning with Six Degrees of Freedom," *Artificial Intelligence*, vol. 31, 1987.

Donald, Bruce R., "A Geometric Approach to Error Detection and Recovery for Robot Motion Planning with Uncertainty," *Artificial Intelligence*, vol. 37, 1988.

Doyle, Jon and Michael P. Wellman, "Impediments to Universal Preference-Based Default Theories," *Artificial Intelligence*, vol. 49, 1991.

Doyle, Jon and Ramesh S. Patil, "Two Theses of Knowledge Representation: Language Restrictions, Taxonomic Classification, and the Utility of Representation Services," *Artificial Intelligence*, vol. 48, 1991.

Doyle, Jon, "A Truth Maintenance System," *Artificial Intelligence*, vol. 12, 1979.

Duda, Richard O., and Peter E. Hart, *Pattern Recognition and Scene Analysis*, John Wiley and Sons, New York, 1973.

Duda, Richard O., Peter E. Hart, and Nils J. Nilsson, "Subjective Bayesian Methods for Rule-Based Inference Systems," Report TR-124, Artificial Intelligence Center, SRI International, Menlo Park, CA, 1976.

Duda, Richard O., Peter E. Hart, Nils J. Nilsson, and Georgia L. Sutherland, "Semantic Network Representations in Rule Based Inference Systems," in *Pattern Directed Inference Systems*, edited by Donald A. Waterman and Frederick Hayes-Roth, Academic Press, New York, 1978.

Dyer, Michael G., *In-depth Understanding: A Computer Model of Integrated Processing for Narrative Comprehension*, MIT Press, Cambridge, MA, 1983.

Ernst, George, and Allen Newell, GPS*: A Case Study in Generality and Problem Solving*, Academic Press, New York, 1969.

Etzioni, Oren, "Embedding Decision-Analytic Control in a Learning Architecture," *Artificial Intelligence*, vol. 49, 1991.

Evans, Thomas G., "A Heuristic Program to Solve Geometric Analogy Problems," in *Semantic Information Processing*, edited by Marvin Minsky, MIT Press, Cambridge, MA, 1968. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1963.

Fahlman, Scott E, *NETL: A System for Representing and Using Real-World Knowledge*, MIT Press, Cambridge, MA, 1979. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1979.

Falkenhainer, Brian, Kenneth D. Forbus and Dedre Gentner, "The Structure-Mapping Engine: Algorithm and Examples," *Artificial Intelligence*, vol. 41, 1990.

Falkenhainer, Brian, "The Utility of Difference-Based Reasoning," *National Conference on Artificial Intelligence*, 1988.

Faltings, B., "Qualitative Kinematics in Mechanisms," *Artificial Intelligence*, vol. 44, 1990.

Faugeras, O. D., E. Le Bras-Mehlman and J. D. Boissonat, "Representing Stereo Data with the Delaunay Triangulation," *Artificial Intelligence*, vol. 44, 1990.

Feigenbaum, Edward A., and Julian Feldman, *Computers and Thought*, McGraw-Hill, New York, 1963.

Feigenbaum, Edward A., and Pamela McCorduck, *The Fifth Generation*, Addison-Wesley, Reading, MA, 1983.

Feigenbaum, Edward A., "The Art of Artificial Intelligence: Themes and Case Studies in Knowledge Engineering," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

Fikes, Richard E., and Nils J. Nilsson, "STRIPS: A New Approach to the Application of Theorem Proving to Problem Solving," *Artificial Intelligence*, vol. 2, 1971.

Fikes, Richard E., Peter E. Hart, and Nils J. Nilsson, "Learning and Executing Generalized Robot Plans," *Artificial Intelligence*, vol. 3, 1972.

Fillmore, C. J., "The Case for Case," in *Universals in Linguistic Theory*, edited by E. Bach and R. Harms, Holt, Rinehart, and Winston, New York, 1968.

Findler, Nicholas V. (editor), *Associative Networks: Representation and Use of Knowledge by Computers*, Academic Press, New York, 1979.

Finkel, Raphael A., and John P. Fishburn, "Parallelism in Alpha–Beta Search," *Artificial Intelligence*, vol. 19, no. 1, 1982.

Finney, D. J., R. Latscha, B. M. Bennet, and P. Hsu, *Tables for Testing Significance in a 2 × 2 Contingency Table*, Cambridge University Press, 1963.

Follett, Ria, "Synthesizing Recursive Functions with Side Effects," *Artificial Intelligence*, vol. 13, no. 3, 1980.

Fong, Sandiway, and Robert C. Berwick, *Parsing with Principles and Parameters*, MIT Press, Cambridge, MA, 1992.

Forbus, Kenneth D., "Qualitative Process Theory," Report AIM-664, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Forbus, Kenneth D., "Qualitative Reasoning About Physical Processes," *Seventh International Joint Conference on Artificial Intelligence*, Vancouver, Canada, 1981.

Forbus, Kenneth D., "Qualitative Process Theory," *Artificial Intelligence*, vol. 24, 1984.

Forgy, Charles L., "RETE: A Fast Algorithm for the Many Pattern/Many Object Pattern Match Problem," *Artificial Intelligence*, vol. 19, no. 1, 1982.

Frankot, Robert T. and Rama Chellappa, "Estimation of Surface Topography from SAR Imagery Using Shape from Shading Techniques," *Artificial Intelligence*, vol. 43, 1990.

Freeman, P., and Allen Newell, "A Model for Functional Reasoning in Design," *Second International Joint Conference on Artificial Intelligence*, London, 1971.

Freuder, Eugene C., "Synthesizing Constraint Expressions," *Communications of the ACM*, vol. 21, no. 11, 1978.

Freuder, Eugene C., "A Computer System for Visual Recognition Using Active Knowledge," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1976.

Freuder, Eugene C., "A Sufficient Condition for Backtrack-Free Search," *Journal of the Association for Computing Machinery*, vol. 29, no. 1, 1982.

Freuder, Eugene C., "On the Knowledge Required to Label a Picture Graph," *Artificial Intelligence*, vol. 15, 1980.

Frey, Peter W. (editor), *Chess Skill in Man and Machine* (second edition), Springer-Verlag, New York, 1983.

Friedman, Jerome H., Jon Louis Bentley, and Raphael Ari Finkel, "An Algorithm for Finding Best Matches in Logarithmic Expected Time," *ACM Transactions on Mathematical Software*, vol. 3, no. 3, 1977.

Funt, V. Brian, "Problem-Solving with Diagrammatic Representations," *Artificial Intelligence*, vol. 13, no. 3, 1980.

Gardin, Francesco and Bernard Meltzer, "Analogical Representations of Naive Physics," *Artificial Intelligence*, vol. 38, 1989.

Gaschnig, John, "Performance Measurement and Analysis of Certain Search Algorithms," Report CMU-CS-79-124, Department of Computer Science, Carnegie–Mellon University, Pittsburgh, PA, 1979.

Gelperin, David, "On the Optimality of A*," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Genesereth, Michael R., "The Use of Design Descriptions in Automated Diagnosis," *Artificial Intelligence*, vol. 24, 1984.

Gentner, Dedre and Kenneth D. Forbus, "A Note on Creativity and Learning in a Case-Based Explainer," *Artificial Intelligence*, vol. 44, 1990.

Gentner, Dedre, and Albert L. Stevens (editors), *Mental Models*, Lawrence Erlbaum Associates, Hillsdale, NJ, 1983.

Gentner, Dedre, "Structure-Mapping: A Theoretical Framework for Analogy," *Cognitive Science*, vol. 7, no. 2, 1983.

Gentner, Dedre, "The Structure of Analogical Models in Science," Report 4451, Bolt, Beranek and Newman, Cambridge, MA, 1980.

Gillogly, James J., "The Technology Chess Program," *Artificial Intelligence*, vol. 3, no. 3, 1972.

