Alden Burgess

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Galileo and the Spread of His Ideas

One of the most famous names in astronomy throughout all of history is Galileo Galilei, the Italian natural philosopher who revolutionized the spyglass and used it to make numerous major breakthroughs in how we modeled the universe. He is most famous nowadays for providing evidence in favor of the heliocentric model of the universe – a movement which brought him under the harsh eye of the Catholic church and eventually led to his arrest. The groundbreaking nature of Galileo's work, while largely due to the merits of the discoveries themselves, can also be attributed to his strategy for presenting his findings. Galileo knew how to impress, but he also knew when to play his cards more carefully. The way he presents his new knowledge largely through observable diagrams backed up by empirical evidence, and his tactic of not stating controversial positives without enough evidence to support his theories, both helped him become more widely known and recognized as a reputable scientific authority. Galileo spread his information through ambitious marketing and careful language, hoping to be accepted in the eyes of his peers, the public audience, and the society of the period.

Galileo's most first and perhaps most famous piece of writing was the Sidereal Messenger, published 1610. The piece described Galileo's breakthroughs following his invention (or more accurately improvement) of the spyglass, including observations of moons circling Jupiter, faint stars that exist behind the layers of visible ones, and irregularities covering the surface of the moon.[1] Galileo was born into a noble family, and thus following his discoveries he

[1] Galilei Galileo in "The Sidereal Messenger", 1610. Translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Company Inc., 2008, p. 83.

sought the patronage of a wealthy family, going so far as to name the moons of Jupiter "the Medicean Stars, after the man whose favor he sought. His flattery paid off, and Galileo quickly became a widely known astronomer and a highly influential figure in the field, due in no small part to the staggering and game-changing nature of his findings.

Most of what Galileo brought to light in "The Sidereal Messenger" was significant because it was so groundbreaking. It is easy to assert that now, looking back on the period as observers, that Galileo's work contributed greatly to astronomy, but even within the actors' time he was making a significant impact. Each discovery he made seemed to upset some previous theory, such as how his observation of shadows on the moon which appeared to be cast by mountains contradicted the previous idea that the moon was a perfect globe of aether. Galileo didn't go so far as to assert that the moon wasn't made of aether[2], but his findings proved the current model incorrect, raised new questions, and eventually led to new theories. It also helped Galileo's case that his discoveries were made following his invention of the spyglass, which in addition to bringing him more recognition as an inventor, allowed others to view the phenomena he described for themselves. He did not have to convince the scientific community that tiny, faint stars existed beyond the ones the eye can normally observe – he could prove it to anyone.[3]

Unfortunately, some of the initial impact from Galileo's findings may have been neutered by censorship. His patrons requested that the particularly controversial information he presented, especially regarding opposition against the geocentric model of the universe, be presented within his writing as non-concrete, or highly theoretical. The hope was to prevent the inevitable

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[2] Galilei Galileo in "The Sidereal Messenger", 1610. Translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Company Inc., 2008, p. 68.
[3] Galilei Galileo in "The Sidereal Messenger", 1610. Translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Company Inc., 2008, p. 65.

resistance that arises when long-standing ideas from well-respected minds are overturned. Patrons of Galileo valued their own reputations, and did not want to be associated with someone the public regarded as ridiculous, or even heretical. Thus, in *The Sidereal Messenger*, when describing the moons of Jupiter, Galileo focuses more on the observations he makes rather than their implications for the geocentric model. He dedicates pages of writing and dozens of drawings to showing that these bodies clearly orbit Jupiter, and then only at the end does he suggest what this might mean[4]. Even then, he does not ever suggest that the geocentric model is incorrect–he only brushes the edge of the issue, suggesting that this is an "...argument to remove the scruple of those who can tolerate the revolution of the planets around the sun in the Copernican system, but are so disturbed by the motion of one moon around the Earth...that they think this constitution of the universe must be rejected as impossible."[5] Note that he does not even imply that he exists within this circle of Heliocentric believers, nor does he make any sort of positive claim about the theory's plausibility–he simply mentions that his findings could contribute to it.

