THE HISTORIAN, THE PHILOSOPHER, AND THE SCIENTIST

THREE APPROACHES TO SCIENCE HISTORY FILMMAKING

by

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DEDICATION

I dedicate this paper and the film that accompanies it to my mother, Patricia Lea Clews, for her enthusiastic support and to my father, Luke Lea, for always encouraging my ideas. This project is also for my husband, Winston Garth, in gratitude to all his patience and love. I would not have completed this project without their spirit and wisdom to guide me. I also dedicate this work to Dennis Aig and wish him all the luck and relaxation in his retirement.

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ABSTRACT

Science history films are an underutilized way to build public interest in science. Required. Science history portrays the genesis of a significant idea and is an ideal topic for documentaries that aim to improve science literacy in a low pressure, highly entertaining cinematic experience, without being overly rhetorical. When attitude towards science improves, understanding may follow. By analyzing three influential filmmakers in their different approaches to history films, Errol Morris's *The Thin Blue Line,* Agnes Varda's *The Gleaners and I,* and Carl Sagan's *Cosmos: A Personal Voyage,* I assemble a toolkit of helpful techniques for science history filmmakers to employ. I apply these conditions to my science history film "The Great French Wine Blight" in order to best present this history in a thoughtful and engaging way while remaining faithful to the science and ideally improving the audience's attitude towards science in general.

INTRODUCTION

Studying history offers a cornucopia of benefits in which any middle school history teacher could easily regale. Beyond the obvious "doomed to repeat history" maxim, history documentaries provide fresh perspectives and deeper insights into our current lives. They can affect an audience profoundly and challenge preconceived beliefs when done effectively. A typical documentary audience has intellectual needs it wants fulfilled- namely, to better understand oneself, one's environment, and one's society; i.e., to essentially gain a new understanding of some universal truth. Films that provide this intellectual stimulation while still being cinematically entertaining, have the potential to affect change in behavior and attitudes in their audience.

A poll conducted by the American Historical Association in partnership with Fairleigh Dickinson University in the fall of 2020, surveyed 1,816 American adults to "assess public perceptions of, and engagement with, the discipline of history and the past" (Burkholder and Schaffer). Their findings which indicate where the public receives historical information should be encouraging to documentary filmmakers:

> Given a range of 19 sources of history… the top three choices were all video format: documentary film/TV, fictional film/TV, and TV news. Of note is that such sources are readily available, usually take minimal effort to engage, and may ask for little imagination on the part of the viewer. Meanwhile, more traditional forms of history fared considerably worse: historic site visits (8th place), museum visits (10th), nonfiction history books (12th), and college history courses (last place). (Burkholder and Schaffer)

The study goes on to further reveal that these preferences do not correspond to the perceived trustworthiness of the source. While fictional films and TV news were ranked low in their trustworthiness, documentaries retained high confidence in its viewers. In terms of trust,

documentary was outranked only by museums and historical sites, both of which tend to be difficult to access. The results of this study indicate that documentary films can be used as an accessible, approachable, yet still respectable medium to disseminate historical information to the public.

Documentary can be extremely effective for preserving histories. The use of archival footage, photographs, maps, primary sources, witness accounts, and recordings accompanied by well-researched narration is perhaps the most thorough way to conceptualize a historical event. Films like these can make distant history become real; the audience experiencing the pain, stress, and desperation of the times, and can open itself to new sympathies, and, therefore, new ideas. This is when science communication takes place.

Carl Sagan eloquently denotes in his book about the importance of science communication, *The Demon Haunted World:*

> ...all over the world there are enormous numbers of smart, even gifted, people who harbor a passion for science. But that passion is unrequited. Surveys suggest that some 95 percent of Americans are 'scientifically illiterate.' …Of course, there's a degree of arbitrariness about any determination of illiteracy, whether it applies to language or to science. But anything like 95 percent illiteracy is extremely serious. (6)

These statistics are disturbing, but modern media offers opportunities to rectify this.

In the article, "Science Communication: A Contemporary Definition", Burns, O'Connor, and Stocklmayer provide some adequate working definitions for a few important foundational terms. They define *understanding* as, "a developing comprehension of both the meaning and implications of some knowledge, action, or process based on appropriate commonly accepted principles" (183). *Science* is hereby referring to "the systematic enterprise of gathering knowledge about the world and organizing and condensing that knowledge into testable laws and

theories" (Burns and O'Connor 183). Kim Hak-Soo proposes that the public's understanding of science can be broken down into three sectors: "the public's interest in science; the public's knowledge of scientific content (vocabulary, concepts, and methods); and the public's attitudes toward science in general, the impacts of science, the scientific community itself, or a policy issue regarding science" (292). This *interest, knowledge, attitude* model is based on a tradition used by social scientists for researching learning techniques and will help to analyze science communication tactics. To change the public's attitude towards science, we first need to build interest in the field. As a filmmaker, interest can be generated by crafting a visual spectacle to hold audience interest while using the narrative to impact viewers emotionally. A positive attitude can unconsciously create a trust for science that allows understanding to follow. Luckily, this is one of the primary strengths of cinema.

