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Historians and Astronomers: Same Pursuits?

JOSHUA B. STEIN

It is a truism that historians look to the past for justification of their existence, their *raison d'être*, and the astronomers are on the cutting edge of that which is new and exciting. But the reality is that historians provide (admittedly very imprecise) forecasts of the future. Astronomers plan trajectories for rockets to Mars and beyond the solar system, preparing us for the eventual life in space, sometime in the future, but every time they look through their telescopes or read their computer printouts of cosmic and radio waves, they are looking deep into the past. The nearest star's light took four years to arrive here; Deneb's took 1,600 years; the nearest large galaxy is 2.2 million lightyears away; light from quasars takes 15 billion years to arrive. Clearly astronomers are looking deeply into the past, asking, «how did it all begin» and like historians, they speculate, «how will it all end». This and other relationships between astronomical scientists and humanistic historians are explored in this chapter.

George and Nick: Polar opposites?

EDWARD ALBEE'S *Who's Afraid of Virginia Woolf* is a brutally intense Greek tragedy set in mid-twentieth century New England. It stars Zeus as George the historian, Hera as Martha the conniving shrew, Prometheus as the scientist Nick, and Humanity as Honey, failed experiment. George, a terminal Associate Professor despite marrying the daughter of the college's president, explains to the wife of a young, eager, on-the-make biologist colleague that, «It's very simple When people can't abide things as they are, when they can't abide the present, they do one of two things ... either they turn to a contemplation of the past, as I have done, or they set about to ... alter the future» through science. As it turns out, neither the historian nor the scientist has been honest about the past, that they barely understand the present, and that the future for both of them is very dim.

It is a bleak portrayal. The accuracy of its commentary on life is not what concerns us, though. It is whether George is right – not in the dissatisfaction with the present: all thinking men must be dissatisfied with the present or we would never make any progress. The axiom that «If it ain't broke, don't fix it» does not apply to practicing scholars. It's all broken; it's all in need of fixing. Nothing is ever complete in its perfection. It can always be bigger or smaller, faster or slower, quieter or louder. More precise. Better explained. No, the question George raises is whether scientists and historians are both doing the same thing. On one level, it's obvious we are (I am an historian interested in, though rarely comprehending, science in general, astronomy in particular). We both

seek truth. On the other hand, the truth we seek seems so very different. I look into my documents and my books and journals and try to find out what happened and why, and what its consequences were. Unlike Newton who demonstrated that what happens anywhere in the universe is duplicable anywhere else, I rarely look at one society and say, «This is what happened here, so the same thing must have happened there». I have no control mechanism, as history never repeats itself (despite the conventional wisdom to the contrary). At best, *similar* circumstances recur. Caesar conquered, Clovis conquered, Charlemagne conquered, William the Conqueror (eponymously) conquered, Napoleon conquered, Hitler conquered. But other than the obvious similarity involved in organizing an army, planning a strategy, applying tactics, seeing and grabbing a fortuitous circumstance, all were different in their motives, techniques and ultimate successes or failures. Studying one does not help us to understand or explain the other, nor does the study of any of them predict the future. If people could learn from history, they certainly would – but it seems to be beyond human understanding (as it is presently constituted) to apply the lessons of the past to make consistently successful predictions of the future. It's a great frustration to us.

Returning to Albee's *Virginia Woolf*, at one point George asks the young scientist, Nick, «Do you believe that people learn nothing from history? Not that there is nothing to learn, mind you, but that people learn nothing?» The tacit suggestion is that other than historians, we do *not* learn anything from history other than history itself. At another point George takes a wild guess about

Nick and is correct. «Yes (*Joyfully*) YES! You mean I was right? I hit it ... My God, what archery! First try, too. How about that!» We are not used to being right in our anticipations, unlike you astronomers. Or so you allow us to think. But maybe you are as good predictors as we are. Try the following mind experiment:

You are sitting somewhere (I can not predict where) reading this journal which appeared in your mail (I am guessing). You are probably an astronomer (though I don't know that for sure) and you have for reasons of your own, which I cannot anticipate, chosen to read this article, at least this far. But none of what I have just said may be true. This paper may be the metaphorical tree that falls onto the floor of the empty forest. I will never know; I cannot predict whether anyone other than the editor will ever read these words. I cannot predict whether the editor will accept this article for publication in his journal. Those are my failures to predict. I'm used to it. You make your living predicting. But you will fail too, in a moment. Let me ask you – what will happen in the next twelve seconds?

