REVIEWERS WANTED

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The Mental Representation of Grammatical Relations, *Joan Bresnan*, Editor, MIT Press.

Issues in the Implementation of Digital Feedback Compensators *Paul Moroney*, MIT Press.

Computational Models of Discourse, *Michael Brad[illegible]ed Robert C. Benawick*, Editors, MIT Press.

Robot Motion, Planning and Control, *Michael Brady, John M. Hollerbach, Timothy L. Johnson, Thomas Lozano-Perez, and Matthew T. Mason*, Editors, MIT Press.

Computer Vision *Dana Bolland and Christopher Brown*, Prentice-hall.

Machine Perception, *Ramakant Nevatia*, Prentice-Hall.

Introductory Readings in Expert Systems, *Donald Michie*, Editor, Gordon and Breach Science Publishers.

Approches Formalles de la Semantique Naturelle, *Andre Borillo, Mario Borillo, Luis Farinas del Cerro and Jacques Virbel*, Editors, (mostly in French).

BOOK REVIEWS

Artificial Intelligence: An MIT Perspective, Volume 2: Understanding Vision, Manipulation, Computer Design, Symbol Manipulation

Edited by Patrick Henry Winston and Richard Henry Brown, The MIT Press, Cambridge, Massachusetts, Second printing, 1980, 486 pages, $25, ISBN 0-262-23097-6, also available in soft cover.

Reviewed by:

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Artificial Intelligence: An MIT Perspective consists of two volumes. In my previous review of Volume 1 (which has sections on Expert Problem Solving, Natural Language Understanding, Intelligent Computer Coaches, and Representation and Learning) I evaluated this set from a general perspective. For brevity, I will not repeat my comments here. Instead, I refer the reader who has not seen the first part of this article to the preceding issue of the Sigart Newsletter. Nevertheless, for the anxious reader I present my point of view concisely: These two volumes make up an excellent set of references and belong to the library of every serious AI researcher.

Although the title of Volume 2 suggests four sections, the book itself is divided into three major parts: Understanding Vision, Manipulation and Productivity Technology, and Computer Design and Symbol Manipulation. In the remainder of this review I will give a synopsis of each paper in Volume 2.

Section I: Understanding Vision consists of six articles. The first three of those pursue the research direction led by late D. Marr. Marr's work attempts to understand vision in the context of biological systems. The rest of the articles in this section concentrate on B.K.P. Horn's research which is motivated by a need to understand how light is reflected from surfaces.

- D. Marr opens this section with this paper "Representing and Computer Visual Information." In this article (which is nearly 60 pages) Marr surveys work in vision from a perspect ive which attaches to the representation problems greater importance. An overall framework suggests the use of three levels of representation: the primal sketch, the 2 1/2-D sketch, and the 3-D model. This paper appeared as "Representing Visual Systems" in Lectures on Mathematics in the Life Sciences published by American Mathematical Society (1978).
- In "Visual Detection of Light Sources," S. Ullman gives an interesting example of using Marr's approach. He studies the light source detection problem and presents a method which accomplishes it in the Mondrian world. His method is based on comparing changes in intensity and changes in derivative of intensity at region boundaries. This work can also be found in Biological Cybernetics (1976) and Ullman's MIT Ph.D. thesis, "The Interpretatior [illegible]isual Motion," published by the MIT Press (1979).
- "Representing and Analyzing Surface Orientation," by K.A. Stevens applies Marr's methodology to the surface orientation problem. Stevens studies the problem of inferring surface orientation from a single image of lines by making assumptions about the nature of surfaces under consideration. This work is reported in his MIT Ph.D. thesis, "Analysis and Representation of Visual Surface Orientation" (1978).
- The fourth paper of this section is "Registering Real Images Using Synthetic Images" by B.K.P. Horn and B.L. Bachman. Here, Horn and Bachman propose a method for accurately aligning images with surface models. Their method matches the real image with a synthetic one generated using a terrain model and a gradient-space representation of light reflectance This paper appeared in Communications of the ACM (1978).
- "Analyzing Curved Surfaces Using Reflectance Map Techniques" is an overview by R. Woodham of his MIT Ph.D. thesis (1978). In this paper, Woodham develops the reflectance map method and a novel technique called photometric stereo. Using these tools, enough information is provided to determine surface orientation at each pixel.
- The last paper of this section, "Analysis of Scenes from a Moving Viewpoint," is by M.A. Lavin. It shows how one can use a series of snapshots of terrain to make a map and to discover position. Some heuristic matching problems are solved by a program called DYNAVU. This work is from Lavin's MIT Ph.D. thesis (1977).

