

▶ England's rocky shorelines, I learned how graptolites — microscopic colonial animals that lived in sediments during the early Palaeozoic era, about 450 million years ago — vanished from the fossil record when the climate cooled, because the cold, oxygen-rich water that penetrated the deep sea let predators invade the sediments and eat them.

But the book's coverage of climate evolution during the earliest nine-tenths of Earth's history — the Precambrian era, 542 million years ago and earlier — is neither so detailed nor so scientifically balanced. One chapter describes most of this time interval, and another focuses on the Late Proterozoic Snowball Earth glaciations, when ice repeatedly covered nearly all Earth's surface, around 635 million years ago.

Zalasiewicz and Williams give scant attention to the carbonate–silicate cycle that many Earth scientists believe is the key to Earth's Goldilocks status. The basic idea is that volcanoes add carbon to the atmosphere and the sea, and the weathering of silicate minerals on the continents and the deposition of carbonate sediments in the oceans take it out. Weathering slows as the climate cools, so carbon dioxide builds up, warming the climate and creating negative feedback. This feedback is mentioned as causing the Snowball Earth to melt, but its importance in regulating climate in general is not really discussed.

Neither are the authors the best guides to Snowball Earth events. They give too much weight to discarded ideas such as the high-obliquity hypothesis, which argues that the glaciations resulted from the tilt of the Earth's axis, and they omit to mention the latest thinking and evidence.

The last chapter of *The Goldilocks Planet* deals with the Anthropocene epoch — a term popularized by Nobel-prizewinning atmospheric chemist Paul Crutzen to describe the geological epoch in which humans have significantly modified the Earth's climate. This is well-trodden ground, but the discussion is on the mark, and the preceding review of climate history gives it credibility. If Earth's climate is as sensitive as it seems to be, then how could it not respond to the massive greenhouse forcing that humans would create by burning a significant fraction of the available fossil fuels?

Pennsylvania State University teaches a general-education Earth science course that approaches global warming in the same way: reviewing climate history to give a context for the anticipated future. It works well for us, and it works for *The Goldilocks Planet*, too. ■

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Ferdinand de Saussure was hugely influential in the social sciences, despite publishing little.

#### LINGUISTICS

## Sound sculptor

**John A. Goldsmith** is intrigued by the life of a linguistics giant who felt himself to be a failure.

“Any life when viewed from the inside is simply a series of defeats,” wrote George Orwell. Each serious study of a great scientist's life is bound to leave us reflecting on that truth, and linguist John E. Joseph's monumental *Saussure* is no exception.

Ferdinand de Saussure (1857–1913) was one of the great nineteenth-century linguists, and Joseph's book, the first comprehensive biography, sheds brilliant light on his life and work. This rich account — sympathetic, respectful and sensitive to political and intellectual context — reveals how Saussure, a dazzling and driven scholar from a bourgeois Swiss family, blazed trails to new vistas of social science that opened out in the century after his death.

Saussure emerges as a complex individual. As Joseph shows us, his virtuosity was

**Saussure**  
JOHN E. JOSEPH  
*Oxford University Press*: 2012. 800 pp.  
£30.00, \$55.00

counterbalanced by a series of unfortunate failures to get projects finished. That Orwellian ‘inside story’ hums away in

the background of the book.

Two works of genius bookended Saussure's life. The first was a revolutionary monograph on Proto-Indo-European — the ‘raw material’ of modern languages from English to Sanskrit — self-published when he was just 21. Saussure's contribution was to deduce that ancient Indo-European must have contained certain sounds that had disappeared from more modern languages and so were undetectable in linguistic history. The prediction was confirmed much later in an analysis of Hittite documents from the thirteenth century BC.

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The second work was a series of groundbreaking lectures that Saussure gave towards the end of his life, and which was later transformed, through notes taken down and edited by his students, into the great *Course on General Linguistics*, published in 1916. Much of Saussure's fame came from a book that he never wrote.

Modern linguists remember the wunderkind who followed his stunning early essay with a doctoral dissertation on Sanskrit just a year later. Saussure is also renowned as a key figure in the rise of structuralism, a method that profoundly influenced the social sciences by looking for a universal structure behind human behaviour and social activity. In linguistics, the method can be used to analyse the evolution of language by searching for patterns and symmetries in sounds.