One ..., two ..., three ..., four ..., five ..., six ..., seven ..., eight ..., nine ..., ten ..., eleven ..., twelve Did you guess that nothing of great importance would happen? And now you are confirmed in your assumption? But what about the «A» people who died, the «B» people who were born, the «C» people who were injured, the «D» people who were healed, the «E» people who were married, the «F» people who were divorced, the «G» people who smiled at a joke, the «H» people who cried at a sad movie, the «I» people who started to read a novel, the «J» people who finished one, the «K» people who plotted to do something awful and the «L» people who prevented them from doing it? Quite a lot happened. Your prediction was no more accurate than mine. An unfair test, you are likely to say, like the silly «think outside the box» messages that flood the internet. You are probably right, but now you know how we feel, stuck in our world of half perceived tricks the past plays on us, we who have no labs to work in, no experiments to repeat, no telescopes with which to peer deeply into the past. When your view of the universe is blurred by a faulty lens you send a shuttle full of repairmen to fix it. Our view of the past is always blurred and we have only our minds and experiences, occasionally some newly unearthed documents, to guide us to a slightly sharper

image. The difference is that I *know* my predictive abilities are nil, you are just finding out. This despite the fact that as a scientist you are trained to predict; you are trained to have controls; you are trained to set up apparatus. The (wise) historian never predicts what will happen in any given circumstance – we leave that to (foolish) «political scientists» and to adherents of the «dismal science» of economics. We have no controls other than the self-imposed one of vaguely defined ethics of not making up our sources, and even that can be compromised to present a distorted view of the truth. You have to have your findings repeated by others; we cannot have ours duplicated, though we must give our sources which can be found wanting, or misapplied. We have no apparatus other than pens and paper (I date myself) and the minds we inherited from our parents, honed (or distorted) by our professors and our experiences. We always look backwards, not like Janus with an eye or two fixed on the future, but always backwards, looking perhaps at the present to explain how the complexity of the past has created the current world, but never looking into the future, not with any confidence at any rate.

Order from chaos

We are jealous of you and fear you. I use George again who tells Nick, the biologist engaged in gene research, of the presumed negative consequences of his work: «History ... will lose its glorious variety and unpredictability ... I, and with me, the ... surprise, the multiplexity, the sea-changing rhythm of ... history, will be eliminated. There will be order and consistency ... and I am unalterably opposed to it». History does not work in patterns, despite Hegel and Marx; it is a disordered collection of singular events upon which we *impose* a specious order, claiming it is real, comforted by the false notion that there is regularity in the human condition that can be understood and used as a guide to behavior. It is a false assumption, but it provides the first true analogy we can make with astronomy. What, after all, did your ancient forebearers in the astronomy business do but look up and see a lion, a bull, a hunter, a goat, a bear (in fact – I use the term loosely – two of them) and two dogs and twins as well? Like us, you (they) created mythical order out of actual chaos. Like us, you are trying to find a grand unification theory to explain the whole universe. Unlike us, you may succeed. We never will. Human beings and their infinite varieties of behavior will never be successfully explained; there are too many variables;

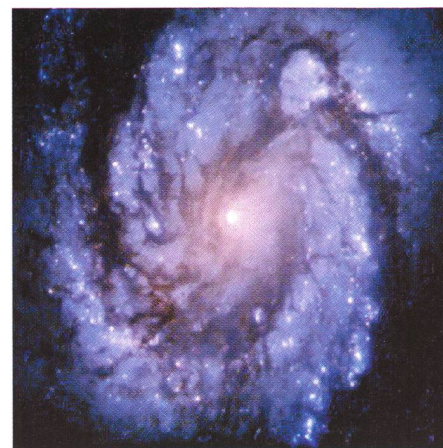


Figure 1: The M100 galaxy as seen by the Hubble Space Telescope before and after installation of the corrective optics. (courtesy NASA)

we will never be able to use our abundant hypotheses to predict the future; they are merely convenient, hopefully correct, guesses about motives, sometimes actions, of the past.