Section II: Manipulation and Productivity Technology concentrates on designing robots with an understanding of manipulation. These robots should be programmed in a language that is strong on problem solving and sufficiently general for the programmer to dictate what is required in a comfortable (non-procedural) manner.

- H. Inoue's "Force Feedback in Precise Assembly Tasks" discusses the use of force feedback to adjust initial positioning of assembly parts to be mated. Since robot arms are usually clumsy mechanical devices with quite poor accuracy, one should solve this problem within some fudge factor.
- In "A Language for Automatic Mechanical Assembly," T. Lozano-Perez investigates model-based programming in robotics. In a model-based programming environment, a user instructs robots in terms of very high-level commands. Lozano-Perez describes such a sophisticated language (LAMA). This paper appeared in Proceedings of the Fifth International Joint Conference on Artificial Intelligence (1977) and as a part of Lozano-Perez's MIT MS thesis (1976).
- The third paper of this section is "Kinematics, Statics, and Dynamics of Two-Dimensional Manipulators," by B.K.P. Horn. In this article, Horn offers a sample analytic study of a simple multi-joint manipulator in 2-D. Such an analysis provides an understanding of simple systems and paves the way for controlling realistic manipulators.
- In the last paper of this section, J. Hollerbach communicates the results of a study on "Understanding Manipulator Control by Synthesizing Human Handwriting." He makes some assumptions about understanding human motor control (particularly handwriting) and implements them as a program for a human-like manipulator.

Section III: Computer Design and Symbol Manipulation reviews two central subjects of AI, namely, computers and programs. First three papers describe the development and underlying ideas of the LISP machine, a powerful AI computer. The second subject of this section (described in the last two papers) is programming in general.

- "The LISP Machine" by A. Bawden, R. Greenblatt, J. Holloway, T. Knight, D. Moon, and D. Weinreb describes a versatile AI machine which combines a large address space, hardware data types, real-time garbage collection, etc. to compose a satisfying processor. The authors detail the computer's architecture and organization and report some tests carried out with the prototype.
- In "Shallow Binding in LISP 1.5," H.G. Baker, Jr. presents a method which embodies continuous control over the trade-off between access time and context switching time. This paper appeared in Communications of the AcM (1978).
- H.G. Baker, Jr.'s second paper is about "Optimizing Allocation and Garbage Collection of Spaces." In it, Baker formulates a technique to determine in what ratios the memory should be allocated to minimize garbage collection overhead.
- G.L. Steele, Jr.'s "Compiler Optimization Based on Viewing Lambda as Rename Plus Goto" presents a compiler for the lexically-scoped dialect of LISP called SCHEME. A macros approach and a small number of effective optimization techniques help speed speed up the execution of generated code. The compiler does not know much about specific data handling primitives such as operators, yet concentrates on general problems of environment and control.
- The last paper of this section (and Volume 2) is "Control Structures as Patterns of Passing Messages," by C. Hewitt. In this work of Hewitt, the ability to synthesize control structures as passing messages among the objects is modeled. Hewitt's approach is also applicable to modeling intelligence in terms of communicating knowledge-based problems-solvers (experts). This paper appeared in Artificial Intelligence (1977).

MACHINE INTELLIGENCE AND RELATED TOPICS: AN INFORMATION SCIENTIST'S WEEKEND BOOK

by Donald Michie
Gordon & Breach,
Science Publishers, Inc.
ISBN 0-677-05560-9
1982

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Machine Intelligence is a collection of articles that Donald Michie has published in various, sometimes obscure, places over the years and which he thought would make an entertaining, informative anthology for the information scientist.

The anthology contains a preamble (believe it or not) and 27 articles whose original publication dates ranges from 1966 through 1981. The articles cover topics from a moderately technical tutorial on heuristic search to a Thurber-style spoof on the trials and tragedies in the life of a researcher (Michie provides a formula to compensate for the effects of Murphy's law when planning an experiment). The length of the articles in the anthology varies from two pages to about 30 pages. There is no unifying them to these articles except that: 1) they are related to machine intelligence, 2) Donald Michie wrote them, and 3) they are informative and entertaining.

There are, however, a few recurrent topics in the book, one of which concerns the history of computing in Britain. Michie provides commentary on the exciting period of World War II and post-war British computer science, Turing's role in it, and finally on Michie's own dissatisfaction with the British granting policies of the early-to-mid 1970's. The history is interesting. The commentary on British granting policies is a barely concealed diatribe against those agencies for cutting back his own research funding.