An Artist's Note on Art in Science

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Abstract I decided to write about art in science by telling personal anecdotes surrounding my involvement in astronomy. These portray what drove me (with a career in the Fine Arts) to try scientific illustration through involvement in the American Association of Variable Star Observers' Citizen Sky project to observe the eclipse of ε Aurigae. These accounts define what I believe to be at the core of being a scientific illustrator: the importance of maintaining accuracy and factual detail without compromising the compelling visuals that evoke curiosity. This, as most people realize, is an important factor in being able to successfully engage the public in science—particularly in astronomy. However, my intention in telling these anecdotes goes deeper than stating the importance of disseminating scientific knowledge through imagery—for which ample examples and literature already exist. Instead, I'm really after contrasting the role of a science illustrator versus that of an artist. In doing so, I will underscore what I believe illustrating phenomena in science really is all about. This note is not intended as a scholarly treatise but rather personal reflections relative to my involvement in Citizen Sky.

1. My introduction to astronomy

On one summer morning in 2009, while I was preparing to begin a painting, I played a daily podcast I sometimes listened to, called 365 Days of Astronomy. That day, a welcoming voice was saying something about an organization called Citizen Sky. She proceeded to describe what was known, at that time, about a peculiar star system in the constellation of Auriga, which had been shrouded in mystery for hundreds of years. Then, she went on to explain that this celestial speck, dubbed ε Aurigae, would be visible by the unaided eye (even under city lights), and most interestingly would be undergoing an eclipse lasting about two years. Because this event only happens every twenty-seven years, she urged the public to assist her organization by collaborating in any relevant way to achieve its mission—to find out more about this star's strange disc-like companion as it transits across said star. As I became intrigued with this weird eclipsing binary system, the narrator mentioned that Citizen Sky would be having a workshop at the Adler Planetarium in Chicago (just a couple of miles from where I lived), and called on those who wished to learn more about ε Aur to help the astronomy community understand this rare phenomenon. I marked my calendar, and when the date came, I eagerly jumped on the train each morning for what would be a

fun weekend of lectures and conversations with passionate, bright individuals trying to set up an unprecedented campaign of observations during the next 640–730 days of eclipse.

My enthusiasm for astronomy was entrenched in curiosity about how the universe works. Very early recollections of Carl Sagan's *Cosmos* and the STS *Challenger* disaster on television are embedded in my memory to this day and had impacted the way I view science. Particularly space exploration intrigued me—from the standpoint of human achievement and engineering advancement—because it was a common topic at the dinner table growing up. That famous image of an astronaut wearing a jet-pack, floating alone in space above Earth, was in my grandfather's home office, and a late 1980s television mini-series about the Apollo missions cemented my utmost admiration, wonder, and thirst for learning about space and the universe. What all of these memories have in common is awe-inspiring imagery. Whether on television or in still pictures, these images, as well as many others (certainly some from science fiction movies as well) would stir my curiosity to learn about what is beyond our home.

Back in Chicago at the Adler Planetarium, I was soaking in all the information available about ε Aur: light curves from past observation campaigns, crude illustrations, data analyses; that, and much more information, provided several possibilities to illustrate what was presumed to be an eclipsing binary system that was just too far to be captured in photographic format—not even with our most powerful observatories. What ε Aur was remained a mystery awaiting resolution, and to me, this meant an opportunity to inspire others with my own space images—ones that would tell what would otherwise be a difficult-to-comprehend celestial conundrum. I met the podcast's voice, Rebecca Turner, and the rest of Citizen Sky crew that weekend and from that point on, I was committed to providing them with illustrations that would help to support their mission.

2. Nature has better imagination

In 2010 Citizen Sky met again, that time in San Francisco, to discuss progress on ε Aur's eclipse and analyses of new data. After lectures, once again, I engaged in conversations with head astronomers and experts on ε Aur to find out what the new leading hypotheses worth illustrating were. I wanted to depict exactly what they envisioned, or more appropriately, what the new information was telling them. About 2,000 light-years away, the only way to bring this eclipsing binary system to life is by imagining and illustrating it, and every new piece of the puzzle meant that we could have a more concrete idea of the system's objects. Evidence of the system's objects' approximate size, positioning, molecular composition, and shape already created an exact model of how ε Aur could look, however, there were new details that dismissed earlier hypotheses.