But you are of the future, you think (society thinks). You are at the proverbial cutting edge of knowledge. You prepare us «to boldly go where no man has gone before» though as your publicists split their infinitives you use your eyes and your mathematics to get you there, not (yet) your starships. More than biology, more than chemistry, more than geology, more than physics, you, the astronomer, are taking us into our future, using those other hard sciences as your tools. Some historians, who practice what they call «Big History», want to go with you. They are not content merely to study the actions of humans, they want to explain them based on geologic tectonic theory, or even to the Big Bang to explain the origins of human behavior and to give us hints as to its future development. If nothing else they want to include the Big Bang in their histories as a modern creation myth, something they feel modern societies have written out of their historical consciousnesses to their detriment.

Anomalies as the keys

On the absurd level astrologers predict the future with the same reckless abandon as historians, and with about the same degree of accuracy. On the banal level astronomers predict eclipses, phases of the moon; you discover the rings of Saturn in the seventeenth century and abundant interlocking patterns within the rings in the twentieth. You also find that Jupiter and the other giant planets have rings which can only be seen up close from passing rocket-borne telescopes. You measure the sky

and tell us that this star is 1,000 light years away and that one «only» eight. You give us the distance measured by a light year. You determine magnitude, both apparent and actual. You look for anomalies, and when you find them, you explain them. Galileo did that too. In *The Starry Messenger* he tells us how when he looked at Jupiter early in 1610 through his new apparatus, the telescope, he saw three starlets, two to the east, the other one to the west. What were they? The next time he looked they were all on the eastern side. On another night, there were only two of them, both to the west. Later observations revealed four of these mysterious objects. They could only be moons circling the planet, confirmation, at least to him, that Ptolemy had been wrong – that everything does not circle the Earth. Galileo had seen his anomalies and discovered four new worlds. He looked at Venus and saw that it had phases, like the moon, but unlike the moon it was brightest when at half phase, less bright when full. How to account for this anomaly? Venus, unlike the moon which circles us, circles the sun; when it was closer to us, it was seen as a half illuminated; on the other side of the sun, it was full, but farther away, and so not as bright. In the twentieth century, in 1979, when photographs from Voyager 2 were being studied, hundreds of astronomers had access to these remarkable pictures of Jupiter's environs. However, only two of them, a CalTech professor and his graduate student saw a little blip of light where none ought to have been. Like Galileo, they thought it might have been a background star. No, that possibility was quickly explored and discounted. It could only be one thing, a newly discovered moon of Jupiter. Like Galileo, nearly 400 years earlier, like historians at all times, these two astronomers had seen

something that was not right and did not simply let it go. They explored and discovered truth. They conquered the unknown and gave it order by looking and seeing. Historians also look for anomalies and when found explain them revealing new truth. Lorenzo Valla, the Neapolitan humanist of the fifteenth century read the so-called Donation of Constantine which purported to be the emperor's last will and testament giving to the pope the entire western half of the roman Empire. But the language of the document was of the 8th century, not the early 4th, and so was obviously a forgery.

Looking backwards

I have described the banal activities of astronomers. But you do much more than that. Like us, you look into the past, but much further back than we do. Historians look back maybe 10,000 years to Neolithic times (though we leave most of that to archeologists and paleontologists), 5,000 years back to Sumaria and Egypt. You, on the other hand, peer through your telescopes at stars that may have become a supernova hundreds of years ago, but the light from that explosion has not yet reached us. You look deeper still and find Quasars at the farthest reaches of remotest antiquity whose light left on its intergalactic journey fifteen billion years ago. You look back to see how the universe developed; we look back to see how society develops. But then you look to the future and you predict how the universe will end. We never do that. Like you, we know that nothing lasts forever, but unlike you we have no idea how our current civilization will end, though we have a pretty good guess as to how and why Egyptian, and Greek, and Roman, and Medieval societies gave way to other forces. Will the universe end with cold death as all the stars eventually wink out, or hot death, re-collapsing on itself, perhaps undergoing another big bang? Today's *New York Times* (January 1, 2002) reminds that you astronomers have the courage, and perhaps the tools, to ask the question based on your understanding of the history of the universe until today¹. We historians are satisfied (sometimes amazed) to realize that we understand how the present has emerged.