Goldberg, David E., *Genetic Algorithms in Search Optimization and Machine Learning*, Addison-Wesley, Reading, MA, 1989.

Goldstein, Ira P., "Summary of MYCROFT: A System for Understanding Simple Picture Programs," *Artificial Intelligence*, vol. 6, no. 3, 1975. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1973.

Gordon, Jean and Edward H. Shortliffe, "A Method for Managing Evidential Reasoning in a Hierarchical Hypothesis Space," *Artificial Intelligence*, vol. 26, 1985.

Green, Claude Cordell, *The Application of Theorem Proving to Question-answering Systems*, Garland, New York, 1980. Based on a PhD thesis, Stanford University, Stanford, CA, 1969.

Green, Claude Cordell, "Theorem Proving by Resolution as a Basis for Question Answering," in *Machine Intelligence 4*, edited by Bernard Melzer and Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1969.

Greiner, Russell, "Learning by Understanding Analogies," *Artificial Intelligence*, vol. 35, 1988.

Griffith, Arnold K., "A Comparison and Evaluation of Three Machine Learning Procedures as Applied to the Game of Checkers," *Artificial Intelligence*, vol. 5, no. 2, 1974.

Grimson, W. Eric L., *From Images to Surfaces*, MIT Press, Cambridge, MA, 1981. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1980.

Grimson, W. Eric L., *Object Recognition by Computer: The Role of Geometric Constraints*, MIT Press, Cambridge, MA, 1990.

Grimson, W. Eric L., "The Combinatorics of Object Recognition in Cluttered Environments Using Constrained Search," *Artificial Intelligence*, vol. 44, 1990.

Grosz, Barbara J., Douglas E. Appelt, Paul A. Martin and Fernando C. N. Pereira, "TEAM: An Experiment in the Design of Transportable Natural-Language Interfaces," *Artificial Intelligence*, vol. 32, 1987.

Grosz, Barbara J., "Natural Language Processing," *Artificial Intelligence*, vol. 19, no. 2, 1982.

Guzman, Adolfo, "Computer Recognition of Three-Dimensional Objects in a Visual Scene," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1968.

Haas, Andrew R., "A Syntactic Theory of Belief and Action," *Artificial Intelligence*, vol. 28, 1986.

Haegeman, Liliane, *Introduction to Government and Binding Theory*, Basil Blackwell Ltd, Oxford, 1991.

Hall, Roger P., "Computational Approaches to Analogical Reasoning: A Comparative Analysis," *Artificial Intelligence*, vol. 39, 1989.

Hammond, K.J., "Explaining and Repairing Plans that Fail," *Artificial Intelligence*, vol. 45, 1990.

Hanks, Steve and Drew McDermott, "Nonmontonic Logic and Temporal Projection," *Artificial Intelligence*, vol. 33, 1987.

Haralick, Robert M., Larry S. Davis, and Azriel Rosenfeld, "Reduction Operations for Constraint Satisfaction," *Information Sciences*, vol. 14, 1978.

Hart, Peter E., Richard O. Duda, and M. T. Einaudi, "PROSPECTOR: A Computer-Based Consultation System for Mineral Exploration," *Mathematical Geology*, vol. 10, no. 5, 1978.

Hart, Peter E., "Progress on a Computer Based Consultant," *Fourth International Joint Conference on Artificial Intelligence*, Tbilisi, Georgia, USSR, 1975.

Hayes, Patrick J., "In Defense of Logic," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

Hayes, Patrick J., "The Naive Physics Manifesto," in *Expert Systems in the Micro-Electronic Age*, edited by Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1979.

Hayes-Roth, Barbara, "A Blackboard Architecture for Control," *Artificial Intelligence*, vol. 26, 1985.

Hayes-Roth, Frederick, Donald A. Waterman, and Douglas B. Lenat (editors), *Building Expert Systems*, Addison-Wesley, Reading, MA, 1983.

Hayes-Roth, Frederick, "Using Proofs and Refutations to Learn from Experience," in *Machine Learning: An Artificial Intelligence Approach*, edited by Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Tioga Publishing Company, Palo Alto, CA, 1983.

Hedrick, L. Charles, "Learning Production Systems from Examples," *Artificial Intelligence*, vol. 7, no. 1, 1976.

Hendrix, Gary G., Earl D. Sacerdoti, Daniel Sagalowicz, and Jonathan Slocum, "Developing a Natural Language Interface to Complex Data," *ACM Transactions on Database Systems*, vol. 8, no. 3, 1978.

Henon, Michel, "Numerical Study of Quadratic Area-Preserving Mappings," *Quarterly of Applied Mathematics*, vol. 17, 1969.

Hewitt, Carl E., and Peter de Jong, "Open Systems," Report AIM-691, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Hewitt, Carl E., "PLANNER: A Language for Proving Theorems in Robots," *First International Joint Conference on Artificial Intelligence*, Washington, D. C., 1969.

Hewitt, Carl E., "Viewing Control Structures as Patterns of Passing Messages," *Artificial Intelligence*, vol. 8, no. 3, 1977.

Hildreth, Ellen C., "The Measurement of Visual Motion," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1983.

Hildreth, Ellen C., "The Detection of Intensity Changes by Computer and Biological Vision Systems," *Computer Vision, Graphics, and Image Processing*, vol. 22, 1983. Based on MS thesis, Massachusetts Institute of Technology, Cambridge, MA, 1980.

Hildreth, Ellen C., "Computations Underlying the Measurement of Visual Motion," *Artificial Intelligence*, vol. 23, 1984.

Hillis, W. Daniel, "Co-Evolving Parasites Improve Simulated Evolution as an Optimizing Procedure," *Physica*, 1990.

Hillis, W. Daniel, "The Connection Machine," Report AIM-646, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1981.

Hillis, W. Daniel, "A High Resolution Imaging Touch Sensor," *International Journal of Robotics Research*, vol. 1, no. 2, 1982. Based on MS thesis, Massachusetts Institute of Technology, Cambridge, MA, 1981.

Hinton, Geoffrey E., "Connectionist Learning Procedures," *Artificial Intelligence*, vol. 40, 1989.

Hinton, Geoffrey E., "Mapping Part–Whole Hierarchies Into Connectionist Networks," *Artificial Intelligence*, vol. 46, 1990.

Hobbs, Jerry R., and Stanley J. Rosenschein, "Making Computational Sense of Montague's Intensional Logic," *Artificial Intelligence*, vol. 9, no. 3, 1977.

Hofstadter, Douglas R., *Gödel, Escher, Bach: The Eternal Golden Braid*, Vintage Books, New York, 1980.

Holland, John H., K. J. Holyoak, R. E. Nisbett, and P. R. Thagard, *Induction: Processes of Inference, Learning, and Discovery*, MIT Press, Cambridge, MA, 1986.

Holland, John H., *Adaptation in Natural and Artificial Systems*, The University of Michigan Press, Ann Arbor, MI, 1975.

Holland, Stephen W., Lothar Rossol, and Mitchell R. Ward, "CONSIGHT-I: A Vision-Controlled Robot System for Transferring Parts from Belt Conveyors," in *Computer Vision and Sensor-based Robots*, edited by George G. Dodd and Lothar Rossol, Plenum Press, New York, 1979.

Hollerbach, John, "Dynamics," in *Robot Motion: Planning and Control*, edited by J. Michael Brady, John M. Hollerbach, Timothy L. Johnson, Tomás Lozano-Pérez, and Matthew T. Mason, MIT Press, Cambridge, MA, 1982.

Hollerbach, John, "A Recursive Lagrangian Formulation of Manipulator Dynamics and a Comparative Study of Dynamics Formulation Complexity," in *Robot Motion: Planning and Control*, edited by J. Michael Brady, John M. Hollerbach, Timothy L. Johnson, Tomás Lozano-Pérez, and Matthew T. Mason, MIT Press, Cambridge, MA, 1982.

Hollerbach, John, "Hierarchical Shape Description of Objects by Selection and Modification of Prototypes," MS Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1976.

