OPERA: HISTORY OF SCIENCE

Nevertheless, It Does Move Us

Jay M. Pasachoff

Although most readers of *Science* are more familiar with apoptosis than apotheosis, it is the latter that is the subject of the latest work in composer Philip Glass's minimalist oeuvre. One of this year's Nobel Prizes dealt with apoptosis, but Galileo also remains contemporary. The themes of his life, scientific work, and clashes with the Roman Catholic Church are woven into the long-discussed conflict between science and religion and are still relevant in our times.

Galileo Galilei
Philip Glass, composer
Libretto by Mary Zimmerman with Philip Glass and Arnold Weinstein
Brooklyn Academy of Music, New York, 1 to 5 October, 2002.

Galileo Galilei is a 21st-century opera, played in nine scenes and an epilogue. The libretto traces his life backward. It starts with old, blind Galileo singing to his deceased daughter, Maria Celeste, in Arcetri near Florence on 8 January 1642, a time close to his death. The major theme is the irony implicit in the blindness of the person who, by first turning the telescope toward the heavens, has seen so far. The magnificent set for the Brooklyn Academy of Music production includes Florentine buildings to the sides of the stage and a backdrop, during the first scene, with a round projection at the left and old constellation figures labeled in German at the right. (Bayer's atlas of 1603, with superior figures, might have been a more suitable source for these constellations. The Harvard-Smithsonian historian of science Owen Gingerich, who accompanied our party, thinks the left portion of the backdrop may have been adapted from a 1617 book by Robert Fludd that links music theory and the sky.) Occasionally, the text being sung appears projected on the backdrop, in lieu of supertitles.

Here and throughout, the characteristics of *Galileo Galilei* qua opera stand out. Glass, perhaps best known to scientists for his earlier opera *Einstein on the Beach*, writes consonant but unexciting music. It is very repetitive, and almost the whole opera is sung as recitative. Though not unpleasant to listen to, the music never soars and there are no memorable melodies. Even *The New York Times* reviewer wondered why Glass's music hasn't advanced much over the last 20 years (*1*). Nonetheless, the composer has his fans. The ontological question is therefore "what is an opera?"

It is thus Mary Zimmerman's work rather than Glass's music that makes the evening memorable. As director, she is responsible for the production, which debuted in June at the Goodman Theatre in Chicago and still includes many Goodman personnel. (Daughter of a physicist, Zimmerman prepared a well-received stage version of *The Notebooks of Leonardo da Vinci* for the Goodman in 1993; her new production of that work will appear at the theater next spring.) It is as a visual feast that *Galileo Galilei* succeeds. If one could not attend, a video without sound would still be of interest, whereas a CD of the music would slip into the background for all but Glass aficionados.

On trial. Galileo in front of the Inquisitors, from the Brooklyn Academy of Music production of *Galileo Galilei*.

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In the first transition of scenes, Galileo wonders whether his blindness was divine punishment. The setting shifts to the tribunal of Cardinals at which Galileo famously repudiated his 1632 book, *Dialogo sopra i due massimi sistemi del mondo*, translated as the *Dialogue Concerning the Two Chief Systems of the World* (*2*). The Cardinals sing that "he was told his book of Dialogues, / That preach theology in the name of science / Would be forever banned." Galileo renounces his book, singing of "the false / Philosophically corrupt opinion that / …the Earth moves."

In the *Dialogo*, Galileo made the tactical mistakes of writing in vernacular Italian instead of Latin and of putting the most simplistic arguments in the mouth of a character called Simplicio. Unfortunately, some of Simplicio's remarks were readily identifiable as the opinions of the current Pope, who had formerly been friendly to Galileo. In the opera, after Galileo's renunciation, the Pope takes him aside and reminisces about a visit that Galileo and Galileo's daughter once made to his villa while he was still a cardinal. The reminiscence brings us to a scene in which Galileo joins his daughter outside her convent. The relationship between Galileo and his daughter was recently made famous by the bestseller *Galileo's Daughter* (*3*) by Dava Sobel, another member of our party at the opera. We were curious whether Sobel deserved some credit for the seeming coincidence of a lead role for Galileo's daughter, something that had been denied in print. Sobel explained that other, earlier accounts provided the librettists with enough information about Maria Celeste to create their character.

