Book Reviews

De MEY, Marc: The Cognitive Paradigm. Cognitive science. A newly explored approach to the study of cognition applied in an analysis of science and scientific knowledge. Dordrecht, Boston: R. Reidel Publ. Co. 1982. 314 p., 482 refs. Hfl. 100,–. US $ 43.50. Sociology of Sciences Monographs. ISBN 90-277-1382-0.

Marc De Mey has been successful in his attempt to establish a synthesis of various scientific tendencies in different disciplines and specialties. In this book, he summarizes these tendencies with the name "cognitive view". As a result, the sense and meaning of what is called cognition, cognitive theory or cognitive paradigm does not stem from the listing and combining of various definitions, but moreover from the performance and the way he develops his ideas in his book. Althogether his ideas contribute to the enlightenment of the following problems: what is knowledge and science, how do they both develop or evolve, and in which way do they function as information processing. It is just the latter aspect, that constitutes the connection to the research in artificial intelligence (AI) and thus a network is built-up that combines both the growing importance of a cognitive pradigm in the development of science and the invention of the first intelligent tool – the computer.

This connection marks the central point of the book. It becomes obvious, from the author's use of a systematic framework in writing the book, which is taken from experiences made in the development of AI. This systematic framework stems from MICHIE, who had looked at the development in AI as having happened in four stages.

1) A monadic stage deals with the collecting and handling of elements, which are regarded separately and independently of each other, as if each were single, selft-contained entities. Examples from AI research, are the template matching as a technique for pattern recognition and word-to-word translation in mechanical translation.
2) A structural stage deals with the perception and discrimination of more holistic and complex structures defining relation among several units. Feature analysis and syntactical analysis are (the corresponding) examples from pattern recognition and mechanical translation, respectively.
3) A contextual stage deals with the examination of context environment, in which structures emerge and by this gain definition and where structures vice versa indicate context. Examples from AI research are context analysis in pattern recognition and indexical expressions in language processing.
4) A cognitive stage deals with world views and world models that regulate the relationship between structure and environment in various respects. From a subjective viewpoint, they direct in selection of the context, that is only indicated in the specific structure. From an objective viewpoint, world models guarantee the asymmetric relation of figure-ground segmentation between structure and environment and constitute the inner-outer-difference. These world models have a task or problem-oriented nature and transcend the traditionally strict difference between subject and object. The corresponding examples are analysis by synthesis in picture processing and the role of world models in language processing.

Having introduced this systematic and fundamental framework at the beginning of the *first part* of the book, the author shows how the four stages can be transferred to the history of empirical sciences and to their specific theory of science (Metatheory). In this transfer, the monadic stage corresponds to Positivism (MACH, PEARSON); the structural stage correspondends to logical Positivism or Empirism (CARNAP); the contextual stage to the science of science (MERTON, MASLOW, FAIRBANK, PIAGET); and the cognitive stage corresponds to cognitive theories of paradigm theories. In this interpretation, the continuity and discontinuity of historical development is presented with a high level of plausibility. Thereby, the ambiquity of cognitive paradigm becomes obvious. As a result of this development, the cognitive paradigm is the subject of consideration. But at the same time, it also marks the viewpoint of the consideration in the four-stages-model. This circle implicitly exposes the cognitive view in a paradigmatic way, as explicitly described in the third part of the book. It is there, that AI research and psychology of attention and perception are connected in terms of a circular procedure, i.e. problem- and puzzle-solving, and debugging.

In the *second part* of the book, the circularity of cognition is revealed in another way, by considering the social components and structures of science. With the help of bibliometric studies, the author illustrates the self-referential basis of informal groups of scientists. In selecting the theoretical concept of a network in order to describe the social structures, he confirms the cognitive viewpoint in this part of the book, as well. Although the concept of a network is not explicitly unfolded thematically, it needs to be considered as the theoretical complement of the paradigmatic view. As far as the cognitive view accounts with the multiplicity of world models as a factor of its own constitution, the connection of this multiplicity cannot exist in ONE system, but only in a loosely coupled network that is functionally centered and condensed in cores. A core should be understood as a metaphorical expression of paradigm. As this point, it would have been appropriate to dispute controversially and systematically the theories of social systems (PARSONS, LUHMANN). This would have helped to clarify the meaning of cognitive paradigm. The connection, that the author has traced out, would have enabled a problem-oriented discussion. The connection of paradigm and network, and of the controversy between network theory and system theory would have also helped to elaborate the concept of a cognitive evolution more strictly and with greater plausibility. For the character of evolution as a characteristic aspect of cognition pervades the book, as well. At the end of the second part, it is discussed as life cycle of scientific speciality and interpreted in analogy to the four-stages-model.