Hopfield, J. J., "Neural Networks and Physical Systems with Emergent Collective Computational Abilities," *Proceedings of the National Academy of Sciences*, vol. 79, 1982.

Horaud, Radu and Michael Brady, "On the Geometric Interpretation of Image Contours," *Artificial Intelligence*, vol. 37, 1988.

Horn, Berthold K. P. and Michael J. Brooks (editors), *Shape from Shading*, MIT Press, Cambridge, MA, 1989.

Horn, Berthold K. P., "The Binford–Horn Line Finder," Report AIM-285, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1971.

Horn, Berthold K. P., *Robot Vision*, MIT Press, Cambridge, MA, and McGraw-Hill, New York, 1984.

Horn, Berthold K. P., "Obtaining Shape from Shading Information," in *Psychology of Computer Vision*, edited by Patrick H. Winston, MIT Press, Cambridge, MA, 1975. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1970.

Horn, Berthold K.P., "Understanding Image Intensities," *Artificial Intelligence*, vol. 8, no. 2, 1977.

Horn, Berthold K.P., "Sequins and Quills: Representations for Surface Topography," in *Representation of Three-Dimensional Objects*, edited by Ruzena Bajcsy, Springer-Verlag, New York, 1982.

Hsu, Feng-hsiung, Thomas Anantharaman, Murray Campbell, and Andreas Nowatzyk, "A Grandmaster Chess Machine," *Scientific American*, vol. 263, no. 4, 1990.

Hubel, D. H., and T. N. Wiesel, "Receptive Fields, Binocular Interaction and Functional Architecture in the Cat's Visual Cortex," *Journal of Physiology*, vol. 160, 1962.

Huffman, David, "Impossible Objects as Nonsense Sentences," in *Machine Intelligence 6*, edited by Bernard Meltzer and Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1971.

Hummel, Robert A., and Steven W. Zucker, "On the Foundations of Relaxation Labeling Processes," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. PAMI-5, no. 3, 1983.

Hunt, Earl B., *Artificial Intelligence*, Academic Press, New York, 1975.

Huyn, Nam, Rina Dechter and Judea Pearl, "Probabilistic Analysis of the Complexity of A*," *Artificial Intelligence*, vol. 15, 1980.

Ikeuchi, K., "Shape from Regular Patterns," *Artificial Intelligence*, vol. 22, 1984.

Ikeuchi, Katsushi, and Berthold K. P. Horn, "Numerical Shape from Shading and Occluding Boundaries," *Artificial Intelligence*, vol. 17, 1981.

Inoue, Hirochika, "Force Feedback in Precise Assembly Tasks," Report AIM-308, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1974.

Kahn, Kenneth, and Anthony G. Gorry, "Mechanizing Temporal Knowledge," *Artificial Intelligence*, vol. 9, no. 1, 1977.

Kanade, Takeo, "A Theory of Origami World," *Artificial Intelligence*, vol. 13, no. 3, 1980.

Kanade, Takeo, "Recovery of the Three-Dimensional Shape of an Object from a Single View," *Artificial Intelligence*, vol. 17, 1981.

Kant, Elaine, "On the Efficient Synthesis of Efficient Programs," *Artificial Intelligence*, vol. 20, 1983.

Kaplan, Jerrold., "Cooperative Responses from a Portable Natural Language Query System," in *Computational Models of Discourse*, edited by J. Michael Brady and Robert C. Berwick, MIT Press, Cambridge, MA, 1983.

Kaplan, Ronald M., "Augmented Transition Networks: Psychological Models of Sentence Comprehension," *Artificial Intelligence*, vol. 3, no. 2, 1972.

Karp, Richard M. and Judea Pearl, "Searching for an Optimal Path in a Tree with Random Costs," *Artificial Intelligence*, vol. 21, 1983.

Katz, Boris, and Patrick H. Winston, "A Two-Way Natural Language Interface," in *Integrated Interactive Computing Systems*, edited by P. Degano and Erik Sandewall, North-Holland, Amsterdam, 1982.

Katz, Boris, "Using English for Indexing and Retrieving," in *Artificial Intelligence at MIT: Expanding Frontiers (Two Volumes)*, edited by Patrick H. Winston and Sarah Alexandra Shellard, MIT Press, Cambridge, MA, 1990.

Kautz, Henry A. and Bart Selman, "Hard Problems for Simple Default Logics," *Artificial Intelligence*, vol. 49, 1991.

Keene, Sonya E., *Object-Oriented Programming in* COMMON LISP, Addison-Wesley, Reading, MA, 1989.

Kimura, Motoo, *The Neutral Theory of Molecular Evolution*, Cambridge University Press, Cambridge, England, 1983.

Kirsh, David, "Foundations of AI: The Big Issues," *Artificial Intelligence*, vol. 47, 1991.

Kirsh, David, "Today the Earwig, Tomorrow Man?," *Artificial Intelligence*, vol. 47, 1991.

Knuth, Donald E., and Ronald W. Moore, "An Analysis of Alpha–Beta Pruning," *Artificial Intelligence*, vol. 6, no. 4, 1975.

Korf, R. E., "Real-Time Heuristic Search," *Artificial Intelligence*, vol. 42, 1990.

Kornfeld, William A., and Carl E. Hewitt, "The Scientific Community Metaphor," *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-11, no. 1, 1981.

Kowalski, Robert, *Logic for Problem Solving*, North-Holland, Amsterdam, 1979.

Kratkiewicz, Kendra, "Improving Learned Rules Using Near Miss Groups," BS Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1984.

Kuipers, Benjamin J., "Commonsense Reasoning About Causality: Deriving Behavior from Structure," *Artificial Intelligence*, vol. 24, 1984.

Kuipers, Benjamin J., "Qualitative Simulation," *Artificial Intelligence*, vol. 29, 1986.

Kulikowski, Casimir A., and Sholom M. Weiss, "Representation of Expert Knowledge for Consultant," in *Artificial Intelligence in Medicine*, edited by Peter Szolovits, Westview Press, Boulder, CO, 1982.

Laird, John E., Alan Newell and Paul S. Rosenbloom, "SOAR: An Architecture for General Intelligence," *Artificial Intelligence*, vol. 33, 1987.

Langley, Pat and Jan M. Zytkow, "Data-Driven Approaches to Empirical Discovery," *Artificial Intelligence*, vol. 40, 1989.

Langley, Pat, Gary L. Bradshaw, and Herbert A. Simon, "Rediscovering Chemistry with the BACON System," in *Machine Learning: An Artificial Intelligence Approach*, edited by Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Tioga Publishing Company, Palo Alto, CA, 1983.

Lathrop, Richard Harold, "Efficient Methods for Massively Parallel Symbolic Induction: Algorithms and Implementation," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1990.

Lauriere, Jean-Louis, "A Language and a Program for Stating and Solving Combinatorial Problems," *Artificial Intelligence*, vol. 10, no. 1, 1978.

Lee, Chia-Hoang and Azriel Rosenfeld, "Improved Methods of Estimating Shape from Shading Using the Light Source Coordinate System," *Artificial Intelligence*, vol. 26, 1985.

Lee, Kai-Fu and Sanjoy Mahajan, "A Pattern Classification Approach to Evaluation Function Learning," *Artificial Intelligence*, vol. 36, 1988.

Lee, Kai-Fu and Sanjoy Mahajan, "The Development of a World Class Othello Program," *Artificial Intelligence*, vol. 43, 1990.

Leech, W. J., "A Rule Based Process Control Method with Feedback," *Proceedings of the International Conference and Exhibit, Instrument Society of America*, 1986.

Lehnert, Wendy G., Michael G. Dyer, Peter N. Johnson, C. J. Yang, and, Steve Harley, "BORIS: An Experiment in In-Depth Understanding of Narratives," *Artificial Intelligence*, vol. 20, no. 1, 1983.