Instead of making positive claims, Galileo represents most of his hard-hitting information with images and visuals of his observed evidence. The most clear example of this is his illustrations of the irregular surface of the moon, which can be verified by anyone with a spyglass who chooses to look through it. Galileo had enough foresight to send replicas of his spyglass to other major astronomers, so they could see this evidence for themselves. The information presented by Galileo through visuals was verifiable, and thus its implications

[4] Galilei Galileo in "The Sidereal Messenger", 1610. Translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Company Inc., 2008, p. 68.
[5] Galilei Galileo in "The Sidereal Messenger", 1610. Translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Company Inc., 2008, p. 83.

unavoidable. How could these irregularities exist on the Moon if the moon were a perfect sphere of aether, as Aristotle had postulated? Without needing to state a positive, Galileo had already overturned the previous notion almost indisputably. When he does go on to give explanations, he does so in a very theoretical way. For example, one of his theories was that the moon has an "envelope" of aether around it, inconsistent in thickness and opacity, which creates the irregular light and dark spots we can observe. He goes over a number of observable phenomena that could be explained by this theory, such as the slight illumination of the dark portion of the moon when the moon appears close to the sun; but he never states his theory as a fact in replacement of the existing idea.[6] In doing so, he both protects himself from controversy and preserves his reputation by not leaping to conclusions. This is what made Galileo so convincing and credible to his readers. Galileo shows his respect for empirical evidence by using it to invalidate prior theories without necessarily replacing them with similarly flawed stand-ins.

Galileo was also talented at making his discoveries sound important to the common audience. While his use of extravagant vocabulary in his writing might not have affected a scholar's perception of the writing within, a reader with less prior knowledge might have little reason to be skeptical of Galileo's claims. Therefore, he overtly states in his writing the importance of his findings, and emphasizes the fact that no one before him has made the same discoveries. Take, for example, the first few lines of "The Sidereal Messenger", in which Galileo says "...I set forth some matters of great interest for all observers of natural phenomena to look at and consider. They are of great interest, I think, first, because of their intrinsic excellence;

[6] Galileo Galilei in "The Sidereal Messenger", translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Inc. in 2008, page 58.

second, because of their absolute novelty..."[7] The purpose of this was to hopefully convince the reader of the impact this information could have, not so much insinuating that he had made a groundbreaking discovery as insisting so. To some extent, this was for the purpose of marketing, as nobody would want to read about an astronomical discovery with no real implications. Though he was cautious about making positive claims concerning the implications of his findings, he showboated his work and how wonderful it was emphatically. Regardless of how effective this technique was, it was certainly an effort on Galileo's part to make his work more widespread, which would ideally lead to them being widely accepted, especially in the eyes of the public.

It could be argued that in the end, these strategies weren't enough. Galileo eventually drew the ire of the Catholic Church for his support of the heliocentric model of the universe, which was deemed heretical by the Inquisition.[8] However, even this simply goes to show that Galileo succeeded in becoming an influential figure in astronomy. His respect for empirical evidence, as well as his aggressive self-marketing and the sheer significance of his discoveries themselves, are what led him to be recognized in the first place; and his use of visual evidence is what made him a credible authority during his time.

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[7] Galileo Galilei in "The Sidereal Messenger", translated by Maurice Finocchiaro in "The Essential Galileo", published by Hackett Publishing Inc. in 2008, page 48.
[8] Maurice Finocchiaro in The Essential Gallileo, page 19.

Bibliography:

Finocchiaro, Maurice. *The Essential Galileo*. Hackett Publishing Company Inc., 2008.

Reflection:

This was a fairly entertaining and challenging paper to write. I feel that my points are strong and I feel that I did a good job working with what material I had. That being said, I struggled finding suitable references. The only source I used, apart from lectures, was *The Essential Galileo,* and sifting through the primary sources therein provided was challenging. I searched for information in the other course books and found minimal pertaining to my subject. I'm pretty sure that in the end, my claims are well enough backed up by Galileo's own works that the paper is accurate, and I believe that since this isn't a research paper, my use of a single source shouldn't be a problem. When receiving feedback on my writing, I'd particularly like to know if there were any arguments you felt went undefended, because this is something I hope to improve at through practice and revision.

Additionally, I recognize that this paper does not have as many quotes as I would have liked it to. With only Galileo's own words to cite, it was hard to find quotes that could support statements about, say, the significance of *The Sidereal Messenger* shortly after its publication. I dug through the book quite thoroughly in search of more quotes I could use, but I found that anything I added would be redundant with what I already had, or would clutter up the essay with an excess of "for example…" lines. I'm curious to know if I should have gone with it to meet the quote minimum, in spite of my own reservations.