

## Reviews

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Maria NOWAKOWSKA  
**Quantitative Psychology: Some Chosen Problems  
 and New Ideas**  
 North-Holland, Amsterdam, 1983.

I am apprehensive of thick books. This book is very thick – almost a thousand pages – and I would be paltering if I said that I studied it from cover to cover. However, getting ahead of my analysis, I must say that this is a good book, and everyone working on producing formal methods in psychology should become acquainted with it.

The *first chapter* is devoted to the contemporary theories of psychological tests. The author discusses there the main methodological problems of psychological tests as well as the statistical concepts underlying them. Special attention is given to Gulliksen's axiom theory and the generation of so-called 'true scores.' The importance of this chapter lies in its thorough analysis of the type of information that can be obtained with the help of test methods. In addition, Nowakowska outlined possible revisions of test theories by changing the interpretation of the concept of trait.

In the *second chapter* the author presents a model based on factor analysis as a technique to process multivariate data and compare it with an alternative model based on multidimensional scaling. The most interesting part of this chapter concerns the application of factor analysis to Cattell's Personality Theory and a demonstration of the cognitive limitations of statistical approaches in the construction and measurement of complex descriptions.

The *third chapter* deals with the problems of constructing questionnaires. I am not an expert in this area and looked through this chapter quite briefly. I would like to mention only the unexpected results obtained by Maria Nowakowska concerning the 'measurement of the degree of

fuzziness of a concept' which provide empirical access to Zadeh's theory.

The *fourth chapter* also presents only original results. The author describes there a circle of problems connected with knowledge representations. She calls this area 'formal semiotics' and singles out three domains: (i) the domain of objects, (ii) the domain of sign, and (iii) the domain of meaning. To the reader the basis of the theory is readily apparent. Nowakowska develops Peirce's approach and introduces there an 'observer' who serves as a special 'agent' between sign and meaning. She assumes that several mechanisms participate in the perception process and constructs a model of perception.

In the *fifth chapter* the author describes her approach to measurement theory. She covers the paradoxes of utility theory (including risk behavior) and discusses the problems of objective and subjective time and memory, which is a theoretical novelty in measurement theory and might be of a special importance for heuristic programming. The chapter includes a section on scaling with descriptions of three types of scaling technique illustrated by the author's own experiments. And the most interesting part of this chapter concerns the problem of applications of measurement theory in linguistics, especially in the analysis of metaphors.

The book closes with the formal theory of actions (*sixth chapter*). Nowakowska proposes an original schema of human actions, the main idea of which is to establish an analogy between action and language. Just as a text can be broken down into separate sentences and then separate words, a human action can be broken down into elementary actions. Of course, one meets here certain difficulties related to the loss of 'integrated meaning' due to the breakdown of the entity into its components. But the author realizes this problem and introduces several new concepts which enable her to overcome these difficulties. She considers an extremely large range of problems: from the single action of a single person to the actions of a group, to the social communication network of a society.

The most attractive aspect of Nowakowska's book seems to me to be her independence from numerous demarcation lines dividing the field of American science. She feels free to ignore these artificial borders and offers an integrated picture by using various traditional and non-traditional methods for representing and studying human activity.

Vladimir A. LEFEBVRE  
*School of Social Sciences*  
*University of California*  
*Irvine, CA 92717, USA*

DOUGLAS R. HOFSTADTER  
**Metamagical Themas: Questing for the Essence of Mind and Pattern**  
 Bantam Books, New York, Softcover edition, June 1986, 852 pages.

For the most part, this thick collection represents separate articles which the author published over the years in a column of the same name in *Scientific American*. It is made up of thirty-three chapters which have been grouped into seven different sections. As in his previous major works (*The Mind's I: Fantasies and Reflections on Self and Soul*, written with D.C. Dennett, New York Basic Books, 1981 and *Gödel, Escher, Bach: An Eternal Golden Braid*, New York, Basic Books, 1979) Hofstadter covers a great deal of territory. The present reviewer will endeavor to give the reader an idea of some of the main themes of the book without pretending to be all-encompassing. Reading this book can be an exciting learning experience, but it must be approached gingerly. Hofstadter is obviously very involved with discovering the nature of formal patterns and their organizations and relationships to the mind, in particular as they are found in music and in language. He says to be fascinated by the possibility of a 'magical formula behind it all', one which will help him understand the mysteries behind musical and visual beauty.

The concept of 'meta' as found in the title seems to be popular at this time given that several authors including the undersigned have used it in their titles (see: H.I. Thorsheim, *Metaperspectives:*

*Systems Approach and Its Vision*, Intersystems Publications, Seaside, CA, 1985; and J.P. van Gigch, Ed., *Decision Making About Decision Making: Metamodels and Metasystems*, Abacus, Tunbridge Wells, 1986). The reason is obvious: we must pay more attention to the epistemological foundations of our sciences in order to be in a position to understand the nature of the paradigmatic changes to which they are subjected. As an example, Computer Science, Management Information Systems and Artificial Intelligence are at their infancy and we are still in search of a paradigm for these sciences (see for instance, John P. van Gigch and L.L. Pipino, 'In Search of a Paradigm for the Discipline of Information Systems', *Int. J. Future Computing Systems* 1 (1) (1986), where this issue is debated).