Lehnert, Wendy, "Plot Units and Narrative Summarization," *Cognitive Science*, vol. 5, no. 4, 1981.

Lenat, Douglas B. and Edward A. Feigenbaum, "On the Thresholds of Knowledge," *Artificial Intelligence*, vol. 47, 1991.

Lenat, Douglas B. and John S. Brown, "Why AM and EURISKO Appear to Work," *Artificial Intelligence*, vol. 23, 1984.

Lenat, Douglas B. and R. V. Guha, *Building Large Knowledge-Based Systems*, Addison-Wesley, Reading, MA, 1990.

Lenat, Douglas B., "The Ubiquity of Discovery," *Artificial Intelligence*, vol. 9, no. 3, 1977.

Lenat, Douglas B., "AM: Discovery in Mathematics as Heuristic Search," in *Knowledge-Based Systems in Artificial Intelligence*, edited by Randall Davis and Douglas B. Lenat, McGraw-Hill, New York, 1982. Based on a PhD thesis, Stanford University, Stanford, CA, 1977.

Lesser, Victor R., and Lee D. Erman, "A Retrospective View of the Hearsay-II Architecture," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

Lettvin, Jerome Y., R. R. Maturana, W. S. McCulloch, and W. H. Pitts, "What the Frog's Eye Tells the Frog's Brain," *Proceedings of the Institute of Radio Engineers*, vol. 47, 1959.

Levesque, Hector J., "Foundations of a Functional Approach to Knowledge Representation," *Artificial Intelligence*, vol. 23, 1984.

Levesque, Hector J., "Making Believers Out of Computers," *Artificial Intelligence*, vol. 30, 1986.

Levesque, Hector J., "All I Know: A Study in Autoepistemic Logic," *Artificial Intelligence*, vol. 42, 1990.

Levi, Giorgio, and Sirovich Franco, "Generalized and/or Graphs," *Artificial Intelligence*, vol. 7, no. 3, 1976.

Levy, David, *Chess and Computers*, Computer Science Press, Woodland Hills, CA, 1976.

Lindsay, Peter H. and Donald A. Norman, *Human Information Processing*, Academic Press, New York, 1972.

Lindsay, Robert, Bruce G. Buchanan, Edward A. Feigenbaum, and Joshua Lederberg, *Applications of Artificial Intelligence for Chemical Inference: The* DENDRAL *Project*, McGraw-Hill, New York, 1980.

Lowe, David G., "Three-Dimensional Object Recognition from Single Two-Dimensional Images," *Artificial Intelligence*, vol. 31, 1987.

Lozano-Pérez, Tomás, "Robot Programming," Report AIM-698, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Lozano-Pérez, Tomás, "Spatial Planning: A Configuration-Space Approach," *IEEE Transactions on Computers*, vol. 71, no. 7, 1983. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1980.

Mackworth, Alan K. and Eugene C. Freuder, "The Complexity of Some Polynomial Consistency Algorithms for Constraint Satisfaction Problems," *Artificial Intelligence*, vol. 25, 1985.

Mackworth, Alan K., "Consistency in Networks of Relations," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Mackworth, Alan K., "Interpreting Pictures of Polyhedral Scenes," *Artificial Intelligence*, vol. 4, no. 2, 1973.

Marcus, Mitchell P., *A Theory of Syntactic Recognition for Natural Language*, MIT Press, Cambridge, MA, 1980. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1977.

Marcus, Sandra and John McDermott, "SALT: A Knowledge Acquisition Language for Propose-and-Revise Systems," *Artificial Intelligence*, vol. 39, 1989.

Marr, David, and Tomaso Poggio, "A Theory of Human Stereo Vision," *Proceedings of the Royal Society of London*, vol. 204, 1979.

Marr, David, "Artificial Intelligence: A Personal View," *Artificial Intelligence*, vol. 9, no. 1, 1977.

Marr, David, *Vision*, W. H. Freeman, San Francisco, CA, 1982.

Martelli, Alberto, "On the Complexity of Admissible Search Algorithms," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Martin, William A., "Descriptions and the Specialization of Concepts," Report TM-101, Laboratory for Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1978.

Mason, Matthew T., "Compliance and Force Control for Computer Controlled Manipulators," *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SCM-11, no. 6, 1981. Based on MS thesis, Massachusetts Institute of Technology, Cambridge, MA, 1979.

Mason, Matthew T., "Manipulator Grasping and Pushing Operations," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Mayhew, John E. W., and John P. Frisby, "Psychophysical and Computational Studies Towards a Theory of Human Stereopsis," *Artificial Intelligence*, vol. 17, 1981.

Mazlack, Lawrence, J., "Computer Construction of Crossword Puzzles Using Precedence Relationships," *Artificial Intelligence*, vol. 7, no. 1, 1976.

McAllester, David A., "An Outlook on Truth Maintenance," Report AIM-551, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1980.

McAllester, David A., "Conspiracy Numbers for Min-Max Search," *Artificial Intelligence*, vol. 35, no. 3, 1988.

McAllester, David and David Rosenblitt, "Systematic Nonlinear Planning," *National Conference on Artificial Intelligence*, 1991.

McCarthy, John, and Patrick J. Hayes, "Some Philosophical Problems from the Standpoint of Artificial Intelligence," in *Machine Intelligence 4*, edited by Bernard Melzer and Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1969.

McCarthy, John, "Circumscription: A Form of Non-Monotonic Reasoning," *Artificial Intelligence*, vol. 13, 1980.

McCarthy, John, "Epistemological Problems of Artificial Intelligence," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

McCarthy, John, "Applications of Circumscription to Formalizing Common-Sense Knowledge," *Artificial Intelligence*, vol. 28, 1986.

McClelland, James L. and David E. Rumelhart (editors), *Parallel Distributed Processing* (Two Volumes), MIT Press, Cambridge, MA, 1986.

McCorduck, Pamela, *Machines Who Think*, W. H. Freeman, San Francisco, CA, 1979.

McDermott, Drew and Ernest Davis, "Planning Routes Through Uncertain Territory," *Artificial Intelligence*, vol. 22, 1984.

McDermott, Drew, and Jon Doyle, "Non-Monotonic Logic I," *Artificial Intelligence*, vol. 13, 1980.

McDermott, Drew, "A General Framework for Reason Maintenance," *Artificial Intelligence*, vol. 50, 1991.

McDermott, John, "R1: A Rule-Based Configurer of Computer Systems," *Artificial Intelligence*, vol. 19, no. 1, 1982.

McDonald, David D., "Natural Language Generation as a Computational Problem," in *Computational Models of Discourse*, edited by J. Michael Brady and Robert C. Berwick, MIT Press, Cambridge, MA, 1983.

Michalski, Ryszard S. and Patrick H. Winston, "Variable Precision Logic," *Artificial Intelligence*, vol. 29, 1986.

Michalski, Ryszard S., and Richard L. Chilausky, "Learning by Being Told and Learning from Examples: An Experimental Comparison of the Two Methods of Knowledge Acquisition in the Context of Developing an Expert System for Soybean Disease Diagnosis," *International Journal of Policy Analysis and Information Systems*, vol. 4, no. 2, 1980.

Michalski, Ryszard S., and Robert E. Stepp, "Learning from Observation: Conceptual Clustering," in *Machine Learning: An Artificial Intelligence Approach*, edited by Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Tioga Publishing Company, Palo Alto, CA, 1983.

Michalski, Ryszard S., Jaime G. Carbonell, and Tom M. Mitchell (editors), *Machine Learning: An Artificial Intelligence Approach*, Tioga Publishing Company, Palo Alto, CA, 1983.

Michalski, Ryszard S., "Pattern Recognition as Rule-Guided Inductive Inference," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 2, no. 4, 1980.

Michalski, Ryszard S., "A Theory and Methodology of Inductive Learning," *Artificial Intelligence*, vol. 20, no. 3, 1983.

Michie, Donald (editor), *Expert Systems in the Micro-Electronic Age*, Edinburgh University Press, Edinburgh, Scotland, 1979.