In the next two scenes, we witness Galileo undergoing his interrogation by the Inquisition. Here, Galileo tells the Inquisitors, "The Bible is a book about how to go to Heaven, not how the Heavens go." Zimmerman, in a director's note, points to this idea's significance and relates it to scientific inquiry as "an act of sustained, intense attention, which is another way of saying an act of love." Then, inventively, we see an enactment of part of his *Dialogue*, with the philosophers Salviati, Sagredo, and Simplicio arguing whether the Earth moves. If the Earth moved, asks Simplicio, "How could the birds of the air keep up? Would buildings sway?"

The inventive delight increases in the next scene, after we jump back chronologically quite a distance to find a young Galileo (played by a different actor) and his assistants happily carrying out experiments with inclined planes. In a change from Glass's repetitive background chords, the music and the staging (with the quasi-dancing and posing of the assistants carrying the planes in and the timing of rolling balls) was charming. Too bad for us scien-

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tists that the spacing between the bells that rang as the balls descended past them looked fairly uniform. They should have been placed to demonstrate the dependence on the square of time that is necessary to provide the steady beat of the tinkling provided by the orchestra. (Interviews that Glass and Zimmerman have given show both were aware of the effect of uniform sounds, having run into it at the Museum of the History of Science in Florence.) Would that C. P. Snow's cultures of science and the humanities respected each other by avoiding such minor errors. Glass, indeed, has himself decried the "schism between scientists and artists."

Similarly, the disruptions in chronology that the opera uses to fit in Galileo's physics experiments were bothersome to those knowledgeable about his life. After watching the Cardinal in his garden give Galileo a letter of support (which we have already seen rejected by the Inquisition), we jump to a young Galileo (*4*) and his daughter in church noticing (and timing with a pulse) the constant period of the pendulum traced out by swinging lamps. That observation is something from 1581, almost 30 years before Galileo's telescope work, which appears in the next scene. There we see Galileo, in a stately home presenting one of his telescopes on a stand (which has been at stage right throughout the opera) to three aristocratic or royal women. Oh, for the aria of a soprano at this point!

In the epilogue (which joins the inclined-plane scene as one of the opera's delightful musical highlights), one of the duchesses and Galileo remember themselves as children. The boy (the third actor to play Galileo) and the child who would become the duchess sit on the floor and watch a performance of a fictitious opera by Galileo's father, Vincenzo. A giant moon—though not one of the images Galileo later drew through his telescopes—forms the backdrop behind the stately home. Vincenzo's supposed opera tells the story of Orion, known for hunting the Pleiades and still a hunter as a constellation in the sky, and Merope, now in the sky as one of the Pleiades. The theme of blindness reappears, as Orion is blinded by Merope's father and later healed by the goddess of the dawn. (Zimmerman is well versed in mythology; her version of Ovid's *Metamorphoses* is a long-running success in Manhattan.) The music at this point brought to my mind a circus melody. The joy of the background performance, and the recreation of what Vincenzo's music might have sounded like, made the production deeply pleasurable. Indeed, the trend from unhappy, ancient Galileo to happy, young Galileo is reported to be a major reason for the adoption of the opera's reverse chronology.

Touchingly, the child Galileo rolls up his program to view his father's opera as through a spyglass, foreshadowing the shape and narrow field of view of a telescope (though not, of course, its magnification or its telescoping). We realize that we have been watching the musings of an elderly man looking back on his life. As the opera ends, 95 minutes after it began (with no intermission), we see all the Galileos on stage together. Maria Celeste appears with wings to bring her father to heaven, and all three Galileos follow. The final singing tells about Orion's restoration of sight as he is being made a god in the sky. And we the audience make the inference that the words apply as well to the blind astronomer. (It is moving to think of the elderly Galileo having his sight restored.) In this view, Galileo's apotheosis into the classical pantheon takes place despite his run-in with the Roman Catholic Church.

