

On Growth and Form. But Bagnold seemed unaware of that. Thompson's epic revised edition, published in 1942, surprisingly neglects not only Bagnold's efforts but the entire issue of ripple and dune formation. A connection to more general patterning processes ultimately emerged from Alan Turing's work on biochemical morphogenesis, described in a 1952 paper. When, in the 1970s, mathematical biologists Hans Meinhardt and Alfred Gierer identified the fundamental ingredients of Turing's stationary chemical patterns — the presence of a locally acting autocatalytic 'activator' and an inhibitor that suppresses pattern elements over longer

ranges — it became apparent why sand ripples resembling in plan form the striped markings of zebras probably result from a Turing-like mechanism. The formation of a ripple is self-enhancing because it captures more sand the bigger it gets. Meanwhile, this process depletes the air of sand grains, suppressing another ripple for some distance downwind.

The fact that granular flow might serve as a universal analogy for other physical phenomena had been suspected in the late nineteenth century by Osborne Reynolds, a pioneer of fluid dynamics. In order to flow, a collection of grains must expand a little, and Reynolds

decided that this 'dilatancy' of powders could explain all the mechanical behaviours in nature if space were filled with submicroscopic grains. A portrait from 1904 shows Reynolds holding a basin of ball bearings, and two years earlier he revealed what he had in mind: "I have in my hand the first experimental model Universe, a soft India rubber bag filled with small shot." William Blake's world in a grain of sand is invoked to the point of cliché in granular research, but here it was claimed as a reality. ■ Philip Ball is a consultant editor for *Nature*. His forthcoming book series is *Nature's Patterns: A Tapestry in Three Parts*.

Inside the map-maker's mind

The Natures of Maps: Cartographic Constructions of the Natural World

by Denis Wood and John Fels
University of Chicago Press: 2008.
231 pp. \$49

I trace with my finger the ridgeline to the summit of Mount Everest. The beautiful, icy, white-, blue- and granite-coloured map on the cover of *The Natures of Maps* brings the peak easily within reach. Yet if I were to try to scale this mountain, it is likely I could die trying. In this sense, argue geographers Denis Wood and John Fels, this map puts nature in its place: under my thumb.

Although I know it is a representation of nature, and not the real thing, such representations are powerful. They affect how we think about the subjects they portray. And therein lies the utility of this terrific book. It uses the tools of cognitive linguistics to conduct a step-by-step analysis of how maps construct — in our minds — the versions of nature that dominate public discourse about the environment, ecology, conservation and the proper place of humans on our planet.

The authors identify eight versions of nature that are constructed by the arguments commonly embodied in maps. Nature may be awesome, a threat or a victim. It embodies a cornucopia, is collectable and an object of scientific study, yet it remains a mystery. Or it may be differentiated as a park, legally protected and codified, "a nature, ultimately, quietly put in its place".

The book is a beautiful tour de force. Laid out like an art book with stunning reproductions of maps, it also contains a trenchant, practical analysis that is useful for anyone wanting to read maps more

critically and construct better maps of nature.

Wood and Fels borrow their conceptual scaffold from cognitive scientists Gilles Fauconnier and Mark Turner, who argue that language opens 'mental spaces' that can blend with other conceptual spaces in our minds to create new combinations. For example, the term computer virus is a powerful mix of two disparate ideas: one technological, the other biological. Wood and Fels analyse how a map similarly provides "a system of propositions" about nature that "get tied together into arguments about the world".

These spatial arguments are constructed

'on the fly' in our minds, say Wood and Fels, presumably using the same kind of activated neuronal assemblies that are proposed to enable the conceptual blending of their linguistic counterparts. But this neuroscience black box distracts from their analysis of how "maps hoist themselves off the page into our brains, spawning world views" as we read the complex propositions posted on their flat surfaces.

The analyses of the eight natures commonly constructed by maps provide the book's greatest value. 'Threatened nature' is the most compelling, and Wood and Fels bring all their tools to bear in an incisive deconstruction of a map from *National Geographic* entitled 'Australia under siege'. They trace the argument being made in geographic terms as this standard, seemingly objective base map is blended — in the reader's mind — with colourful maps of Australia's land cover 200 years ago and today, showing the threats posed by fire, feral species, forestry, grazing and mining. Ultimately, they say, the map argues that the past equals nature, and no map of the future is needed: "the meaning (and the fear and anxiety) emergent in the blend is perfectly clear".

The eight natures arguably encompass the most important currents in contemporary thought, save for one: nature is change. That is not just the nature that has been changed, as in Australia, but nature that is always dynamic. The omission of this dynamism is a weakness of this book, and in fairness, of most maps. It is a pity that the authors limit their analysis to static maps of nature when we are witnessing the proliferation of 'mash-ups' that link data sources to web-based applications, such as Google Earth, to create dynamic, interactive maps. Fortunately, the analytical tools that Wood and Fels demonstrate can help us understand how interactive maps work too.