Michie, Donald, *On Machine Intelligence*, John Wiley and Sons, New York, 1974.

Michie, Donald, "Chess with Computers," *Interdisciplinary Science Reviews*, vol. 5, no. 3, 1980.

Miller, G. A., E. Galanter, and K. H. Pribram, *Plans and the Structure of Behavior*, Holt, Rinehart, and Winston, New York, 1960.

Minker, Jack, Daniel H. Fishman, and James R. McSkimin, "The Q* Algorithm: A Search Strategy for a Deductive Question-Answering System," *Artificial Intelligence*, vol. 4, no. 3&4, 1973.

Minsky, Marvin (editor), *Semantic Information Processing*, MIT Press, Cambridge, MA, 1968.

Minsky, Marvin, "A Framework for Representing Knowledge," in *Psychology of Computer Vision*, edited by Patrick H. Winston, MIT Press, Cambridge, MA, 1975.

Minsky, Marvin, "Plain Talk about Neurodevelopmental Epistemology," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

Minsky, Marvin, *The Society of Mind*, Simon & Schuster, New York, 1985.

Minsky, Marvin, "K-lines: A Theory of Memory," *Cognitive Science*, vol. 4, no. 1, 1980.

Minsky, Marvin, "Matter, Mind, and Models," in *Semantic Information Processing*, edited by Marvin Minsky, MIT Press, Cambridge, MA, 1968.

Minton, Steven, Jaime G. Carbonell, Craig A. Knoblock, Daniel R. Kuokka, Oren Etzioni and Yolanda Gil, "Explanation-Based Learning: A Problem Solving Perspective," *Artificial Intelligence*, vol. 40, 1989.

Minton, Steven, "Quantitative Results Concerning the Utility of Explanation-Based Learning," *Artificial Intelligence*, vol. 42, 1990.

Mitchell, T. M., R. M. Keller, and S. T. Kedar-Cabelli, "Explanation-Based Generalization: A Unifying View," *Machine Learning*, vol. 1, no. 1, 1986.

Mitchell, Tom M., "Generalization as Search," *Artificial Intelligence*, vol. 18, no. 2, 1982. Based on a PhD thesis, Stanford University, Stanford, CA, 1978.

Montanari, Ugo and Francesca Rossi, "Constraint Relaxation May Be Perfect," *Artificial Intelligence*, vol. 48, 1991.

Moore, James A., and Allen Newell, "How Can Merlin Understand?," in *Knowledge and Cognition*, edited by L. Gregg, Lawrence Erlbaum Associates, Hillsdale, NJ, 1974.

Moore, Robert C., "Semantical Considerations of Nonmonotonic Logic," *Artificial Intelligence*, vol. 25, 1985.

Morevec, Hans P., "Towards Automatic Visual Obstacle Avoidance," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

Moses, Joel, "Symbolic Integration," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1967.

Mostow, Jack, "Design by Derivational Analogy: Issues in the Automated Replay of Design Plans," *Artificial Intelligence*, vol. 40, 1989.

Nagel, Hans-Hellmut, "On the Estimation of Optical Flow: Relations Between Different Approaches and Some New Results," *Artificial Intelligence*, vol. 33, 1987.

Nau, Dana S., "An Investigation of the Causes of Pathology in Games," *Artificial Intelligence*, vol. 19, no. 3, 1982.

Nevatia, Ramakant, and Thomas O. Binford, "Description and Recognition of Curved Objects," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Nevatia, Ramakant, *Machine Perception*, Prentice-Hall, Englewood Cliffs, NJ, 1982.

Newborn, M. M., "The Efficiency of the Alpha–Beta Search on Trees with Branch-Dependent Terminal Node Scores," *Artificial Intelligence*, vol. 8, no. 2, 1977.

Newell, Allen, and Herbert A. Simon, *Human Problem Solving*, Prentice-Hall, Englewood Cliffs, NJ, 1972.

Newell, Allen, John C. Shaw, and Herbert A. Simon, "Preliminary Description of General Problem Solving Program-I (GPS-I)," Report CIP Working Paper 7, Carnegie Institute of Technology, Pittsburgh, PA, 1957.

Newell, Allen, *Unified Theories of Cognition*, Harvard University Press, Cambridge, MA, 1990.

Nilsson, Nils J., *Principles of Artificial Intelligence*, Tioga Publishing Company, Palo Alto, CA, 1980.

Nilsson, Nils J., "Logic and Artificial Intelligence," *Artificial Intelligence*, vol. 47, 1991.

Nilsson, Nils J., "Probabilistic Logic," *Artificial Intelligence*, vol. 28, 1986.

Nishihara, H. Keith, "Intensity, Visible-surface, and Volumetric Representations," *Artificial Intelligence*, vol. 17, 1981. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1978.

Norman, Donald A., "Approaches to the Study of Intelligence," *Artificial Intelligence*, vol. 47, 1991.

O'Gorman, Frank, "Edge Detection Using Walsh Functions," *Artificial Intelligence*, vol. 10, no. 2, 1978.

Ogden, C. K., *Basic English: International Second Language*, Harcourt, Brace, and World, New York, 1968.

Ohlander, Ronald B., Keith Price, and D. Raj Reddy, "Picture Segmentation Using a Recursive Splitting Method," *Computer Graphics and Image Processing*, vol. 8, 1979.

Ohlander, Ronald B., "Analysis of Natural Scenes," PhD Thesis, Carnegie–Mellon University, Pittsburgh, PA, 1975.

Palay, Andrew J., "The B* Tree Search Algorithm: New Results," *Artificial Intelligence*, vol. 19, no. 2, 1982.

Papazian, Pegor, "Principles, Opportunism and Seeing in Design: A Computational Approach," MS Thesis, Department of Architecture, Massachusetts Institute of Technology, Cambridge, MA, 1991.

Papert, Seymour A., "Some Mathematical Models of Learning," *Proceedings of the Fourth London Symposium on Information Theory*, 1961.

Papert, Seymour, and Cynthia Solomon, "Twenty Things to Do with a Computer," Report AIM-248, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1971.

Papert, Seymour, *Mindstorms*, Basic Books, New York, 1981.

Papert, Seymour, "Uses of Technology to Enhance Education," Report AIM-298, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1973.

Pastre, D., "Automatic Theorem Proving in Set Theory," *Artificial Intelligence*, vol. 10, no. 1, 1978.

Patil, Ramesh S., Peter Szolovits, and William B. Schwartz, "Causal Understanding of Patient Illness," *Seventh International Joint Conference on Artificial Intelligence*, Vancouver, Canada, 1981.

Patil, Ramesh, "Causal Representation of Patient Illness for Electrolyte and Acid-Base Diagnosis," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1981.

Paul, Richard P., *Robot Manipulators: Mathematics, Programming, and Control*, MIT Press, Cambridge, MA, 1981.

Pearl, Judea, "Knowledge versus Search: A Quantitative Analysis Using A*," *Artificial Intelligence*, vol. 20, no. 1, 1983.

Pearl, Judea, "Distributed Revision of Composite Beliefs," *Artificial Intelligence*, vol. 33, 1987.

Pearl, Judea, "Embracing Causality in Default Reasoning," *Artificial Intelligence*, vol. 35, 1988.

Pearl, Judea, "Fusion, Propagation, and Structuring in Belief Networks," *Artificial Intelligence*, vol. 29, 1986.

Pednault, E. P. D., Steven W. Zucker, and L. V. Muresan, "On the Independence Assumption Underlying Subjective Bayesian Updating," *Artificial Intelligence*, vol. 16, no. 2, 1981.

Pentland, Alex P., "Shading into Texture," *Artificial Intelligence*, vol. 29, 1986.

Pentland, Alex P., "Perceptual Organization and the Representation of Natural Form," *Artificial Intelligence*, vol. 28, 1986.

