Models of Thought, Volume II *by Herbert Simon*
(Yale University Press, New Haven and London, 1989) pp.xviii + 508, ISBN 0-300-04230-2.

How do people think, learn and remember? This has fascinated the ancient Greeks and philosophers, psychologists, and countless other people including scientists, writers, mnemonists, and teachers of all kinds.

Simon's book is an important compendium of 30 papers from one of the world's leading figures in this field, and consists of most of his published papers in psychology since 1976 together with a specially written introduction to each section. Ten years earlier at the "solemn age of sixty" Simon thought he had come to the end of his work, but he and the world are both lucky that his good health continued, together with his being "unable to stay away from the many exciting research questions that cry for attention in cognitive psychology today". Those lucky enough to manage time to read this work will be well rewarded.

The papers, mostly with co-authors, are in seven groups — system principles, memory structures (models and not physical ones), learning processes, problem solving, rules and concepts, perception, and (the most difficult and least satisfactory) understanding. Threaded through the text is discussion on the nature of science and proof.

Orthodoxy, behaviourism, Gestalt, and connectionism are rebuked, gently: "Schools are for fish, not scientists". Much of the text is defence of his EPAM model (Elementary Perceiver and Memorizer) devised with Newell, though he wants to retain some classical Gestalt terms with modified meanings (unacceptable to the orthodox) to save proliferation of new terms.

His experiments have been ingenious, often using two aspects of language in parallel. Subjects who are fluent in French and English do not remember in what language they were told something. In the mind there is an underlying meaning, a semantic structure like Chomsky's deep structure. Such meanings are remembered when the exact words are lost.

The concept of the Magic Number Seven, the number of chunks (aggregates of items) that can be kept in STM (short-term memory) is revised after its long and honorable service since 1956 when George Miller introduced it. The number of things that can be remembered is smaller, only two to four, if there is no auditory loop — for example, rehearsing a telephone number either silently or aloud. Here the experimental language was Chinese, in which each spoken work corresponds to half a dozen written characters, exact homophones, with different meanings. Depending on the type of chunk, STM varied from three to nine. Detailed analysis reveals even more about the nature and power of STM.

In other experiments, he studied the power of pictures in conveying information. The unfamiliar situation of a whale smoking a cigar was presented to subjects using words or drawings either separately or grouped, supporting the EPAM model.

Long-term memory (LTM) is represented as a node-link structure with an EPAM-like index. The model of thinking is constructed in three parts — a front end that works as a parallel processor to extract features, a recognition or indexing system that uses these features to access LTM, and a semantic memory consisting of a myriad of nodes linked by direct association.

What of another explanation of the power of pictures? Could it be the viewer's ability to take either a global or a detailed view, instead of linear reading or scanning of text? This is important for the design of text and pages, an issue which is coincidentally taken up in the second edition of John Brockman on *Writing Better User Documentation* which arrived in the post for review soon after Simon's book.

May one dare question a Nobel laureate in economics who is also a world authority in this field? Some propositions seem doubtful. Obviously only a serious academic cognitive psychologist will be familiar with the 59 properties of thought referred to in classical papers in the psychological literature — but the model of the LT (Logical Theorist) flies in the face of poor human ability to judge risk. Intonation does not drop at the end of clauses if you speak like a rural South Australian, or a typical Chinese (whom he studies in such detail otherwise).

Proposing that one recognises the letter A through absence of curves (p.34) contradicts Hofstadter's 56 examples of variations of the letter A from a Letraset catalogue — all recognisable, though some easier to read than others. Hofstadter's 23 examples of different styles for the Chinese character for black got an instant sigh of recognition when I showed a slide of them to demonstrate differences in legibility during a series of ergonomics lectures I gave at Changsha in China two years ago. Gestalt rules there, as much as in the West.

More important in today's preoccupation with misnamed chaos theory, any discussion of systems today should note 'emergent properties' (for which the political metaphor is "it seemed like a good idea at the time"). Simon only seems to get close to this aspect of practically anything being discussed at present when he talks about hybrid case-transformational grammars.