The *third part* of the book presents the procedure of problem-solving, that is of a network-like nature with an example of the psychology of attention and perception. The expert-model – taken again from AI research – functions as the paradigm of the study. If the set of characters is not adequately decoded to one level of view (analogous to the four stages), the problem is delivered to another procedure which uses another level. Each level has a corresponding expert automaton which is only able to solve the problem of this level. The final

solution results from the interaction among the experts. Thereby, it is unimportant whetber the method which is employed to solve the problem goes forward from the elements to the models or whether vice versa, or whether it is circular interaction. In any case, the problem-solving can be looked at as a dynamic path through a network, whose knots (cores) are the expert subsystems. In general, the problem-solving follows the rules of a cognitive structure, whose main law consists in the arbitrary change of the system-subsystem-relation. Thus in cognition, the feature analysis (structural stage) can be a subsystem of template matching (monadic stage), and furthermore, template matching can be a subsystem of the analysis by synthesis (cognitive stage). In this way, a circular paradox network of inherences appears as the law of the dynamics in which the expert systems interact. That means, the subsystem that has just been subordinated can be the higher system in the following step of the problem-solving procedure. It is easy to see, that this law represents Russel's antinomy of the set which contains itself as an element, although the stage structure is implemented in a type-theoretical manner.

Marc De Mey did not realize this phenomenon. I do not want to say, that he gets entangled in contradictions, but he missed the chance to make use of this main figure of cognition that contradicts all formal logic for a theory of dynamics. For, the inherence of "all in all" forces unfolding, that is a process creating situativly the formation of a hierarchy, that is of a problem-oriented, unstable nature. The hierarchy has to be unstable enough to collapse at any time, in order to give way to a new unfolding process. Instability on the one side and heterarchical control on the other side are thus the main features of cognition. This is what Piaget – still being caught in the idea of a harmonical equilibration – called mobility.

Therefore, the reader is not surprised to see De Mey referring to Piaget in the last chapter of his book, in order to explain the dynamics of cognition. This reference certainly points in the right direction, for it is unquestionable, that Piaget's genetic psychology has to be understood as a decisive attempt to grasp theoretically the nature of the process in which thinking and knowledge develops. For this purpose, however, neither the concept of scheme nor the concepts of mental balance in scheme, that is achieved in the course of the development, is appropriate. For, the former is a far too static concept and the latter in being a teleological concept submits a harmonizing tendency. Harmony denotes the state of rest of intelligence, that means the stage in which intelligence is exhausted on its path through the world. Piaget being highly sensitive to the cognition demands the mobility of a scheme even if he does not give reason for it.

However, this concept too is not able to grasp theoretically the dynamics of intelligence. It only marks the basic restlessness, that becomes dynamic in the case of quantitative supercomplexity in one stage, in order to perform "Superzeichen" and thus to emerge on a higher level of quality, for example from the monadic stage to the structural stage, for example from alphabet to meaning and thus cognition goes on to reduce complexity. Instability results from the overstrain and forms the actual motor of development. This theoretical state of affairs – that I could only outline briefly – has not been seen by DE MEY und thus constitutes the main weakness of the book. Inspite of the sensitivity for the problem and the historical and interdisciplinary context he presents, De Mey has not been able to transform his feeling for right position into a systematical discussion in order to lead to an appropriate solution. This is deplorable, for it throws the high quality of the book into the shade. This quality consists of the author's ability to bring together various ideas and thus provides a basis for a reformulation of a cognitive theory. I have enjoyed reading De Mey's book very much and have recommended it to my friends.

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RICHARDSON, Jacques (Ed.): **Models of Reality: Shaping Thought and Action.** Mt. Airy, MD: Lomond Publ., Inc. (P.O. Box 88) 1984. 328 p., ISBN 0-912338-35-0. US $ 22.95 (Microfiche ed. $ 15.00. ISBN 0-912338-36-9)

This book with its 21 contributions in two parts covers a rather wide range of a both comprising and intricate subject. Such an undertaking, however meritful in itself, has to meet inherent requirements, e.g. in structuring the material as to facilitate an overview and to show, what has been included, why so, and what has been left out. Accepting the title as a sufficient attempt, the volume presents several informative articles, that is, critical approaches for the expert as well as well written descriptions on familiar subjects to further the understanding of a larger public. Especially for the latter one, parts I and II distinguish between 'Concept' and 'Application'.

But what is a model? What is it designed and what is it applied for? The Earth as a System (ch. 2) proves an excellent example of the systems approach in general, stressing the relationships between man, ecology and, most importantly, policy making as derived from the world wide problems of preservation and evolvement. Though pointing out the main factors of modeling the introductory chapter 'A Primer of Model Systems' falls short of expectation. The tables on model systems and forecasting scenarious do not, in the reviewers opinion, make up for the lack of vivid and systemized, graph supported basic information on the nature of models and for what they are meant to serve. Granted that this is a nearly impossible task: a more thorough attempt would facilitate insight into the meaning of the twenty one mosaic chapters as a coherent body. Thus it could better contribute, in addition, 'to bridge . . . awareness of the nature of models . . . for a better understanding of the complex world . . .' (Publishers foreword p. iii) and, it might be added, for a globally responsible problem solving.

Measured by this yardstick the chapters 6 to 8 contribute excellently ro critical insight into modeling as a tool: that is for analysis, responsible choice and sophisticated, long-term, sensible implementation of human problem solving. The outline of 'Interactive Modeling Systems for Complex Socio-Economic Problems' (ch. 6)