Pereira, Fernando C. N., and David H. D. Warren, "Definite Clause Grammars for Language Analysis: A Survey of the Formalism and a Comparison with Augmented Transition Networks," *Artificial Intelligence*, vol. 13, no. 3, 1980.

Pereira, Fernando C. N. and Martha E. Pollack, "Incremental Interpretation," *Artificial Intelligence*, vol. 50, 1991.

Pitrat, Jacques, "A Chess Combination Program which Uses Plans," *Artificial Intelligence*, vol. 8, no. 3, 1977.

Poggio, Tomaso A., and Federico Girosi, "Networks for Approximation and Learning," *Proceedings of the IEEE*, vol. 78, no. 9, 1990.

Pomerleau, Dean, A., "Efficient Training of Artificial Neural Networks for Autonomous Navigation," *Neural Computation*, vol. 3, no. 1, 1991.

Pomerleau, Dean, A., "Neural Network Based Vision for Precise Control of a Walking Robot," *Machine Learning*, 1992.

Pople, Harry E., Jr., "Heuristic Methods for Imposing Structure on Ill-Structured Problems: The Structuring of Medical Diagnostics," in *Artificial Intelligence in Medicine*, edited by Peter Szolovits, Westview Press, Boulder, CO, 1982.

Pople, Harry E., Jr., "On the Mechanization of Abductive Logic," *Third International Joint Conference on Artificial Intelligence*, Stanford, CA, 1973.

Popplestone, R.J., A. P. Ambler and I. M. Bellos, "An Interpreter for a Language for Describing Assemblies," *Artificial Intelligence*, vol. 14, 1980.

Pylyshyn, Zenon W., "Literature from Cognitive Psychology," *Artificial Intelligence*, vol. 19, no. 3, 1982.

Quinlan, J. Ross and Ronald Rivest, "Inferring Decision Trees Using the Minimum Description Length Principle," Report TM-339, Laboratory for Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1987.

Quinlan, J. Ross, "Inferno: A Cautious Approach to Uncertain Inference," *The Computer Journal*, vol. 26, no. 3, 1983.

Quinlan, J. Ross, "Learning Efficient Classification Procedures and their Application to Chess End Games," in *Machine Learning: An Artificial Intelligence Approach*, edited by Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Tioga Publishing Company, Palo Alto, CA, 1983.

Quinlan, J. Ross, "Discovering Rules by Induction from Large Collections of Examples," in *Expert Systems in the Micro-Electronic Age*, edited by Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1979.

Quinlan, J. Ross, "Simplifying Decision Trees," Report AIM-930, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1986.

Raibert, Marc H., and Ivan Sutherland, "Machines that Walk," *Scientific American*, vol. 248, no. 1, 1983.

Rao, Satyajit, "Knowledge Repair," MS Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1991.

Raphael, Bertram, *The Thinking Computer*, W. H. Freeman, San Francisco, CA, 1976.

Reiter, R., "A Logic for Default Reasoning," *Artificial Intelligence*, vol. 13, 1980.

Reiter, Raymond and Alan K. Mackworth, "A Logical Framework for Depiction and Image Interpretation," *Artificial Intelligence*, vol. 41, 1990.

Reiter, Raymond, "A Theory of Diagnosis from First Principles," *Artificial Intelligence*, vol. 32, 1987.

Requicha, Aristides A., "Representations for Rigid Solids: Theory, Methods, and Systems," *ACM Computing Surveys*, vol. 12, no. 4, 1980.

Rich, Charles and Richard C. Waters, *The Programmer's Apprentice*, Addison-Wesley, Reading, MA, 1990.

Rich, Charles, and Howard E. Shrobe, "Initial Report on a LISP Programmer's Apprentice," *IEEE Transactions on Software Engineering*, vol. SE-4, no. 6, 1978.

Rich, Elaine, *Artificial Intelligence*, McGraw-Hill, New York, 1983.

Richards, Whitman (editor), *Natural Computation*, MIT Press, Cambridge, MA, 1988.

Richter, Jacob, and Shimon Ullman, "A Model for the Temporal Organization of the X- and Y-Type Receptive Fields in the Primate Retina," *Biological Cybernetics*, vol. 43, 1982.

Rieger, Chuck, "On Organization of Knowledge for Problem Solving and Language Comprehension," *Artificial Intelligence*, vol. 7, no. 2, 1976.

Roberts, R. Bruce, and Ira P. Goldstein, "The FRL primer," Report AIM-408, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1977.

Robinson, J. A., "A Machine-Oriented Logic Based on the Resolution Principle," *Journal of the Association for Computing Machinery*, vol. 12, no. 1, 1965.

Robinson, J. A., "The Generalized Resolution Principle," in *Machine Intelligence 3*, edited by Donald Michie, Elsevier, New York, 1968.

Rosenbloom, Paul S., John E. Laird, Alan Newell and Robert McCarl, "A Preliminary Analysis of the Soar Architecture as a Basis for General Intelligence," *Artificial Intelligence*, vol. 47, 1991.

Rosenbloom, Paul S., "A World-Championship-Level Othello Program," *Artificial Intelligence*, vol. 19, no. 3, 1982.

Rosenfeld, Azriel (editor), *Multiresolution Image Processing and Analysis*, Springer-Verlag, New York, 1983.

Rosenfeld, Azriel, and Avinash C. Kak, *Digital Picture Processing*, Academic Press, New York, 1976.

Rosenfeld, Azriel, Robert A. Hummel, and Steven W. Zucker, "Scene Labeling by Relaxation Operators," *IEEE Transactions on Systems, Man, and Society*, vol. 6, 1976.

Ruth, Gregory R., "Intelligent Program Analysis," *Artificial Intelligence*, vol. 7, no. 1, 1976.

Sacerdoti, Earl D., "Planning in a Hierarchy of Abstraction Spaces," *Artificial Intelligence*, vol. 5, no. 2, 1974.

Sacks, Elisa P., "Automatic Qualitative Analysis of Dynamic Systems Using Piecewise Linear Approximations," *Artificial Intelligence*, vol. 41, 1990.

Sacks, Elisa P., "Automatic Analysis of One-Parameter Planar Ordinary Differential Equations by Intelligent Numeric Simulation," *Artificial Intelligence*, vol. 48, 1991.

Sacks, Elisa P., "A Dynamic Systems Perspective on Qualitative Simulation," *Artificial Intelligence*, vol. 42, 1990.

Salisbury, J. Kenneth, Jr., and B. Roth, "Kinematic and Force Analysis of Articulated Mechanical Hands," *Journal of Mechanisms, Transmissions, and Automation in Design*, vol. 105, 1983.

Salisbury, J. Kenneth, Jr., and John J. Craig, "Articulated Hands: Force Control and Kinematic Issues," *International Journal of Robotics Research*, vol. 1, no. 1, 1982.

Salisbury, J. Kenneth, Jr., "Kinematic and Force Analysis of Articulated Hands," PhD Thesis, Stanford University, Stanford, CA, 1982.

Samuel, Arthur L., "Some Studies in Machine Learning Using the Game of Checkers II. Recent Progress," *IBM Journal of Research and Development*, vol. 11, no. 6, 1967.

Samuel, Arthur L., "Some Studies in Machine Learning Using the Game of Checkers," *IBM Journal of Research and Development*, vol. 3, no. 3, 1959.

Schank, Roger C. and C. J. Rieger III, "Inference and the Computer Understanding of Natural Language," *Artificial Intelligence*, vol. 5, 1974.

Schank, Roger C. and David B. Leake, "Creativity and Learning in a Case-Based Explainer," *Artificial Intelligence*, vol. 40, 1989.

Schank, Roger C., and Kenneth Colby (editors), *Computer Models of Thought and Language*, W. H. Freeman, San Francisco, CA, 1973.

Schank, Roger C., "Conceptual Dependency: A Theory of Natural Language Understanding," *Cognitive Psychology*, vol. 3, no. 4, 1972.

