



Researchers working at the Laser Interferometer Gravitational-Wave Observatory.

SOCIOLOGY OF SCIENCE

Chasing the gravitational wave

Marianne de Laet enjoys a sociological analysis of how a select group of physicists works.

In *Gravity's Ghost and Big Dog*, British sociologist Harry Collins documents the astrophysical search for the elusive gravitational wave. In part an account of sociological fieldwork among scientists in the field and part astronomy-history mystery, Collins's book is a terrific read informed by almost 40 years of research.

The book homes in on two sudden energy surges, thought to be the first truly significant detections of gravitational-wave signals, that got the astrophysics community in a stir: the

Equinox Event in 2007 and Big Dog in 2010. The book's first part was previously published in 2010 as *Gravity's Ghost* (University of Chicago Press), a stand-alone account of the Equinox Event. The new, second part documents the frenzy over Big Dog — so named because the signal was bigger than the 2007 surge and seemed to come from the constellation Canis Major — when the stakes were higher and the future of the field hung in the balance. As an 'embedded' observer, participant, apprentice and analyst working

among the astrophysicists, Collins reports on meetings, telephone conferences, e-mail discussions and social events. By conversing with and analysing scientists at research facilities, scientific conferences and home institutions, he offers a glimpse of the ways in which knowledge is made in this esoteric field.

Predicted by Albert Einstein's general theory of relativity, first published in 1915, gravitational waves are formed when the mass of an imploding star disappears, causing ripples in space time. Ground-based interferometers built to detect them have been in use for decades, but Collins focuses on the Laser Interferometer Gravitational-Wave Observatory (LIGO), which has sites at Hanford, Washington, and Livingston, Louisiana.

Two questions drive the narrative: are the signals real? And do they prove that gravitational waves exist? Collins lets us in on the conversations among the scientists. At times, they focus on the rigour of statistical margins by asking at which margin error can be ruled out; at others, they discuss the semantics of knowing, pondering whether they are confronted with observation, evidence or fact. He intersperses these exchanges with historical information and his own sociological analysis of gravitational-wave research. As the astrophysicists debate the two detection events, it emerges that deciding whether a gravitational wave exists is not just a matter of observation, calibration and learning to understand LIGO's idiosyncrasies. It also involves semantics, political considerations and attending to expectations from funders, media and the public.

A debate among key collaborators about how to announce Big Dog is a case in point. The degree of certainty with which a finding is announced sets expectations, and these find their way into the rationales for retooling or building new instruments. The validity of past research, the promise embedded in future instruments and scientific reputations are all explicitly at stake in the exchanges among the collaborators. Collins has turned the minutiae of these conversations into an exciting detective story.

Collins finds himself immersed, learning so much science that he becomes a force to be reckoned with. His queries are pertinent to the research and, by his own account, that gets the scientists to rethink strategies or interpretations of their findings. Collins even tries his hand at physics, and suggests an alternative strategy for some of the calculations for Big Dog. Flirting with the



Gravity's Ghost and Big Dog: Scientific Discovery and Social Analysis in the Twenty-first Century
HARRY COLLINS
University of Chicago Press: 2013.

science, he begins to think not only about the astrophysicists, but with them. With Collins, we begin to wonder what it takes to be an expert in the field.

In social science, going native in this way is a tricky business. In an effort not to alienate his subjects, the sociologist may end up relying too much on the group's own interpretations of their actions, leading to less insightful renderings of their world. If, by contrast, he lacks credibility with the group, his presumption to reveal something new may offend. Collins walks a tight line deftly; although his interlocutors are somewhat incredulous at his

“Collins learns so much science that he becomes a force to be reckoned with.”

efforts to do physics, the group does engage with them. That does not make Collins an expert within their culture — only about it. And here, in trying to justify his calculations by asserting that they are not far off, he violates a golden rule of the sociology of science. Understanding the process of knowledge-making is not predicated on whether the knowledge in question is right or wrong. At the same time, Collins defies a best practice of anthropology — to examine one's motifs and motivations. He is not the first researcher in the sociology of science whose observation of scientific expertise turns into the desire to possess it. This interesting feature of the analysis of science remains unexamined in Collins's book.

