

Fictional explorations of astronomy: how to reach the parts other narratives miss.

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Abstract

In this paper I look at the way that astronomers report their work, and attempt to show that this reporting necessarily leaves out important aspects of how that work is done. I argue that literature can investigate aspects of astronomy in ways that scientific reports are not always able to do. Literature can look at how and why astronomy is done, and what impact it can have at a human level. And it can also be used to communicate the processes of doing astronomy to a wider audience.

Let's start with examining the way that astronomy is usually reported, through formal scientific papers mostly published in peer-reviewed journals. The ostensible aim of these papers is to present a problem and a solution. The solution can be found through experiment, or through theory. The solution can actually be a sort of anti-solution, in that it can rule out existing solutions and not actually postulate anything to replace them.

Scientific papers have elements in common with a detective story. The problem is set up and defined in the opening paragraphs, the preferred approach to solving the problem is explained, the results of that approach are presented and analysed, and the outcome is identified and discussed, along with the resulting impact on the existing science, and possibilities for future work. There is a clear and logical sequence to the events and an implicit chronological structure. There is a beginning and an end. Hey presto – we have a narrative.

But note the following excerpts from papers published in astronomy journals:

- 'A recalculated value of the mass of Ceres is presented.'¹
- 'A sample of 87 quasars were chosen at random...'²
- 'Observations of 0217+70 were made with the NRAO Very Large Array (VLA).'³
- 'The data were calibrated...'⁴
- 'Absolute visual magnitudes were calculated...'⁵

There is a ghost in this machine. Where is the narrator? He or she has been banished through the use of the passive voice. In all of these excerpts, the writers have absented

¹ Kovacevic, A.B., 2012

² Goldschmidt, P., Kukula, M.J., Miller, L., Dunlop, J.S, 1999

³ Brown, S., Duisterhoeft, J., Rudnick, L., 2011

⁴ Mason, B.S., Leitch, E.M., Myers, S.T., Cartwright, J.K., Readhead, A.C.S, 1999

⁵ Faber, S.M., 1973

themselves. So the reader is faced with a curious inevitability to the whole affair, as if events have unfurled like clockwork.

This tradition of using the passive voice may have developed to encourage a belief in the universality and objectivity of the actions and results being reported. If the individual is not present in the work, then there can be nothing subjective in the findings, or nothing specific or unique in the doing of this piece of work by these particular people.

Now note these excerpts, also taken from papers published in astronomy papers:

- ‘We present a model for star formation and supernova feedback.’⁶
- ‘We achieve photometric redshift accuracies competitive with other ... techniques.’⁷
- ‘We use semi-analytic techniques to study the formation and evolution of brightest cluster galaxies.’⁸
- ‘We present an analysis of the host properties of 85,224 emission-line galaxies.’⁹
- ‘We show that disks heated primarily by external irradiation always satisfy the standard cooling time criterion.’¹⁰
- ‘We discovered a previously unknown M-star companion to HD 1051.’¹¹
- ‘We examine how the time variation of the gravitational constant influences the variation of the orbital elements of planets.’¹²

Here, instead of the passive voice; the collective voice is being used. Quite often, the collective voice is used in the abstract of the paper, and the passive voice is used in its main body. Does this use of the collective voice help stamp authority on the reported work and findings?

So, as a result of the use of these grammatical structures; the interior background to the work, including the interaction between the individual authors and their world, cannot be fully explored. If Dr Nobody or Dr Us is reporting this work, then which individuals made the decisions? It means we can’t fully understand the choices made by the narrator because they can’t discuss themselves. And if the choices are not scientific they become invisible in the traditional scientific narrative.

Does popular science do any better? We might assume that it’s not as constrained as more formal papers. The following are examples taken from the reporting of science on various news websites;

- ‘scientists are to expand a clinical trial of a new malaria vaccine.’¹³

⁶ Springel, V., Hernquist, L., 2003

⁷ Geach, J.E., 2012

⁸ de Lucia, G., Blaizot, J., 2007

⁹ Kewley, L.J., Groves B., Kauffmann, G., Heckman, T., 2006

¹⁰ Kratter K.M., and Murray-Clay R.J., 2011

¹¹ Rodriguez, D.R. and Zuckerman B., 2012

¹² Li, L., 2012

- ‘scientists track falling satellite.’¹⁴
- ‘scientists have created autistic mice that could help unlock the riddle of the increasingly common condition’¹⁵
- ‘A team of Russian and American scientists will set off on an expedition this week to try to solve the mystery of the Abominable Snowman’¹⁶
- ‘Scientists have detected higher than expected energy emitting from the Crab Nebula.’¹⁷

You can see that language is not exactly used to its fullest effect here. The people responsible for all these different activities and experiments don’t even have proper job descriptions, they’re all lumped together under that generic term ‘scientists’. They’re rendered anonymous, faceless white coats.