Schank, Roger C., *Dynamic Memory*, Cambridge University Press, Cambridge, England, 1982.

Schubert, L. K., "Extending the Expressive Power of Semantic Networks," *Artificial Intelligence*, vol. 7, no. 2, 1976.

Sejnowski, Terrence J. and Charles R. Rosenberg, "NETtalk: a Parallel Network that Learns to Read Aloud," in *Neurocomputing: Foundations of Research*, edited by James A. Anderson and Edward Rosenfeld, MIT Press, Cambridge, MA, 1989. Based on a technical report that appeared in 1986.

Selfridge, Mallory, "A Computer Model of Child Language Learning," *Artificial Intelligence*, vol. 29, 1986.

Selman, B. and H. A. Kautz, "Model-Preference Default Theories," *Artificial Intelligence*, vol. 45, 1990.

Shannon, Claude E., "Programming a Digital Computer for Playing Chess," *Philosophy Magazine*, vol. 41, 1950.

Shannon, Claude E., "Automatic Chess Player," *Scientific American*, vol. 182, no. 48, 1950.

Shirai, Yoshiaki, "Analyzing Intensity Arrays Using Knowledge about Scenes," in *Psychology of Computer Vision*, edited by Patrick H. Winston, MIT Press, Cambridge, MA, 1975.

Shoham, Yoav and Drew McDermott, "Problems in Formal Temporal Reasoning," *Artificial Intelligence*, vol. 36, 1988.

Shoham, Yoav , "Temporal Logics in AI: Semantical and Ontological Considerations," *Artificial Intelligence*, vol. 33, 1987.

Shoham, Yoav, "Chronological Ignorance: Experiments in Nonmonotonic Temporal Reasoning," *Artificial Intelligence*, vol. 36, 1988.

Shortliffe, Edward H., and Bruce G. Buchanan, "A Model of Inexact Reasoning in Medicine," *Mathematical Biosciences*, vol. 23, 1975.

Shortliffe, Edward H., MYCIN: *Computer-Based Medical Consultations*, Elsevier, New York, 1976. Based on a PhD thesis, Stanford University, Stanford, CA, 1974.

Shostak, Robert E., "Refutation Graphs," *Artificial Intelligence*, vol. 7, no. 1, 1976.

Sidner, Candace L., "Focusing in the Comprehension of Definite Anaphora," in *Computational Models of Discourse*, edited by J. Michael Brady and Robert C. Berwick, MIT Press, Cambridge, MA, 1983.

Simmons, Robert, "Semantic Networks: Their Computation and Use for Understanding English Sentences," in *Computer Models of Thought and Language*, edited by Roger Schank and Kenneth Colby, W. H. Freeman, San Francisco, CA, 1973.

Simon, Herbert A., and Joseph B. Kadane, "Optimal Problem-Solving Search: All-or-None Solutions," *Artificial Intelligence*, vol. 6, no. 3, 1975.

Simon, Herbert A., "The Structure of Ill Structured Problems," *Artificial Intelligence*, vol. 4, 1973.

Simon, Herbert A., *The Sciences of the Artificial*, MIT Press, Cambridge, MA, 1969.

Simon, Herbert A., "Search and Reasoning in Problem Solving," *Artificial Intelligence*, vol. 21, 1983.

Slagle, James R., "A Heuristic Program that Solves Symbolic Integration Problems in Freshman Calculus," in *Computers and Thought*, edited by Edward A. Feigenbaüm and Julian Feldman, McGraw-Hill, New York, 1963. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1961.

Sloman, A., "Interactions Between Philosophy and Artificial Intelligence: The Role of Intuition and Non-Logical Reasoning in Intelligence," *Artificial Intelligence*, vol. 2, 1971.

Stallman, Richard M. and Gerald J. Sussman, "Forward Reasoning and Dependency-Directed Backtracking in a System for Computer-Aided Circuit Analysis," *Artificial Intelligence*, vol. 9, no. 2, 1977.

Stefik, M., "Inferring DNA Structures from Segmentation Data," *Artificial Intelligence*, vol. 11, 1978.

Stefik, Mark, "Planning with Constraints (MOLGEN: Part 1 and Part 2)," *Artificial Intelligence*, vol. 16, no. 2, 1980.

Stepankova, Olga, and Ivan M. Havel, "A Logical Theory of Robot Problem Solving and Language Comprehension," *Artificial Intelligence*, vol. 7, no. 2, 1976.

Stepp, Robert E. and Ryszard S. Michalski, "Conceptual Clustering of Structured Objects: A Goal-Oriented Approach," *Artificial Intelligence*, vol. 28, 1986.

Stevens, Albert L., R. Bruce Roberts, Larry S. Stead, Kenneth D. Forbus Cindy Steinberg, and Brian C. Smith, "Steamer: Advanced Computer Aided Instruction in Propulsion Engineering," Report 4702, Bolt, Beranek and Newman, Cambridge, MA, 1981.

Sugihara, Kokichi, "Mathematical Structures of Line Drawings of Polyhedrons: Toward Man-Machine Communication by Means of Line Drawings," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. PAMI-4, 1982.

Sugihara, Kokichi, "Quantitative Analysis of Line Drawings of Polyhedral Scenes," *Proceedings of the Fourth International Joint Conference on Pattern Recognition, Kyoto, Japan*, 1978.

Sussman, Gerald J. and Guy L. Steele Jr, "CONSTRAINTS: A Language for Expressing Almost Hierarchical Descriptions," *Artificial Intelligence*, vol. 14, 1980.

Sussman, Gerald J. and Richard M. Stallman, "Heuristic Techniques in Computer Aided Circuit Analysis," *IEEE Transactions on Circuits and Systems*, vol. CAS-22, no. 11, 1975.

Sussman, Gerald J., Terry Winograd, and Eugene Charniak, "MICRO-PLANNER Reference Manual," Report AIM-203A, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1971.

Sussman, Gerald J., *A Computer Model of Skill Acquisition*, Elsevier, New York, 1975. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1973.

Szolovits, Peter (editor), *Artificial Intelligence in Medicine*, Westview Press, Boulder, CO, 1982.

Szolovits, Peter, Lowell B. Hawkinson, and William A. Martin, "An Overview of OWL, a Language for Knowledge Representation," Report TM-86, Laboratory for Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1977.

Szolovits, Peter, "Compilation for Fast Calculation over Pedigrees," *Cytogenetics and Cell Genetics*, vol. 59, 1992.

Tanimoto, Steven L., *The Elements of Artificial Intelligence*, Computer Science Press, 1990.

Tate, Austin, "Generating Project Networks," *Fifth International Joint Conference on Artificial Intelligence*, Cambridge, MA, 1977.

Tenenbaum, Jay M., and Harry G. Barrow, "Experiments in Interpretation-Guided Segmentation," *Artificial Intelligence*, vol. 8, no. 3, 1977.

Terzopoulos, D., A. P. Witkin and M. Kass, "Constraints on Deformable Models: Recovering Three-Dimensional Shape and Nonrigid Motion," *Artificial Intelligence*, vol. 36, 1988.

Terzopoulos, Demetri, "The Computation of Visible-Surface Representations," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1983.

Tesauro, G. and T.J. Sejnowski, "A Parallel Network that Learns to Play Backgammon," *Artificial Intelligence*, vol. 39, 1989.

Thorne, J., P. Bratley, and H. Dewar, "The Syntactic Analysis of English by Machine," in *Machine Intelligence 3*, edited by Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1968.

Touretzky, David S., "BoltzCONS: Dynamic Symbol Structures in a Connectionist Network," *Artificial Intelligence*, vol. 46, 1990.

Tversky, Amos, "Features of Similarity," *Psychological Review*, vol. 84, no. 4, 1977.

Ullman, Shimon and Ronen Basri, "Recognition by Linear Combinations of Models," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 13, no. 10, 1991.

Ullman, Shimon and Ronen Basri, "Recognition by Linear Combinations of Models," Report AIM-1152, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1989.

