

latest data and theories from current physics research. Einstein tries to explain his ideas to a skeptical Newton using an array of thought experiments, logical arguments, intuitive insights and analogies, many of which are graphically illustrated in the book.

On many different levels this is a staggering read. First, the sheer scales involved in relativity theory, sub-atomic and astro-physics—both the micro- and the macroscopic—are unimaginable. We are dealing with measurements that are, at one extreme, billionths of billionths of a centimeter small and, at the other, trillions of miles long. There are immensities of heat, depths of coldness, magnitudes of energy, and speeds so colossal that one is left simply staring at numbers, trying to form some image that refuses to materialize. On another level, one is left in awe of the achievements of both Newton and Einstein and their capacities for perseverance and original thought. Finally, there is the semi-religious sense of one's own transient existence combined with the almost comforting sense of continuity with a universe that transcends life itself. It is little wonder that Einstein made such frequent reference to God, as the quotes included in this volume bear witness.

There have been many admirable attempts to bring Einstein's ideas to a wider public, and I am sure *The Curvature of Spacetime* makes a contribution to that process. It is by no means the easiest of such books to read, particularly for one with no scientific training and very little mathematical fluency. But I found I was able to follow most of what was discussed, even if I could not hold it all together long enough to see the grand picture. In this respect one can at least take consolation from the example of Einstein's humility when he writes:

"If I have learned one thing from all the pondering that has accompanied me through my long life, it is this: we are further removed from a deep insight into the elementary processes in our world than most of our contemporaries would believe" (p. 36).

MEMORIES ARE MADE OF THIS: HOW MEMORY WORKS IN HUMANS AND ANIMALS

by Rusiko Bourtchouladze. Columbia Univ. Press, New York, 2002. 208 pp., illus. ISBN: 0-231-12020-6.

Reviewed by Robert Pepperell, Polar (the Posthuman Laboratory for Arts Research). E-mail: <pepperell@ntlworld.com>.

The subtitle of *Memories Are Made of This* is somewhat misleading and would have more accurately reflected the contents of the book had it run: "*Some Theories About How Certain Aspects of Memory Might Work in Humans and Animals.*" A prominent researcher into the biology of memory, Bourtchouladze starts this book by briefly surveying the various attempts to understand memory throughout Western history, from the ancient Greeks to the birth of modern psychology to present-day techniques involving genetic manipulation and sophisticated scanning.

The author is at her best when setting out this historical narrative, particularly the rise of experimentation in the 19th century and the subsequent classification of distinct kinds of memory, such as *accessible* and *available* or *recognition* and *recall*, in the 20th. It transpires, for example, that when subjects are shown hundreds of different images in sequence and then asked to pick them out from a second sequence that includes those already shown plus new pictures, they recognize up to 97% of the original images, even though an average subject will recall only 17 to 20 images without any visual reminder (p. 62). The distinction made here is between those memories that are accessible and available, that is, between those that are somehow stored but cannot be remembered without prompting and those that can be voluntarily recalled without prompting.

But having guided us so patiently through this maze of concepts and theories, with excellent account taken of the non-specialist reader, the author jarringly shifts gears in the last 40 or so pages. Bringing us up to date with current research, and particularly her own, Bourtchouladze slips into a rather technical mode of writing, employing a profusion of acronyms and specialist terminology. Although I could not claim to follow with certainty, the gist seems to be that there is an important distinction to be drawn between short-term and long-term memory, each of which is endowed with its own neural mechanism. It is likely that long-term memories are stored as a result of long-term potentiation (LTP), that is, changes in the strength of the synaptic connections between neurons. The author's own contribution to the field has been the study of a gene that when switched off in rodents prevents the production of a certain protein (CREB), which, in turn, prevents the

formation of long-term learning whilst apparently leaving short-term memory unaffected.

Fascinating as this all is, I could not help but be disturbed by the indifferent attitude the author displays towards the many monkeys, birds, rodents and other creatures that have variously been electrocuted, lobotomized, terrified, half-drowned, and genetically disfigured in the name of memory research. No doubt this can be justified on the grounds that a cure may result one day for human degenerative diseases such as Alzheimer's. But at the same time, one wonders about the extent to which such practices are driven by little more than curiosity or, worse, by naked scientific ambition. At least Bourtchouladze acknowledges this aspect of the scientific imperative when she quotes Jim Watson's comment that scientists are "a little evil and very competitive" (p. 165).

Despite the optimistic subtitle, she also recognizes how far we are from a full understanding of the biology of memory processes: "We are beginning to develop some idea about the molecules and genes necessary for memory to be formed, and yet in many ways memory still remains as much of a mystery to us as it was to the ancient Greeks" (p. vii).

For the most part *Memories Are Made of This* is a highly readable and accessible account of recent research into memory and should serve as a helpful introductory textbook to this important subject for students in a variety of disciplines.

CREPUSCULAR DAWN

by Paul Virilio and Sylvère Lotringer. Semiotext(e) (Foreign Agents Series), 2002. 185 pp. ISBN: 9-781584-35013.

Reviewed by Sean Cubitt, Screen and Media Studies, University of Waikato, Private Bag 3105, Hamilton, New Zealand. E-mail: <seanc@waikato.ac.nz>.

Paul Virilio has long been admired and cited by the theoretically inclined techno-savvy of <nettime>. Nowadays, thanks largely to the efforts of John Armitage [1], he is becoming an obligatory citation for many social and media theorists of more traditional kinds. This book forms an excellent career overview and contains plenty of surprises and new material for readers who already know of his earlier work. *Crepuscular Dawn* is a book-length interview with Sylvère Lotringer, himself a