That said, Collins's respect for science compels him to make a lovely observation: that there is something admirable about the modes of science — its aspiration to honesty, persistence and truth-seeking — and that this should serve as a moral and epistemological model for how to behave. And if, as US anthropologist Stefan Helmreich suggests in his book *Silicon Second Nature* (UC Press, 1998), social analysis of science enables participants to “recognize something new of themselves”, Collins's serial monograph is on point. It tells of scientists who are well aware of their own practices — perhaps not least as a result of having a sociologist in their midst. ■

Marianne de Laet is an associate professor of anthropology and science, technology, and society at Harvey Mudd College in Claremont, California, USA. She observed the emerging collaboration of the California Extremely Large Telescope, renamed in 2003 as the Thirty Meter Telescope.

e-mail: delaet@g.hmc.edu

PSYCHOLOGY

Mapping memory's lanes

Alison Abbott sees the science and poetry in a penetrating study of reminiscence in the elderly.

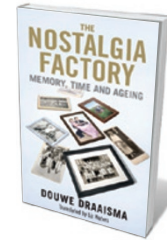
In 1688, Swiss physician Johannes Hofer coined the term nostalgia to describe the clinical symptoms of homesickness. Hofer linked the Greek words *nostos*, for homecoming, and *algia*, for pain. Nostalgia could even be life-threatening, he noted. In *The Nostalgia Factory*, psychologist Douwe Draaisma touches on this phenomenon in his exploration of memory and ageing, which draws on scientific work and anecdotal case studies.

He tells of the Dutch emigrants after the Second World War who, crippled by homesickness, later found that return offered no respite: ‘home’ no longer matched their memories of it. He describes the twentieth-century emigration agencies as ‘nostalgia factories’. But the real nostalgia factory, he says, is time — which “makes emigrants of us all”. In old age, memories are all that remain of the land of our youth, even if we never left home. His beautifully written book attempts to capture the nebulous essence of reminiscence in eight elegant, authoritative essays.

Draaisma's style is both literary and scientific. It calls to mind the works of Oliver Sacks, who popularized neuroscience through the intriguing stories of his neurological patients. (In fact, one of Draaisma's essays is based on a conversation with Sacks about “what time does to memories and what memories do to time”.) But Draaisma's style is perhaps the more poetic, which is what makes the powerful insights in his book so penetrating.

It is disconcerting to learn from Draaisma how unstable and adrift our own biographies are: we constantly reconstruct our lives as our memories are refiltered through new experiences. Draaisma offers both reassurance and warnings. Forgetting names rarely foretells dementia, and many old people who describe themselves as forgetful have a well-functioning memory when tested objectively. But claims that food supplements, enriched environments or computer training programs can halt the natural process of harmless age-related forgetfulness are hokum. “Anyone who thinks that such tricks ... can actually give them a better memory probably also thinks they would be able to walk better if they used a walking frame,” notes Draaisma.

For many, *The Nostalgia Factory* will be what Draaisma refers to as a ‘decisive’ book, one that changes one's perspective on life. Or maybe that would be true only for the young? Because in this book we also learn



The Nostalgia Factory: Memory, Time and Ageing
DOUWE DRAAISMA
Yale University Press:
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about the ‘reminiscence-curve bump’.

Modern psychological research into reminiscences uses cue words — such as ‘flag’ or ‘circus’ — to prompt memories in elderly people, and researchers then date these to the year they happened. The number of memories recalled for each age, beginning at age three or four, follows a predictable

pattern. Numbers rise to a peak at around 20 years old, then fall rapidly, flattening out at an alarmingly low level well before middle age. The curve rises again in later life, when people recall things simply because they happened recently. Middle age barely registers.

So it is not surprising that most people, if asked to name a decisive book, cite one they read before they were 23 — a time they will also describe, unprompted, as ‘their era’, when pop music was best. Its reflection can be seen in almost all autobiographies. In *Peeling the Onion* (Harville Secker, 2007), Nobel-prize-winning author Günter Grass devotes the majority of pages on the first 30 years of his life to those between the ages of 17 and 21.

Draaisma argues that the bump in the reminiscence curve has less to do with the ability of the young adult brain to store memories efficiently and more to do with the quality of memories accrued as we set out on independent adult life. Indeed, the bump advanced by more than a decade in a study of people who had migrated in their mid-thirties. Sacks, who emigrated from England to the United States in the 1960s at the age of 27, muses in his conversation with Draaisma that when he recorded his own year-by-year reminiscences during long driving trips, his tapes for the 1970s overflowed, but thereafter the length of the tape “decreased almost linearly”.

Rigorous psychological research into the reminiscence phenomenon, whether healthy or distorted, is relatively new. This short book shows that it can reveal much about who we are at different stages of our lives. ■

Alison Abbott is Nature's senior European correspondent.