Dynamic maps open up new mental spaces more quickly and readily than static



The peak of Mount Everest, within touching distance.

maps, and can be generated by users who ask their own questions of data sources. Instead of going to pre-existing maps for answers about nature, we can create our own maps to query nature. Rather than relying on reified versions of idealized natures, maps can allow us to explore changing versions of the real, messy natures we live in.

The Natures of Maps should be read and put to use by anyone who makes or uses maps, whether they are scientists, conservationists or landowners. The constructs of nature that Wood and Fels identify inform the way maps are interpreted. And the analytical techniques that they deploy can be used to make new maps

of science and nature that are better at helping us to ask important questions.

Maps are indeed arguments about our world, but the future also rides on maps. People use them to shape what we know and what becomes of the territory. As Wood and Fels argue so provocatively, “Pretending to be no more than scorekeepers, maps stand revealed as more like the ball, the very medium through which the game’s moves are made.” ■

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ease with which the origin of any Internet communication can be traced. It is daunting to see how quickly we have become inured to surveillance as normal when we would once have viewed it as intrusive. My daily bus journey is now almost entirely recorded on video — a development that was inconceivable both technically and ethically only a few years ago.

Privacy, a slim but beautifully produced volume by sociologist Wolfgang Sofsky, is a manifesto in the classic sense. In a 148-page translation from the original German edition of 2007, he outlines his concerns over the depth of information that is now held, analysed and used from almost every aspect of our lives. Beginning with a review of the daily surveillance encountered by an average citizen, the author takes us on a personal journey that discusses the cultural roots of privacy, the origins of property and the pivotal nature of freedom of thought.

Sofsky covers an enormous amount of territory on his voyage, and digs deep into our core social values to discuss the origins of our behaviours, interactions and innate needs. Human territoriality, the concepts of personal space and the conventions regarding bodily functions all build together into a convincing justification of why privacy becomes such an emotive issue in a crowded, and perhaps threatening, environment. Private spaces are our refuges from society at large. Sofsky discusses the way we extend private space — into our cars, for example — but also shows us how vulnerable we become to these boundaries being breached.

Setting this against the development of an information-oriented world, Sofsky skilfully weaves his argument that we, as groups and individuals, have lost significant independence and freedom of action. We are, he argues, at the behest of “an unholy alliance of institutions” — both governmental and commercial — that ensure we never feel free from observation in any aspect of our lives. The technologies are available, they are being used and, as the tools become more sophisticated, so too will the use of the data they generate.

Reading Bennett’s book is like joining a conversation in a commuter train where the regular passengers know and respect each other. You are informed of the points being debated, then left to make your own judgement. The journey with Sofsky is similarly amicable but is more like being a passenger on a long taxi ride, where the driver shares his life-vision and philosophy. Both approaches work well — the time spent in the authors’ company passes both quickly and profitably. ■

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Who’s watching you?

The Privacy Advocates: Resisting the Spread of Surveillance

by Colin J. Bennett
MIT Press: 2008. 259 pp. £18.95

Privacy: A Manifesto

by Wolfgang Sofsky
(Translated by Steven Rendall)
Princeton University Press: 2008.
148 pp. £13.95

If you have ever caught a bus, you will be familiar with this experience: you wait ages for one to arrive, then two turn up together. As with transport, so with books. These two titles use different approaches to unpick the entwined concepts of surveillance, privacy and human rights.

In *The Privacy Advocates*, political scientist Colin J. Bennett reviews the privacy landscape from the perspective of those who seek to prevent society from sliding into an unthinking acceptance of surveillance culture. Advocates of surveillance cameras in public places cite the prevention of crime as a key motivation, yet the same technology could be subverted to intrusively monitor innocent people.

Bennett suggests that we should all be privacy advocates because there are elements of everyone’s life that are so personal that they should not become public or state property. Active himself in issues of privacy, Bennett could risk bias in covering such an emotive topic. Instead, he seeks to hold up a mirror to the network of privacy advocates. By allowing the network members he already knows to select secondary contacts for him, he develops an organic web of opinion and insight.

The strength of character of many privacy campaigners might set them as outliers of current social opinion. To his credit, Bennett



Banksy’s graffiti art criticizes surveillance culture.

takes great care to avoid depicting them as a naive fringe element. In describing the publicity-friendly techniques used by the privacy movement, such as performing Shakespearean drama in front of surveillance cameras, he acknowledges the serious intent of such activity as a wake-up call to society.

In a thoughtful and determined voice, Bennett provides an international perspective and comprehensive coverage. The material is current and the history of the topic is well presented. The development of the privacy lobby is tied in with the technological advances that, to a large extent, have driven it — such as the

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