Apart from some fine individual examples of biographies of famous scientists, in most popular science there is little interest displayed in the humans behind the work.

Why is this important? It means there are gaps in the narrative. And these gaps are human sized. As an extreme example, a purely scientific account of Galileo’s observations of the moons of Jupiter cannot show one of the most revolutionary aspects of this discovery; what the destruction of the Earth-centred model of the Universe implied for the all-powerful religious authorities of the time.

Can literature do any better? If so, why? Because, even if there is no science overtly in the text, there may be similarities between what motivates a writer and a scientist. And that desire lies in not knowing, and wanting to know, the outcome to an initial set-up. Writing a story entails following the logic implicit in the set-up. For example, the premise of *Madame Bovary* can be expressed as the following:

What happens if a young woman becomes bored with her life and takes a lover or two?

The set-up of *Timescape*, the science fiction novel by Gregory Benford, can be expressed as: What happens if people are able to transmit warnings back to the past about impending ecological disaster?

Literature can be considered to be a type of thought experiment¹⁸, and just like scientific thought experiments, they’re another way of testing out hypothetical scenarios. And as I said earlier, even formal scientific papers rely on a narrative structure, in the way that literature does.

So, there are aspects in common with both science and literature. Let’s look at how literature can investigate science, and what this investigation can uniquely add to our understanding. For example John Banville’s two novels about Copernicus and Kepler

¹³ Matt McGrath, ‘Malaria vaccine trial raises hope’

¹⁴ Ian Sample, ‘Scientists track falling satellite expected to hit Earth this week’

¹⁵ Fiona MacRae, ‘Scientists create world’s first autistic mice in bid to unlock riddle of condition’

¹⁶ Anon, ‘Scientists set off to find the abominable snowman.’

¹⁷ ‘TWS Space reporter’, ‘scientists detect ‘stunning’ energy gamma ray emission from Crab Nebula.’

¹⁸ Swirski, P., ‘Of Literature and Knowledge’, 2007

attempt to situate these astronomers' discoveries in their lives and explain where their discoveries came from. They imagine an answer to the question 'what was it about these men's characters and lives that made them see the universe in such revolutionary ways?' The novels can inhabit real characters, invent new characters, and fill in the holes of imperfectly documented lives, so the reader feels they can understand the reasons behind the discoveries. Literature's liberty to explore lives without being tied to documented facts may mean the end results are not historically true. But they can be psychologically true.

We'll never know if Banville's account of how Kepler came up with his laws of planetary motion is the way it actually happened, but thanks to Banville's ability as a writer, when we read his account we believe it might have happened in this way, and that allows us to think about Kepler and his work in a more concrete way. Literature makes science human-sized, shows us how and why humans engage in science and what their concerns are with it, and how it impacts on them.

One of the most powerful tools that literature uses to make concepts tangible is metaphor. For example, here is Banville's Kepler musing on Copernicus' heliocentric model, and its inadequacies in its reliance on epicycles and equants:

*It was as if the master [Copernicus] had let fall from trembling hands his marvellous model of the world's working, and on the ground it had picked up in its spokes and the fine-spun wire of its frame bits of dirt and dead leaves and the dried husks of worn-out concepts.*¹⁹

And here is Kepler shown to be spurred on by the desire to find harmony in the seemingly chaotic observations bequeathed to him by Tycho Brahe:

Troubled by an inelegance in the Ptolemaic system, Copernicus had erected his great monument to the sun, in which there was embedded the flaw, the pearl, for Johannes Kepler to find... Harmony was all. And harmony as Pythagoras had shown was the product of mathematics, therefore the harmony of the spheres must conform to a mathematical pattern. [ibid]

Here the flaw in the Copernican model is compared to a pearl; and not only is this biologically accurate, it's also a powerful way of illustrating the value to Kepler of finding this flaw.