But there were, as Joseph clearly recounts, setbacks. He shows how, after the publication of the monograph, Saussure's teachers at the University of Leipzig in Germany were stunned. They saw his dazzling, innovative reconstruction of Indo-European vowels as a brazen elaboration on what he had been taught in their courses. Fortunately, his doctoral dissertation was much more conventional, and he was granted a degree. When he left Germany, he was not much missed by his teachers.

Saussure then spent a decade teaching in Paris, publishing nothing except a few brief notes and unable to obtain a professorship. He spent a good deal of money he didn't have betting at the races, making up for his losses by winning at poker. Saussure eventually returned to Switzerland, where he was named a professor at the University of Geneva. He continued to teach, but never had many students.

Although Saussure filled scores of notebooks with his research, he never succeeded in producing a book that satisfied his own standards. His students produced a publication in his honour on his 50th birthday, but he died a few years later, unable to see any accomplishments in his life past what he did as a very young man. Yet, as Joseph shows, the *Course on General Linguistics* continues to have enormous influence on thinkers not only in linguistics, but also in anthropology, sociology and literary criticism.

Weighing up the truth about the whole person — life and work — is no easy thing. Saussure was never to have the satisfaction of understanding the vast reach of his own work. And although we do at least have that, we must sift through the evidence to make our estimation of the life and the man. ■

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## Books in brief



### Science in the Twentieth Century and Beyond

Jon Agar POLITY 256 pp. £30 (2012)

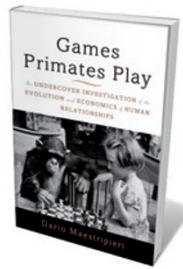
Global in scope and fresh in approach, this monumental history lays out the evolution of science during a tumultuous century. Philosopher of science Jon Agar casts research as a way of solving problems generated by human activity in arenas such as health, warfare, civil administration and agriculture. Starting with the new physics and the breakthroughs of figures from James Clerk Maxwell to Albert Einstein, he travels through the life sciences, psychology, the maelstrom of science in the two world wars, the atomic age, upheavals of the 1960s and current environmental challenges.



### Innovation Generation: How to Produce Creative and Useful Scientific Ideas

Roberta Ness OXFORD UNIVERSITY PRESS 272 pp. \$29.95 (2012)

Obesity, Alzheimer's disease, cancer and climate change are very much with us, says Roberta Ness, yet innovation that could mitigate them has slowed catastrophically in US science. Ness, vice-president for innovation at the University of Texas Health Science Center at Houston, outlines a method to ignite creativity. Through role models and exercises, she shows how better metaphors and observation can shift paradigms; and how specific issues can be solved with the right questions, the right analogies and group intelligence.



### Games Primates Play: An Undercover Investigation of the Evolution and Economics of Human Relationships

Dario Maestri BASIC BOOKS 320 pp. \$27.99 (2012)

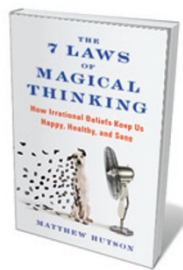
Evolutionary biologist Dario Maestri uncovers the roots of human social behaviour using psychology, behavioural science and economics. Reasoning that social selective pressures are similar in humans and other primates — and roping in 'rational' models such as game theory — he examines everyday situations from multiple perspectives. Whether scoping out the 'elevator dilemma' of sharing a confined space with strangers, the human tendency to nepotism or the "economics of love", Maestri argues his case compellingly.



### Net Smart: How to Thrive Online

Howard Rheingold MIT PRESS 272 pp. \$24.95 (2012)

Fragmented attention, aimless dabbling — the pitfalls of Internet misuse are well known. Social-media writer Howard Rheingold argues that the solution to "always on" media is mindfulness and cooperation. His recipe for digital literacy, based on 30 years of Internet immersion, is to hone attention, participation skills, critical approaches to information, collaboration and "network smarts". Rheingold's observations and solutions — from how tweeting is fuelled by dopamine to how to craft a thoughtful network — are informed by science and illustrated with apt, entertaining anecdotes.



### The 7 Laws of Magical Thinking: How Irrational Beliefs Keep Us Happy, Healthy, and Sane

Matthew Hutson HUDSON STREET 304 pp. \$25.95 (2012)

Irrationality, says science writer Matthew Hutson, is universal, and is essential to the way humans function. Uniting findings from neuroscience, cognitive science and evolution, he argues that magical thinking gives us crucial feelings of connectedness, control and meaning. Hutson analyses the call of the numinous in a range of beliefs: the 'sacred' essence in wedding rings or signed footballs, lucky numbers, an afterlife, fate, psychic powers and more.