I agree with Sagan that many individuals could find joy in science-themed programs if they were presented in an entertaining and thought-provoking way. I believe those curious about history could transfer that curiosity to science if they were given the confidence and encouragement to do so. Hak-Soo proposes that science communication is most effective when communicators *evoke* an associated idea rather than plainly relaying a body of facts; he claims that "scientific knowledge is not received impersonally, as the product of disembodied expertise, but comes as part of life" (294). Exposing viewers to these facts out of context will not increase their understanding of science. I argue that this desperately needed context tends to be historical in nature. As Sarton states, "More than that, I am convinced that the historical method is the best to convey scientific facts and ideas to unprepared minds and to make them thoroughly understandable" (323). Science history films could be used to introduce science to beginners,

provide additional context to those already familiar with science, and even inspire fresh research approaches for working scientists. In this paper I will focus on what cinematic qualities most inspire new audiences to appreciate the sciences.

The science history film is a deeply educational endeavor with the potential to galvanize its audience. To influence an audience enough to change a closely held belief requires careful tact and technique. This is the situation in which an artful and entertaining approach becomes most valuable, especially for science-based media. It is not easily done but not impossible. Three filmmakers whose documentaries succeeded in deeply affecting their audiences are Errol Morris's *The Thin Blue Line*, Agnes Varda's *The Gleaners and I*, and Carl Sagan's series *Cosmos: A Personal Voyage*. Though these examples are not all specific to science communication, I argue that they each tell a historical story in an artful way; by dissecting these films and the approach of each filmmaker, we can devise a set of strategies for science history filmmakers to use in order to have the most impact on their audience. I then compare my film, "The Great French Wine Blight", to this framework in order to assess what techniques were most effective and how to employ them.

THREE APPROACHES TO SCIENCE HISTORY FILMMAKING

In order to analyze each filmmaker's approach, I have divided them into three schools of thought according to an educational theory proposed by George Sarton in his 1916 paper, "The History of Science." Sarton notes that people who have slight knowledge of science are afraid of it, but that any intelligent man or woman can understand the development of science if properly presented and taken from the beginning (323). The best way to introduce a new idea is to understand why it was first needed historically. He goes on to recognize three academic institutions which he argues should collaborate in order to best preserve the history of science: the disciplines of history, philosophy, and science- "For one thing, we must bear in mind that we have all- philosophers, historians, scientists- the same purpose: we try to explain, to generalize, to deepen, to simplify the data of experience" (Sarton 328). Sarton observed that all three of these pursuits are aligned in their systematic search for lasting and impactful human wisdom. Similarly, a documentary patron hopes to fulfill certain emotional and intellectual needs when watching a history film. When asked about *why* participants wanted to learn about history in the American Historical Association survey, the top three responses were "want to be more informed about past events" at 39%, "find learning about past events entertaining" at 33%, and "experience/knowledge gained is important to share with children" at 19% (Burkholder and Schaffer). These viewers are not just looking for mindless entertainment. They are seeking inspiration and deeper understanding. An effective filmmaker should consider these needs.

I propose that Sarton's observation also relates to three mindsets with which a filmmaker can approach their science history documentary: as the historian, the philosopher, and the scientist. Each provides a different perspective to the audience. The historian draws complex

connections, the philosopher inspires and appreciates, while the scientist rationalizes and explains. The primary goal of a filmmaker is to be entertaining, since a boring film will struggle to be effective. The filmmakers I have chosen to compare, also fall into these categories: Errol Morris as the historian, Agnes Varda as the philosopher, and Carl Sagan as the scientist. I argue that a filmmaker who can consider their narrative from these three perspectives will create the most stimulating presentation of information.

FILMMAKER AS HISTORIAN

> "The history of science can often be characterized as a sequence of revolutions and reactions" (Beer 99).

The role of a historian is to dutifully assemble evidence in order to draw connections between events which demonstrate a cause-and-effect relationship. Determining these causal factors gives the audience satisfaction by feeling they understand what conditions create societal unrest and what conditions resolve it. They have new warning signs to look out for in life. I believe a lot of people watch documentaries to satiate a need for comforting protective knowledge. We like to hear about threatening circumstances from the safety of our sweatpants, as indicated by the popularity of true crime programming across media platforms. Generally we remember stories more easily than we remember facts, and I believe this is an opportunity for science communication to use history programming to their advantage.