Banville's Kepler is motivated by a desire for symmetry and simplicity in the same way that a modern astronomer might be, but what gives us pause for thought is the fact that this desire is expressed in very different ways. For example, Kepler is desperate to link the relative distances between planets to other patterns found in nature, such as musical harmonics, or the relative sizes of Platonic shapes. Having this brought to life by Banville beautifully illustrates two ideas:

1) are Kepler's apparently misguided attempts to identify order and patterns in the universe in any way similar to contemporary scientific work and;

¹⁹ Banville, J., 'Kepler', 1981

2) even though the initial premise behind Kepler's work looks misguided, the outcome is correct. Kepler's laws are empirically valid.

I think literature's ability to link science with humans is especially important for those scientific disciplines which aren't human-sized to start with, such as astronomy, or geology, or nuclear physics. It's difficult to imagine a successful novel about atoms unless you humanise them, but you could write a novel set in CERN. The challenge is always to make sure that the science is integral to the plot and not just there as high-concept decoration.

So, is literature just experiment? Is it totally synonymous with science? Is all we're doing when we write fiction simply experimenting in a made up world?

There are differences. Some of these differences lie with the reader.

When a writer of literature writes, they set up the initial conditions of their thought experiment. They may or may not describe the outcome or interpretation of that experiment. But regardless of how specific they are about the outcome, it is always incomplete, until the reader or audience 'experiences' the experiment and comes to their own conclusion.

This conclusion may not be what the author anticipated. And unlike the scientist, the author may not want to anticipate any specific reading of their work. Because of this incompleteness in the work, the reader is as essential as the writer to the overall process of carrying out the experiment.

This is different to the ostensible aim of the thought experiment in science in which the experimenter is aiming for a clear result. Indeed, this incompleteness in literature is probably essential to its success. Let's look at a counter example, at what can happen when things start to get too assertive. The playwright Brecht rewrote his famous biographical play, 'Life of Galileo', several times. The first version, written in the late 1930s, shows Galileo as a wily old man by the end of the play, publicly telling the Catholic Church and its inquisitors what they want to hear, but only as a strategy for survival so that he can secretly carry on with his work. In this version, he's a typical Brechtian anti-hero, fully able to subvert the power of the authorities for his own purposes.

The second version of the play was written when Brecht was in America at the end of the war, at the time when the atom bomb was dropped. The work of the Manhattan Project, which had until then been secret, became public. In response to this, Brecht rewrote the play to show Galileo as someone who recants his life work, simply out of fear of the Inquisition. Even when other characters in the play attempt to put a better gloss on his actions, he corrects them and says he was afraid of being tortured, and that is why he gave in. In this version Galileo has a long speech at the end of the play in which he says; *'Science's sole aim must be to lighten the burden of human existence. If the scientists, brought to heel by self-interested rulers, limit themselves to piling up knowledge for knowledge's sake then science can be crippled and your new machines will lead to nothing but new impositions. Your cry of triumph at some new achievement will be*

*echoed by a universal cry of horror. As a scientist I had a unique opportunity. Had I stood firm the scientists could have developed something like the doctors' Hippocratic oath, a vow to use their knowledge exclusively for mankind's benefit.'*²⁰

So the moral of the story has completely changed in this version, from 'subvert the authorities in any way possible, or the ends justify the means' to 'behave in such a way as to set an example to others, or the means are all-important'.

Obviously a character's beliefs are not necessarily synonymous with those of the author. But it is clear that the speech I've just quoted was written by Brecht in response to his horror at what scientists had created in Los Alamos. However, Brecht damages his argument through its reliance on polemic. His attempts to force the audience to come to a particular conclusion risk making the narrative too mechanical. We stop believing in the inner lives of the characters. This didn't bother Brecht, but it should have. Because when literature becomes so categorical and assertive there is a danger that it can be used for the same political ends that it accuses science of.

Doesn't science require the same certainty as propaganda? Isn't the purpose of a scientific text to convince the reader that there is only one interpretation?

This may indeed be the purpose of the writer, but the reader is free to reject it. There is a difference between the ostensible aim of scientific writing and its reception. In practice other scientists read scientific accounts in order to test them, to pick holes, to find the gaps in logic, and the uncertainties in the data. These gaps are essential – out of these gaps spring the new work.

However, even if the literary experiment fails in some ways, it can still be said to succeed in its ability to communicate. Almost by definition, a literary work on science reaches out to new audiences.

To summarise, I've attempted to show that literature is a valid way of investigating science and should be seen as complementary to scientific descriptions of the world. Conversely, science has great potential for helping literary writers to define their universes.

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