When I began illustrating ε Aur, I looked at earlier illustrations of the system, as well as ones of other similar systems. One had a black hole with spewing jets of energy coming from the middle of this companion disk—a compelling image that was negated by data confirming that there were no black holes in ε Aur. (That's not to say that impressive jets of energy spewing from black holes don't exist, or haven't been seen—they have.) Another ε Aur illustration had its visible star (what came to be recognized as a large F-type star) pulling mass from the obscure companion through the inner Lagrangian point and creating a disk of material if its own—that idea was also rejected after more solid data came to light. Again, trafficking material between two celestial objects that trespass their Roche Lobe does exist. My point is that at the time, it was anybody's guess what was going on in ε Aur, but as more knowledge was acquired, these guesses were appropriately marginalized. I was supposed to illustrate the new "guesses," and it was my duty to make an attractive image while keeping in mind that any extrapolation of my own would wrongly make the illustration become something other than ε Aurigae—just like the ones prior to mine, just like my first ones.

Today, my favorite eclipsing binary system remains much of a mystery despite hard-earned new data. Its dark, humongous disc-like component could be a planetary system in its infancy, or one in limbo that will never form planets due to gravitational pulls from its inside (where a small B star was found) and the F-star companion. ε Aur could end up being several surprising things (but not too many). However, these plausible surprises, I'm sure, will be fascinating. Nature has a way of revealing herself, in the most "out-there" of ways—she outdoes even science fiction flicks. From planets with four stars, to planetary formation itself, we should just illustrate natural phenomena as honestly as possible, since those images are certainly as (if not more) creative and imaginative than any artist could imagine.

3. Artwork created in support of Citizen Sky and the AAVSO

The work I did related to Citizen Sky and ε Aur was my first in scientific illustration and my first related to astronomy. Artwork I created on behalf of Citizen Sky and the AAVSO included:

- potential designs for the Citizen Sky logo
- seven depictions of the ε Aur system
- icons for the data plotting and analysis software VSTAR, a crucial element of Citizen Sky that is being used by variable star observers and analysts far beyond the original Citizen Sky audience
- illustration for a Citizen Sky participation certificate
- characters for a Citizen Sky comic strip

- illustration commemorating the receipt of the AAVSO's 20 millionth variable star observation
- October page in the American Astronomical Society's 2011 calendar, commemorating the AAVSO's centennial
- potential designs for the AAVSO logo

4. Not apples and oranges, more like apples and onions

As an emerging visual artist, I underwent an intentional shift from nebulous abstract conceptualism to the constrictions of imperative predestinarianism in picture-making. That shift effectively converted me into an illustrator for the time being. This duality must be addressed because, while the juxtaposition of these two different fields has provided an abundance of intellect and creativity in my art, one must understand the extents and limitations that these two fields impose on each other. To say that a scientific illustrator took some artistic liberties when rendering a natural phenomenon implies misdirection—such as fabrication of facts, exaggeration, and image entitlement, to name a few. Conversely, when an artist renders ideas as visual explanations of themselves, without context ambiguity, or abstraction of any kind, this artist becomes an illustrator.

There are certain things in the universe that can't be directly translated into visual form, so we use symbols, approximations, and the imagination. But, scientific illustrators fill in this gap, and they must derive their work from research and scientific hypotheses. A scientific illustrator has the obligation to explain a scientific subject concisely, thoroughly, and accurately, whether the medium is animation or illustration, and in doing so, he or she must excite the imagination without misleading the viewer.

Beauty and aesthetics are very important aspects of scientific imagery. Undoubtedly, science illustrators must make their subject matters visually attractive and unforgettable. That being said, scientific imagery should also be reserved, humble, and have an anonymous quality. It should be economic and focused solely on its depictions, without compromising on its scientific accuracy. Scientific illustrators are not making art; they are not making a personal statement; they are not trying to convey an idea indirectly or per ambiguities and insinuations, nor are they speaking about themselves, abstract concepts (like love or life), or society. Instead, they are providing a precise, hyper-realistic representation (as best as they can) of the physical world and its natural occurrences. Scientific illustrators have formal and conceptual constrictions and are obliged to capture the subject matter explicitly. The artistry in scientific imagery lies in how effective and well-executed the subject matter is, in order to make learning faster, easier, and more enjoyable.

My hope is for other creative individuals to follow the points I lay out in this note, and to remember that the essence of scientific illustration lies in the comprehension of knowledge.