There is another way astronomy and history run parallel courses. You use what we do to further your own processes. We preserve and some of us interpret the writings of the past, and you read them and study them and begin to realize why what we have done

maintains something true, or flawed, possibly entirely false. Copernicus knew the writings of both Aristarchus and Ptolemy, and that while the former might have been correct, the latter was definitely wrong. Tycho realized that the fixed stars actually move, by comparing his own observations with those of Ptolemy and noticing some discrepancies. Newton read Kepler and Galileo and realized that the planetary motions of the former operated on the same principles as the terrestrial physics of the latter. Without the work of historians who maintained the ancient texts, astronomers would constantly have to re-invent the wheel of the universe. But more important is the astronomers' perception that they must stay in touch with the past in order to proceed into the future, developing new theories to replace or supplement their predecessors'. Historians do the same thing. We study what one scholar has produced in his time and then let our own *zeitgeist* influence our reinterpretation of the same data – or we realize that our predecessors were not cognizant of material we now have and can use to explain the past. Our vanity permits us to expect that we will have the final word on whatever it is we pronounce; I imagine your vanity is of equal measure, and that we are both deceived in equal amounts.

Conflict with authorities

Astronomers sometimes find themselves embroiled in social conflict not of their choosing, sometimes becoming, usually against their wills, martyrs. Perhaps Copernicus was too afraid to publish *De Revolutionibus* because he feared the wrath of the Roman church as he seemed to be defying the Bible, and most definitely Aristotle, both pillars (maybe foundations is the better metaphor) of traditional Catholic religious belief. Certainly his publisher was concerned, appending an unauthorized disclaimer to the effect that none of what was written was to be taken as truth, merely as another way to «save the appearances». Giordano Bruno, an astronomer and philosopher who believed the Copernican theory (as well as that the stars were suns and that there might be an infinite amount of «earths» in the heavens) was burned at the stake in 1600. Galileo, after swearing not to teach the Copernican theory as fact narrowly escaped Bruno's fate when he mocked the Ptolemaic system in his *Dialogue Concerning the Two Chief World Systems*. Placed under house arrest in 1633, he was forbidden to teach. He did have visitors, however, including the

Englishmen THOMAS HOBBS and JOHN MILTON. Whether Hobbes objected to the treatment of Galileo, I do not know, but Milton certainly did. In his *Areopagitica* of 1644, his lavish condemnation of press censorship, the poet/essayist/politician tells of his conversation with the imprisoned Italian astronomer/physicist/gadfly. In essence Galileo says he admires England, where a man can speak the truth.

That astronomers could feel the heat of the Inquisitor's fury means that what they were doing in their observatories and with their mathematics was very relevant to the world in/on which they lived, that their discoveries were life and death matters, not only in the pragmatic fields of determining longitude, but in the intellectual world of what is truth and who holds it in his hands. Until the scientific revolution, which so much depended on the work of astronomers, the answer to that question was the «Church knew the truth», having received it from God directly or through intermediaries. When Galileo dared to instruct priests in how to interpret Scripture in his *Letter to the Grand Duchess Christina* (written in 1615, but not published until 1635), his fate was sealed. In this letter Galileo is acting as an historian. While he does not deny that Scripture is Divine revelation, he does deny that it is to be taken as a scientific handbook. It was written in the language that the ancient Jews would understand, not only in their Hebrew tongue, but also with concepts that would not strain their unsci-