The detailed index has no reference to the work of Neville Moray on mental workload, or Jens Rasmussen on mental models, or James Reason of Manchester on slips and errors. In an age where it is good to strengthen bridges between academe and industry, there is also little reference to obvious areas of application of this work.

The most rapidly growing area to which Simon's work should apply is Human-Computer Interaction, especially relevant in Australia in the very month in which the formation of a national centre for this purpose has been announced. STM and problem-solving relate closely to the question of mental overload of operators in nuclear power plants — Chernobyl, Three Mile Island — and in other critical situations, like aircraft cockpits and monitors in hospital intensive care wards.

Simon does discuss applications of his work to education, and gives examples of experiments drawn from school and university, from physics, economics, and thermodynamics among ohters. Obviously models of thought are important for research into artificial intelligence and expert systems, of which many well-known examples are discussed in detail.

His one mention of medicine (apart from the MYCIN program) prompted my own wonder about models of thought of manual activities. Some early papers of mine on how skilled hand movements can be consciously analysed, taught, and used, fizzled out years ago, and it seems that anything as gross as physical activity — skills in sport, craft, art, and industry — have their own strategies and models which are ignored by cognitive psychologists such as Simon.

These petty comments should not detract from a great book and a great mind at work. What is under scrutiny is the working of the most miraculous system in the universe known to humans, which is the human mind itself. Learning a language so naturally in the first five years of life becomes a major challenge a few years later on. The original thoughts developed by giants like Galileo,

Kepler and Copernicus over a lifetime of intense application are now learned by many teenagers in a few years late in high school. How many readers of this review can still draw Euclid's simple geometric proof that in a right-angled triangle where C is the long side, $C^2 = A^2 + B^2$?

Some of the gems in this book come in general discussion, when, like Feyerabend, he asks "what is this thing called science"? He gives the characteristics of a good explanation as scope, depth, simplicity, free of ad hockery.

Reading this book, not as carefully as it deserved, still took twenty or thirty hours, so it is not one for people busy in other areas. However it has a place in every academic library, and in the personal libraries of researchers into the fields mentioned at the start — thinking, learning, remembering — and researchers in the quickly growing area of human-computer interaction. It will also be fertile ground for popular writers in these areas wanting to add something new and constructive to the wisdom and the platitudes in these areas.

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A History of Japanese Economic Thought *by Tessa Morris-Suzuki* (Cambridge, London and Oxford, Routledge and Nissan Institute For Japanese Studies, 1989), ISBN 0415 012 64 3.

With the Meiji Restoration and the internal creation of an appropriate environment, capitalist institutions and technology were imported extensively into Japan. At the same time, as this book shows, many of the ideas generated in the West to understand the workings of the capitalist system were also imported to Japan. However, as with the imported technologies, Western ideas were to some extent modified and adapted to suit Japanese circumstances.

Since Japan was a late-comer, the fact that capitalist institutions, technology, and related ideas were all imported, rather than being developed indigenously from scratch, was hardly surprising. Much more important from the point of view of the history of thought in Japan, however, were the modifications and adaptations that were made to Western ideas. Morris-Suzuki generaly manages successfully to draw out the strands of continuity and change in the transfer of Western thought to Japan. A case in point is her treatment of the reception in Japan of the ideas of Friedrich List (1789-1846) and his successors in the German Historical School like Gustav Schmoller (1838-1917).

Although it took some forty years for the ideas of List to become popularised in Japan, by which time liberal economics had gained the upper hand in Britain and many parts of the Continent, in Japan List was given a very sympathetic hearing. Thus Sadamasu Oshima, List's translator, took issue, in line with List, over the alleged benefits of free trade and the corresponding theory of comparative advantage. The effort to interpret the theory of comparative advantage as a universal law and to give it policy import according to Oshima was (in Morris-Suzuki's words) "Merely a device to perpetuate the dominance of the existing economic powers over newly industrialising nations such as Germany and Japan. In the short term, free trade might indeed appear to