implicated in the execution of rule-like behaviour.

In a final chapter, Pinker argues that the regular–irregular distinction exemplifies a more general feature of the human mind. Cognition, he argues, is supported by two types of categories — classical categories (for example, odd number) and fuzzy, family-resemblance categories (for example, chair). The nature of the categories supporting cognition is an old chestnut in cognitive science, and Pinker wants to connect the psycholinguistic research to more general properties of cognitive systems. Regular words are examples of classical categories, whereas irregular words are examples of family-resemblance categories. Symbol combination is crucial for the computation of regulars, as well as classical categories more generally; and associative memory is the core mechanism subserving the representation of family-resemblance categories in general, and irregulars in particular. Insofar as both classical, definitional information and family-resemblance information constitute crucial aspects of what the mind must deal with, both mental mechanisms are integral requirements for a functioning cognitive system.

For a broad audience, *The Language Instinct* (Penguin, 1995) was Pinker's more amusing book, and *How the Mind Works* (Penguin, 1998) was more speculative. *Words and Rules* is an academic work. I very much like the thoroughness and clarity of this book, notwithstanding at least one important sin of omission. Pinker thoughtfully argues for abstract representation and symbolic computation. In fact, a central concern throughout is to show that one cannot get away without a highly structured linguistic computational system. Surprisingly, Pinker does not raise what many linguists and psycholinguists consider the most interesting argument for a richly structured computational system (language faculty) that makes use of symbolic rules. It is called the poverty-of-the-stimulus argument, and it asserts that every speaker comes to know abstract properties of his or her language in the absence of any input that could provide the necessary evidence. In a work of such broad scope, the most powerful argument for structure deserves mention.

This complaint, however, is somewhat cosmetic. More importantly, the book provides a scholarly, persuasive, enjoyable and eminently readable account of important language phenomena. ■

David Poeppel is in the Cognitive Neuroscience of Language Laboratory, University of Maryland, College Park, Maryland 20742, USA.

More on language

How the Brain Evolved Language
by Donald Loritz
Oxford University Press, £35, $45

Why not knot right?

The 85 Ways to Tie a Tie: The Science and Aesthetics of Tie Knots
by Thomas Fink and Yong Mao
Fourth Estate: 1999. 144 pp. £10

Gregory Buck

There is a little irony in the fact that I am reviewing this book. I am a modern American mathematician, well-schooled in the sartorial traditions of my field, and so would perhaps be a natural reviewer for a book entitled *The Well-Wrinkled Tee Shirt* or, perhaps, *Wearing Sandals in the Snow*. However, I teach at a liberal arts college, and so can wear a tie while teaching when I want to without risking my mathematical reputation — of course, for conferences I pull my clothes out of the bottom of the dirty-laundry pile like everyone else. (My colleagues in the economics department scoff at my tie-wearing, considering it too infrequent to be taken seriously, but they are extremists — I am pretty sure they wear ties with their pyjamas.) I have always liked tying ties, but, despite the fact that I study knot theory, like most people my tie-knot knowledge was cultural and accidental. I knew a couple of tie knots but not their names, nor could I recall where or when I learned them.

This wonderful little book by Thomas Fink and Yong Mao has changed my life. Now, when I tie a tie, I know what I am doing, and why. Fink and Mao have performed a great service for civilization, doing for tie-knot tying what Isaac Newton did for the motion of the heavens: lifting it from the darkness of secrecy, ritual and superstition to the light of rational, scientific good taste.

To accomplish this remarkable feat, Fink and Mao have employed the analytical tools of topological (and geometric) knot theory and statistical mechanics with cleverness and dexterity — introducing just enough of each to get the job done. That may sound ambitious, but this is a book aimed at the general reader. A beautifully concise, four-page appendix contains the only mathematics that could be considered challenging. The illustrations are superb — I tried nearly all the knots illustrated and got them right first time. The notation for the knots is elegant and easy to master.

The scientific force of the work is that Fink and Mao have created a formal model that captures the salient characteristics of tie-knot tying in the real world, and have then analysed the formal model, guided by the scientific lights of simplicity and symmetry, and have solved the problem completely, identifying the 85 ways to tie a tie (given natural constraints). Their model predicts the knots most commonly used, and provides several new possibilities.

Knotty problem: imagine how many tie knots are tied in a day.

Fink and Mao have obeyed the imperative of the scientific entrepreneur: create a niche, and then fill it completely. This book is now the definitive work on tie knots, and as such is the definitive work on one of the most common applications of knot theory (and therefore of topology). The applications of knot theory are legion: a test tube of DNA may contain billions of knots, but sometimes they are hard to see. Polymers in general may gain many of their characteristics from tangling, knotting and linking, but this may not be apparent when you are holding the material in your hand. Magnetic field lines are often knotted, linked or otherwise entangled, but one doesn't often observe this on the way to the market. But now imagine the morning dressing routines around the world — imagine how many tie knots are tied in a day.

Finally, we must consider the stylistic force of the work. Fink and Mao provide an informative history of tie-knot evolution. They also provide much more — a guide to taste in knot tying. An attentive reader will learn which knot works best with a given tie and collar, and will learn tie knots that can be enjoyed as things of beauty in and of themselves (for me it was the Plattsburgh). Fink and Mao have shown that it is possible to be both smart and smart — in brains and style. And so here is a prediction: anyone who wears a tie, who is at all of a scientific bent, will enjoy this book very much. ■

Gregory Buck is in the Department of Mathematics, Saint Anselm College, Manchester, New Hampshire 03102, USA.

Also available

Ideal Knots
edited by A. Stasiak, V. Katritch & L. H. Kauffman
World Scientific, $55, £34