

Paul Murdin

## Data, information and science

I was one of almost half the IAU General Assembly that voted against the IAU resolution initiated by Elizabeth Griffin in Manchester in August 2000. The reason I did so was that the proposal, cogently explained in the accompanying article in the last issue of *A&G*, was both too broad (in asking for all astronomical data to be archived digitally) and too specific (being focused on the conversion of photographic material), as well as being impracticable and not focused enough on specific science goals.

The idea of astronomical archives is a good one in principle and there are several examples of archives that have been powerful tools in generating new science. The IUE archive, for example, delivers ultraviolet spectra into the hands of the community at the same rate that the satellite itself used to do, and papers frequently appear that are based on the archive. Other space missions like ISO and XMM have and are completing similar archives. Ground-based telescopes – especially those that have contributed large quantities of survey data, like the UK and ESO Schmidt telescopes – also provide archives that are in constant use, and their photographic archives are being converted to digital form. The output of data lists – galaxies, clusters of galaxies, stellar populations, objects of different colours (low-resolution spectroscopy) – is impressive and of great scientific value.

On the other hand there are lots of examples of archives whose use has been at a low rate. A generation ago, I laboured myself at the RGO measuring some of the century-old *Carte du Ciel* plates that were stored in the archive there and comparing them to repeat photographs taken with the same instrument. This was to establish the angular motions of selected objects such as RR Lyrae stars. Now, the Hipparcos satellite's great accuracy in measuring angle on the sky and thus its measurement of proper motions more than makes up for the 100-year baseline between the photographic plates. The *Carte du Ciel* plates, and others in the collection, were transferred with the RGO to Cambridge and on its closure were stored by PPARC in air-conditioned vaults. There has been just one scientific-based request for items in the

RGO archive in the past four years and no more than a handful while the plates were in Cambridge. Every time we – astronomers, funding agencies – spend money on something that is not well used we fail to support something that could be scientifically productive.

Elizabeth Griffin argues that virtually all analogue astronomical data (photographic archives) should be made digital to keep them widely available, indefinitely. Digital archives are vulnerable to technology evolution on a scale of a few years. Will CD-ROMs really last "forever" as the advertising literature claims? And what about the technology available to read them? Space mission archives are by their nature digital. But to preserve the readability of the Hipparcos catalogue, it was published not only in digitally readable form but also as paper catalogues – the only way that it could be guaranteed that they could be read a century from now. These considerations argue for a focused digital archiving project that will be milked for its scientific potential and then end.

I support Elizabeth Griffin's proposal to the degree that the archives that would be produced are scientifically based. The IUE archive, for example, is unique in its wavelength coverage and its volume; the objects that it observed include some of the most interesting in the universe, and the data in the archive is readily interpreted because they are stored in calibrated form. The archive has a history establishing its scientific use. An archive of data, based on all sky surveys, relating calibrated images of the sky in various wavebands and spectral resolutions, with the temporal dimension, would also be a powerful research tool, judging by the science output from similar, smaller archives. This is one of the concepts underlying the Virtual Observatory being developed now.

There is sense in the funding agencies' approach, which is to foster the preservation of older material but support such development only if aimed at research that, through peer review, is shown to be of higher scientific priority than everything not funded. Data is not the same as information and information is not the same as science: that is an ascending order of value. *Paul Murdin, PPARC, Swindon.*

M T Wright

## The Antikythera Mechanism

Edmunds and Morgan (*A&G* 41 6.10–6.17) base their account on that of Price (their reference: de Solla Price 1975). They mention a paper by my co-worker (Bromley 1986) which, with further articles in which he developed these ideas (Bromley 1990 *Horol. J.* 132,12 412–415; 133,1 28–31; Bromley 1990 *Antiq. Horol.* 18,6 641–652) were also based on Price, as are all modern accounts.

Readers may wish to know about the subsequent and continuing work by Bromley and myself, which will oblige all who are interested in this mechanism to trust less implicitly in what Price wrote. Our work began with my misgivings about Price's treatment, which arose in the course of my involvement from 1983 in work on another early geared device of astronomical interest (Field and Wright 1985 *Ann. Sci.* 42 87–136; Field and Wright 1985 *Early Gearing The Science Museum*; Wright 1990 *History of Technology* 12 65–102).

Our work includes: visual re-examination of the original fragments including careful measurement; simple and stereographic-pair photography; extensive new radiography including stereographic pairs and series of tomographic exposures. An epigrapher also studied the inscriptions.

This material is as comprehensive as could be got at reasonable expense and under the conditions that could conveniently be made available by our kind hosts in Athens, and our analysis continues. We have already announced early findings in print (Wright, Bromley and Magou 1995 *PACT* 45 531–543; Wright and Bromley 1997

*Current Work on the Antikythera Mechanism* Proc. conf. Ancient Greek Technology, Thessaloniki 19–25), and discussed them elsewhere. Our significant point is that the detail of Price's reconstruction must be abandoned; it is not well supported in important respects and there is evidence of features that cannot be made compatible with it. Devising a new reconstruction is, however, much harder.

Professor Bromley's objection to Price's reconstruction is based on a well-developed sense of what is practicable. In no working reconstruction that I have seen has any attempt been made to reproduce in detail the probable proportions and methods of mounting and guiding of the moving parts, which would work less freely than modern arrangements. Price's scheme is incomplete and any additions would exacerbate the problem. We have considered the possibility that the Mechanism could have exhibited planetary motions, whether by a mechanism similar to that used by Giovanni de Dondi, as suggested by Edmunds and Morgan, or in some other way; but we have been more inhibited by an appreciation of the limitations imposed by space.

It is surprising that Edmunds and Morgan do not mention our work, since the communication that they acknowledge was a telephone conversation between Prof. Edmunds and myself in which I outlined it.

Finally, the reference by Edmunds and Morgan to Field and Wright 1996 is in error; the chapter in question was written by Dr Field alone.

*M T Wright, Curator of Mechanical Engineering, The Science Museum.*

Mike Edmunds

## In favour of scepticism

I am delighted at Michael Wright's scepticism about Price's reconstruction, which we share. Our problem was that (so far as we are aware) no full and detailed results from Wright and Bromley's investigation (other than reports of work in progress) have yet been published. Detailed measurements and complete data are desperately needed – indeed modern tomographic imaging could revolutionize the interpretation of the device. I would

plead (and have proposed to the Greek authorities, with Greek collaborators) that such imaging should be carried out with state-of-the-art equipment – Wright and Bromley's radiographs were taken over 10 years ago.

The data would be immediately released into the public domain, and allow the speculations of us all to be tested and developed.

*Mike Edmunds, Department of Physics and Astronomy, University of Cardiff.*