¹ The news is not good. The universe began 15 billion years ago, or so. A billion years later the first stars emerged. Five billion years ago the Sun was born, followed 5 hundred million years later by the birth of the Earth. That's history. Using that knowledge astronomers speculate that in 2 billion years the Sun will warm to such a degree that life on Earth will be inhospitable. In 5 billion years the sun will swell up and die, in the process incinerating Mercury, Venus and the Earth. At about the same time, if this were not bad enough, the Milky Way will collide with the Andromeda galaxy. In 150 billion years most galaxies will have moved so far away from each other that none will be visible from any others. In 2 trillion years interstellar gas and dust will be exhausted so that no new stars will be created. In 10³⁰ years galactic cores will collapse into black holes. In 10⁶⁴ years black holes with the mass of ordinary stars will explode. In 10⁹⁸ years black holes with the mass of whole galaxies will explode. All remaining stars in the universe will decay to iron in 10^{1.500} years and finally in 10¹⁰ (and 75 additional-zeros) iron objects will collapse, emitting bursts of X-rays and high-energy particles. It's a very gloomy prospect.

entific perspective. Had God or his prophets said the sun is stationary and the earth rotates on its axis while traveling around it every year, the Jews would not have believed Him and would have rejected His truth. Galileo does not condemn the Jews of antiquity; he does not mock them; he tries to understand them. This is exactly what an honest historian does when he studies an ancient civilization. We don't come, see and conquer; we come, see and try to understand.

The present is the past – and vice versa

Neither astronomy nor history studies reality as it is now, but as it was a long time ago. Sometimes we each reverse the process – imposing on the past or the future what it is we know of the present. This is not necessarily a bad thing to do. The present does inform us of the past. Astronomers look at the

present geologic, physical, chemical nature of the world we live in and, following Newton's instructions, peer out to the remotest points their telescopes can reach. A spectroscope on earth tells the scientist what elements make up a compound in his lab, and then he attaches one to his telescope and looks deep into the past to determine what elements make up the nature of the distant sun he is studying. When last year and for decades before I taught the English Civil War and Cromwell's Commonwealth I favored the actions against the monarch. In the post September 11, 2001 world I see the parallels between the Taliban and the Puritans, and I'm no longer so confident of my approach. Both the astronomer and the historian observe the here and now and apply it to the there and then.

The historian looks for traces of the past as they altered mankind's billions of presents; the astronomer studies light

emitted billions of years ago just now reaching us in our present. The difference is that while astronomers use the light of the past to trace back to the beginning of time in an effort to see into the remotest future, historians use what has been to understand our ancestors and ourselves. Yours is the more galactic, ours the more prosaic search, but in the end, as Albee's George, played by Zeus, reminds you, you live in our world after all. As he asks Nick, the scientist, «But you *are* going to have kids ... anyway. In spite of history». In spite of history, in spite of predictions of the cold death the universe faces, we – you the astronomer, I the historian – live in history, are part of it; we are condemned to it; we make it; we are made by it.

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The following article is reproduced, with permission from the author and the publisher, from the third volume of the series of books entitled «Organizations and Strategies in Astronomy», in short OSA Books.

Those volumes, edited by Andre Heck and published by Kluwer Academic Publishers (<http://www.wkap.nl/>) in their Astrophysics and Space Science Library series, cover the following fields/themes (random order):

- characteristics of astronomy-related organizations,
- recruitment and promotional policies,
- economy of activities,
- publishing and communicating procedures,
- interactions with other communities and society at large,
- evaluation processes (proposals, individuals, institutions, etc.),

- series of astronomy-related conferences,
- sharing personal experience,
- or, more generally, the sociology as well as the contemporaneous history of the astronomy community.

Additional issues are also of interest, such as:

- the definition of quality research and its evolution over time,
- the distinction between trendiest and best science,
- the authorship of contributions versus actual work,
- the links between creativity and career,
- the relationships between administration and research,
- the disparity and evolution of contracts and salaries,
- the management policies of big projects, of large institutions, of international consortiums,

- the modulations by national and/or regional specificities of various issues above,
- and so on.

In practice, all aspects of astronomy-related life and environment could be tackled in the spirit of sharing specific expertise and lessons learned.

The tables of contents of the two volumes published so far can be found at

<http://vizier.u-strasbg.fr/~heck/s1toc.htm>

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<http://vizier.u-strasbg.fr/~heck/s2toc.htm>

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The table of contents of the third volume that will be published in Fall 2002 can be found at:

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