

Matchmakers

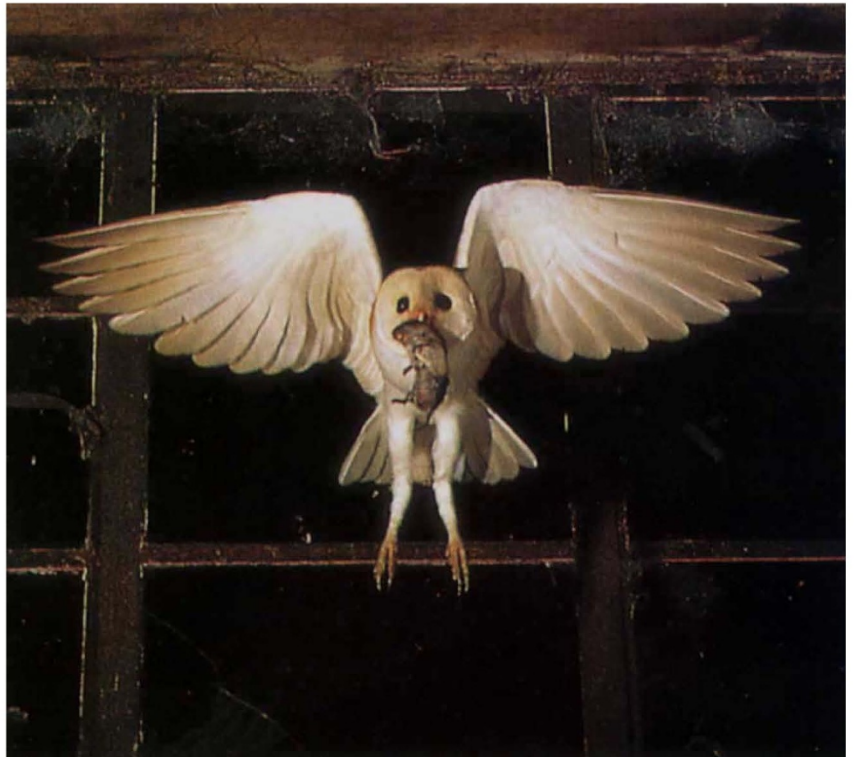
Stuart Sutherland

Mental Leaps: Analogy in Creative Thought. By Keith J. Holyoak and Paul Thagard. MIT Press: 1995. Pp. 320. \$24.95, £19.95.

NOWADAYS, in a few limited domains, computers equal or excel human intellectual capacities. They play chess at the grandmaster level and in certain branches of medicine they diagnose more accurately than expert medical specialists. But they have had no common sense — until recently. The simulation of common sense has been made possible by two developments: greatly increased computer storage and machines that can process information in parallel, thus vastly reducing the time needed to retrieve a particular concept. *Mental Leaps* describes an attempt to simulate one aspect of common sense — the ability to find appropriate analogies.

To construct their computer program, Keith Holyoak and Paul Thagard had to carry out a careful analysis of the nature of analogies. One example they use may have contributed to President George Bush's decision to start the Gulf War: he compared Hitler's occupation of Austria (the source of the analogy) with Saddam's invasion of Kuwait (the target). From this analogy one can conclude that Saddam's aggression would escalate unless something was done to stop it. According to the authors, analogies are based on three constraints: similarity (Hitler and Saddam were evil, occupation is similar to invasion); structure (the elements of the source must be mapped in a one-to-one way to those of the target (Hitler=Saddam, occupation=invasion and Austria=Kuwait) and the relations between the two sets of elements must be the same); and purpose, for example to discover how to solve a problem by analogy with one already solved or to persuade others, for instance by using case studies in law.

The authors proceed to describe a computer program for recovering analogies which makes use of these constraints to narrow the search for the appropriate source given a particular target. A network of connected nodes is established, each of which represents a possible correspondence between a target concept and a source concept. The nodes have excitatory and inhibitory connections between them, representing the three constraints. For example, the node Hitler=Saddam would have excitatory connections with occupy=invasion whereas Hitler=Saddam would have inhibitory connections with Hitler=Ho Chi Minh on the grounds that only one member of the



WITH its combination of ghostly pallor and eldritch shriek, the barn owl *Tyto alba* is perhaps the quintessential owl of popular imagination. It is captured here in its 'heraldic' pose, a symbol of excellence and sagacity (its prey is a short-tailed vole). From the informative and well-illustrated *The Barn Owl* by Mike Read and Jake Allsop. Blandford, £16.99.

source can be matched to one member of the target. The strength of each node is changed iteratively according to the excitation and inhibition feeding into it from other nodes until there are no further changes in strengths, at which point there remains the most consistent set of nodes, those that still have high strength. These represent the analogy.

Three problems remain. First, it is easy to see how a clear-cut purpose can be used as a constraint in recovering an analogy. If we wish to show that Hitler is evil, it is no use matching him with Gandhi: the purpose provides a constraint. But it is not so clear how constraints would operate where we need a helpful scientific analogy, for example, atom=Sun and electrons=planets. All the relevant properties of the two systems would have to be set in one-to-one correspondence, but how do we decide what is relevant? Holyoak and Thagard are aware of the problem and emphasize that often the appropriateness of an analogy can be evaluated only through complex chains of reasoning after it has been found. Second, despite the parallel search used, it is not clear that the program avoids the combinatorial explosion. When tested on Aesop's fables as a source, the required number of iterations hardly increased from a choice

between fifty fables to a choice between a hundred. But the concepts in the fables would not have doubled — many of the second fifty would have appeared in the first fifty. Third, we are not told either how often the program failed to find an analogy or what proportion of the analogies found were appropriate as judged by people.

The book is nevertheless interesting and important, even if it sometimes makes heavy and perhaps unnecessary demands on its readers' application. In outlining what I regard as the most significant and original part of it, I have had to omit many subtleties. Moreover, most of it is devoted to a general discussion of analogies and their roles, presented in an attractive and novel way and covering among other topics the phylogenetic and ontogenetic development of analogical reasoning, the use of analogy in everyday life, politics, warfare, education and science, and the Chinese tea ceremony as an analogy for their way of life. To end with an avowal that the authors' program might or might not have recovered, I have been able to exhibit only a few pearls from the wares in the jeweller's shop. □

Stuart Sutherland is in the Laboratory of Experimental Psychology, University of Sussex, Brighton BN1 9QG, UK.