The story of Galileo retains a resonance for our times. It was retold on PBS's *NOVA* a few weeks after the opera played in New York, in a version openly based on Sobel's book.

Even though the opera's theme is blindness versus seeing, or darkness versus light, and the telescope was on stage throughout, little was made of Galileo's astronomical discoveries. I would have thought them more suitable than the inclined plane and pendulum research that we did see. In addition, the astronomical work has stood the test of time better than some of the arguments Galileo used in the *Dialogo*, and it provided the valid arguments for the Copernican view of the solar system on which we still rely. Albert van Helden's translation of and introduction and notes to *Sidereus Nuncius* (*5*), show the power of Galileo's ideas about astronomy. In this succinct 1610 book, Galileo reports his discoveries of the mountains and maria on the Moon, of the many stars in the Pleiades and Orion, and, most importantly, of the moons of Jupiter; his account should be read by all.

Perhaps we are such a visual culture that even in an opera the music is not especially important. It is Zimmerman's conception and libretto (structured around Glass's idea of the reverse chronology), and the wonderful sets and costumes, that we remember and that make *Galileo Galilei* worthwhile for most of us. Anyone who reads this magazine should certainly try to see this operatic drama when next it is mounted.

References and Notes

1. A. Kozinn, "A Heretical Astronomer Rethinking His Revolution," *New York Times*, 3 October 2002, p. B1.
2. Galileo's works are available in facsimile as well as in rare-book libraries. A beautiful recent edition of *Dialogo sopra i due massimi sistemi del mondo* (Leo S. Olschki, Florence, Italy, 1999) is especially interesting because it includes the marginalia in Galileo's own hand from a copy held by the Biblioteca del Seminario of Padua. The book opens with Stefano della Bella's famous frontispiece that portrays Aristotle, Ptolemy, and Copernicus (drawn with Galileo's face) standing together.
3. D. Sobel, *Galileo's Daughter* (Walker, New York, 1999).
4. Though a professor, Galileo is dressed in ordinary clothes. Even at this early age, his contrariness is apparent, as he ignored laws requiring that he wear the traditional academic gown at all times, on pain of heavy fines. He voiced his objections in a long, satiric poem (1590), which the Italian astrophysicist Giovanni Bignami recently translated and published in a limited edition as *Against the Donning of the Gown* (Moon Books, Milan, 2000); see www.galileounaluna.com.
5. G. Galilei, *Sidereus Nuncius, or The Sidereal Messenger*, A. van Helden, Transl. (Univ. of Chicago Press, Chicago, 1989).

BOOKS: ECOLOGY

It's a Dog's Life

Tim Caro

African wild dogs (*Lycaon pictus*) resemble domestic dogs in appearance, live in packs, hunt large ungulates, are difficult to find, and are highly endangered. All of which make them extraordinarily attractive to tourists visiting Africa, the public in the Western world, and an increasing number of Africans. No wonder there is a raft of popular books about them. Only now, however, do we have the first real scientific treatise on the species. *The African Wild Dog* is jammed full of theoretical background, empirical data, and synthetic discussion by two authors eminently qualified to rise to such a challenge; Scott and Nancy Creel have already published over 20 scientific papers on their subject.

The African Wild Dog
Behavior, Ecology, and Conservation
by Scott Creel and Nancy Marusha Creel
Princeton University Press, Princeton, NJ, 2002. 355 pp. $90, £62.00. ISBN 0-691-01655-0. Paper, $45, £29.95. ISBN 0-691-01654-2.

Focused on 366 wild dogs in 11 packs that inhabit 2600 square kilometers in the northern part of the Selous Game Reserve in southeastern Tanzania, the book is based on field observations gathered between 1991 and 1997. I visited the Selous twice during the Creels's study. The area is extraordinarily tough to work in: steep banks

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