As in his previous opus, Gödel's famous Incompleteness Theorem plays an important role in Hofstadter's world view. He uses it in connection with many 'Themas'. He refers to it when, discussing self-referential sentences and shows how Gödel avoided falling in the paradox trap. As Hofstadter notes: 'Gödel's Theorem [while not paradoxical], constitutes a hair-raisingly close approach to [a paradox]. It turns out to be true, and for this reason, it is unprovable in the given axiomatic system':

'The revelation of Gödel's work is that in *any* powerful and consistent axiomatic system, an endless series of true but unprovable formulas can be constructed by the technique of self-reference, revealing that somehow the full power of human mathematical reasoning eludes capture in the cage of rigor' (p. 8).

On the subject of creativity, Hofstadter discusses how people, and by extension machines, can take innovative leaps which can qualify as being 'intelligent'. We all have the ability to detect the sameness of patterns and, conversely, the ability to break out of loops, that which is the antithesis of the mechanical. Thus, it is this natural endowment 'to watch oneself as one deals with the world, to perceive in one's own activities a pattern and to be able to do so at many levels of abstraction' which spells the root of creativity. However, this human endowment must never be conceived as being 'perfect', in the sense that one could never be in a position to conceive either a mind or a computer program which could detect all loops without failing. This assertion is grounded

in the fact that we are unable to build a perfect artificial intelligence. Furthermore, as Hofstadter does not cease to remind us, such perfection is not in the realm of the possible as the metamathematical work of Kurt Gödel proved it. While respecting the awesome capability of the machine, Hofstadter is in the camp of those who believe that 'no machine could ever be conscious in the way that humans are' (p. 536). To make his point he quotes the English philosopher J.R. Lucas:

'(...) The paradoxes of consciousness arise because a conscious being can be aware of itself, as well as other things, and yet cannot really be construed as being divisible into parts. It means that a conscious being can deal with Gödelian questions in a way in which a machine cannot, because a conscious being can both consider itself and its performance and yet not be other than that which did the performance (...).'

Whereas we would like to think that our language and our logic are nicely organized according to clearly distinguishable levels of abstraction, Hofstadter dispels this notion rather facetiously by noting that metaknowledge is not some sort of 'extra layer added on top [of knowledge] by a second-generation programmer who decided that metaknowledge is a good thing, over and above knowledge!' 'No, metaknowledge and knowledge', Hofstadter tells us, '*are simmering together in a single stew, totally fused and flavoring each other richly*' (p. 538) (emphasis added by the reviewer).

Does this mean that Kuhn's distinct worlds of ordinary and extraordinary (creative) science are also, we wonder, 'simmering together in a single stew'? If this were the case, Kuhn's entire explanation of how scientific revolutions occur would need to be revised... Hofstadter concludes his incursion in the world of creativity by extending his views of the fallibility of the human mind to the quest of truth. From Gödel to Niels Bohr and from Quantum Mechanics to the Complementarity Concept, without forgetting Heisenberg's Uncertainty Principle, all scientific evidence leads to the admission that 'yes, all intelligences are indeed vulnerable' (p. 546). There is no point then to be searching for 'absolute' truth, 'perfect' beauty, or the 'complete' solution of a problem. No such feat is possible. We must grapple with the imperfection of the mind as we attempt to find closure to our constant search for answers. That truth, beauty and irrationality are so often linked may indeed be one of Hofstadter's most categorical statements and one which carries the heaviest consequences (p. 540). It may serve to explain, although not to

justify, our inability, as human beings, to cope with complexity and the world of technology that surrounds us. It may be a sad but realistic comment that may give us all pose to reflect, as we witness how our systems fail. Is it that our individual and collective intelligence is not well organized or well managed, or is there an inherent Gödelian curse that will always prevent us from reaching a 'satisfactory' solution? As with all other questions, the answer to this one will also have to remain unanswered. Such is the fate of modern science and the conclusion to which the epistemologists have arrived at. We recall that Max Delbrück (*Mind From Matter? An Essay on Evolutionary Epistemology*, Blackwell, Palo Alto and Oxford, 1986) whose work we reviewed in a recent issue of *HSM* (see *HSM* 6(2) (1986) 189–190) reached conclusions about the inadequacy of our versions of reality which are similar to Hofstadter's.

It would take a very long review to discuss the richness of Hofstadter's work. We will limit ourselves to refer to his own review of Andrew Hodges' book *Alan Turing: The Enigma* (Simon and Schuster, New York, 1983) to which he devotes an entire chapter of the book. Hofstadter proceeds to place Turing's work in the context of that of other workers in the field such as Hilbert, Gödel, of course, Russell and others. We are taken by the chronicle of Turing's poignant life and dismayed at the turn of events that led to the suicide of such a brilliant mind. It is certainly a sad reflection of the legal system under which he had to live and an ever present reminder of the very imperfection of the norms by which society asks 'the most talented among the talented' to abide, regardless of their human frailties. Society may cease to be so intolerant, once it realizes that, as Hofstadter so well brings out in his book, perfection, whether in science or in law, is an impossibility. Thus, to judge impassively as if we had the omnipotence of God is not only arrogant but ignorant. The descendants of Gödel and of Hofstadter should know better by now! We conclude by commending this book to our readers and noting that the author has included a very rich bibliography, which in itself, is worth the price of the book.

John P. van GIGCH  
 School of Business and Public Administration  
 California State University  
 Sacramento, CA 95819, USA