Ullman, Shimon, *The Interpretation of Visual Motion*, MIT Press, Cambridge, MA, 1979. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1977.

Ulrich, Karl T., "Computation and Pre-Parametric Design," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1988.

VanLehn, Kurt Alan, "Felicity Conditions for Human Skill Acquisition: Validating an AI-based Theory," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1983.

VanLehn, Kurt, "Learning One Subprocedure per Lesson," *Artificial Intelligence*, vol. 31, 1987.

Vere, Steven A., "Relational Production Systems," *Artificial Intelligence*, vol. 8, no. 1, 1977.

Waltz, David, "Natural Language Access to a Large Data Base: An Engineering Approach," *Fourth International Joint Conference on Artificial Intelligence*, Tbilisi, Georgia, USSR, 1975.

Waltz, David, "Understanding Line Drawings of Scenes with Shadows," in *Psychology of Computer Vision*, edited by Patrick H. Winston, MIT Press, Cambridge, MA, 1975. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1972.

Waters, Richard C., "The Programmer's Apprentice: Knowledge Based Program Editing," *IEEE Transactions on Software Engineering*, vol. SE-8, no. 1, 1982.

Watson, James D., Nancy H. Hopkins, Jeffrey W. Roberts, Joan Argetsinger Steitz, and Alan M. Weiner, *Molecular Biology of the Gene* (fourth edition), Benjamin/Cummings Publishing Company, Menlo Park, CA, 1987.

Webb, Jon A., and J. K. Aggarwal, "Structure from Motion of Rigid and Jointed Objects," *Artificial Intelligence*, vol. 19, no. 1, 1982.

Webber, Bonnie L., "So What Can We Talk about Now," in *Computational Models of Discourse*, edited by J. Michael Brady and Robert C. Berwick, MIT Press, Cambridge, MA, 1983.

Weiss, Solomon M., Casimir A. Kulikowski and Saul Amarel, "A Model-Based Method for Computer-Aided Medical Decision-Making," *Artificial Intelligence*, vol. 11, 1978.

Weizenbaum, Joseph, *Computer Power and Human Reason*, W. H. Freeman, San Francisco, CA, 1976.

Weld, Daniel S., "Exaggeration," *Artificial Intelligence*, vol. 43, 1990.

Weld, Daniel S., "The Use of Aggregation in Causal Simulation," *Artificial Intelligence*, vol. 30, 1986.

Weld, Daniel S., "Comparative Analysis," *Artificial Intelligence*, vol. 36, 1988.

Weyhrauch Richard W., "Prolegomena to a Theory of Mechanized Formal Reasoning," *Artificial Intelligence*, vol. 13, 1980.

White, Barbara Y. and John R. Frederiksen, "Causal Model Progressions as a Foundation for Intelligent Learning Environments," *Artificial Intelligence*, vol. 42, 1990.

Wilks, Yorick A., *Grammar, Meaning, and the Machine Analysis of Language*, Routledge and Kegan Paul, London, 1972.

Wilks, Yorick, and Eugene Charniak, *Computational Semantics*, North-Holland, Amsterdam, 1976.

Wilks, Yorick, "A Preferential, Pattern-Seeking, Semantics for Natural Language Inference," *Artificial Intelligence*, vol. 6, 1975.

Wilks, Yorick, "Making Preferences More Active," *Artificial Intelligence*, vol. 11, 1978.

Williams, Brian C., "Qualitative Analysis of MOS Circuits," *Artificial Intelligence*, vol. 24, 1984.

Winograd, Terry, "Extended Inference Modes in Reasoning by Computer Systems," *Artificial Intelligence*, vol. 13, 1980.

Winograd, Terry, "Towards a Procedural Understanding of Semantics," *Revue Internationale de Philosophie*, vol. 3, 1976.

Winograd, Terry, *Understanding Natural Language*, Academic Press, New York, 1972. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1971.

Winograd, Terry, *Language as a Cognitive Process, Volume I: Syntax*, Addison-Wesley, Reading, MA, 1983.

Winograd, Terry, "Frame Representations and the Declarative/Procedural Controversy," in *Representation and Understanding*, edited by Daniel G. Bobrow and Allan Collins, Academic Press, New York, 1975.

Winston, Patrick H. and Sarah Alexandra Shellard, *Artificial Intelligence at MIT: Expanding Frontiers* (Two Volumes), MIT Press, Cambridge, MA, 1990.

Winston, Patrick H. and Satyajit Rao, "Repairing Learned Knowledge Using Experience," in *Artificial Intelligence at MIT: Expanding Frontiers (Two Volumes)*, edited by Patrick H. Winston and Sarah Alexandra Shellard, MIT Press, Cambridge, MA, 1990.

Winston, Patrick Henry (editor), *The Psychology of Computer Vision*, McGraw-Hill, New York, 1975.

Winston, Patrick Henry and Richard Henry Brown (editors), *Artificial Intelligence: An MIT Perspective* (Two Volumes), MIT Press, Cambridge, MA, 1979.

Winston, Patrick Henry, and Berthold K. P. Horn, LISP, Third Edition, Addison-Wesley, Reading, MA, 1989.

Winston, Patrick Henry, and Karen A. Prendergast (editors), *The AI Business: The Commercial Uses of Artificial Intelligence*, MIT Press, Cambridge, MA, 1984.

Winston, Patrick Henry, Thomas O. Binford, Boris Katz, and Michael R. Lowry, "Learning Physical Descriptions from Functional Definitions, Examples, and Precedents," *Proceedings of the National Conference on Artificial Intelligence, Washington, D. C.*, 1983.

Winston, Patrick Henry, "Learning by Creating and Justifying Transfer Frames," *Artificial Intelligence*, vol. 10, no. 2, 1978.

Winston, Patrick Henry, "Learning and Reasoning by Analogy," *Communications of the ACM*, vol. 23, no. 12, 1980.

Winston, Patrick Henry, "Learning New Principles from Precedents and Exercises," *Artificial Intelligence*, vol. 19, no. 3, 1982.

Winston, Patrick Henry, "Learning Structural Descriptions from Examples," in *Psychology of Computer Vision*, edited by Patrick H. Winston, MIT Press, Cambridge, MA, 1975. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1970.

Winston, Patrick Henry, "Learning by Augmenting Rules and Accumulating Censors," Report AIM-678, Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA, 1982.

Winston, Patrick Henry, "The MIT Robot," in *Machine Intelligence 7*, edited by Bernard Meltzer and Donald Michie, Edinburgh University Press, Edinburgh, Scotland, 1972.

Witkin, Andy, "Scale-Space Filtering," *Eighth International Joint Conference on Artificial Intelligence*, Karlsruhe, Germany, 1983.

Woodham, Robert J., "Analysing Images of Curved Surfaces," *Artificial Intelligence*, vol. 17, 1981. Based on a PhD thesis, Massachusetts Institute of Technology, Cambridge, MA, 1978.

Woods, William A., and Ronald M. Kaplan, "The Lunar Sciences Natural Language Information System," Report 2265, Bolt, Beranek and Newman, Cambridge, MA, 1971.

Woods, William A., "Transition Network Grammars for Natural Language Analysis," *Communications of the ACM*, vol. 13, no. 10, 1970.

Woods, William A., "What's in a Link?," in *Representation and Understanding*, edited by Daniel G. Bobrow and Allan Collins, Academic Press, New York, 1975.

Yip, Kenneth Man-kam, "KAM: Automatic Planning and Interpretation of Numerical Experiments Using Geometrical Methods," PhD Thesis, Department of Electrical Engineering & Computer Science, Massachusetts Institute of Technology, Cambridge, MA, 1989.

Zucker, Steven W., Azriel Rosenfeld, and Larry S. Davis, "General Purpose Models: Expectations About the Unexpected," *Fourth International Joint Conference on Artificial Intelligence*, Tbilisi, Georgia, USSR, 1975.

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