By witnessing humans discover a novel solution in a film, as is fun to watch in science history films, the audience can learn alongside the subjects in an almost heuristic way. Heuristic learning allows, "students to learn by discovering things themselves and learning from their own experiences rather than by telling them things" ("Heuristic"). Since this style of communication mimics childhood learning, this approach is most effective for introducing newcomers to science. I argue that the heuristic approach should be a priority for science communication. What better way to establish a foundation than to understand how that science was born and trace how it became a part of our lives. When one scientific principle is gently absorbed into their understanding, they can build off it. These principles function as intellectual anchor points. The audience can use these anchor points to help them grasp increasingly complex ideas, now that

they have a clearer intellectual framework in which to place them. Since science is a cumulative discipline, it makes sense that understanding the history of an idea can help clarify its context today. With a heuristic understanding, the audience is more likely to relate ideas from a film into their everyday life. “Many advances in science are made on the basis of what, after the fact, seems to be a simple “it’s like …” type of transfer…because theoretical thinking and a complex knowledge base were required before the higher order of transfers could be made” (Haskell 575).

The historical approach also provides context to deepen audience appreciation for the working conditions of a scientist. As Sarton states, “indeed it is the survey of the past that enables us…to extricate what is really essential. The importance of a concept appears in a much better light when one has taken the trouble to consider all the difficulties that were surmounted to reach it, all the errors with which it was entangled, in short all the life that has given birth to it”(350). The public is rarely shown the process of science, and rather sees sensationalist headlines like “Breakthrough Cancer Treatment Found” without addressing the caveats and additional testing required before being usable by the public. This leads to undue stress and ultimately deflated confidence in the sciences. But history stories include what academic journals do not - the secret that science is incredibly messy and full of missteps. Scientists must work within the constraints of the tools and ideas available to them, and helping audiences to understand these limitations will humanize the many scientific efforts we take for granted when we see their footnote in our textbooks. Science media does not glorify the errors during the trials, but history can. I believe that exposure to the missteps and mixed social ramifications which follow cutting edge science will help audiences better appreciate the sacrifices necessary for progress.

I refer to Errol Morris's 1988 classic, *The Thin Blue Line*, as an artful example of a history film done so well that it functionally changed the trajectory of a subject's life. Morris approaches this narrative as a historian would. Telling a narrative thoroughly from the beginning by diligently collecting relevant documents and testimonies, and then presenting them in a precise, calculated order are all hallmarks of an historian. *The Thin Blue Line* dutifully investigates the context surrounding a particular moment in history: in this case, the night a police officer was slain, to faithfully depict the event as it unfolded along with every misstep and devious plot that impeded the search for justice. We learn heuristically along with Morris as he pieces together dozens of conflicting personal accounts to help understand why the truth was lost for so long. This technique builds trust in the audience and allows them to form their own impression guided by Morris. Historians are editors and researchers by nature. The story they tell is a carefully curated assembly of relevant events, presented chronologically until a meaningful pattern emerges. Once the audience catches onto the pattern, they feel as if they have discovered it themselves. Gentleness is key. Morris's editing choices, like juxtaposing two characters' contradictory statements and use of meticulous reenactments, shines a revealing light on some of what he considers the brazenly false testimonies in the film.

This introduces an important element of history narratives: the subjective quality of "truth" and the power of the filmmaker to shape what he or she considers it to be:

> In the discussions surrounding the truth claims of many contemporary documentaries, attention has centered upon the self-reflexive challenge to once hallowed techniques of verite. It has become an axiom of the new documentary that films cannot reveal the truth of events, but only the ideologies and consciousness that construct competing truths- the fictional master narratives by which we make sense of events. Yet too often this way of thinking has led to a forgetting of the way in which these films still are…documentaries- films with a special interest in the

> relation to the real, the "truths" which matter in people's lives but which cannot be transparently represented. (Williams 13)

Since the public trusts documentaries to accurately provide historical information, it is the duty of the filmmaker to ensure they represent the narrative faithfully. Errol Morris explores this expectation in his film by visually highlighting that his subjects are not always to be trusted. He uses re-enactments to faithfully portray each detail of his subjects' interviews as a way to draw attention to the conflicting details between their stories. Rather than Morris deciding which story sounded the most truthful and focusing on it, he gives equal attention to each narrative and lets the audience decide who is most convincing. Morris is allowing the audience to participate in his decision making process as a historian which allows for an intellectually challenging and heuristic educational experience for the audience.

Morris's challenge for this narrative is similar to many scientific origin stories in that he has no primary photographs or footage of the event itself. He must use his creativity as a filmmaker and resources as a historian to *evoke* the situation being scrutinized. Given that most scientific fields formally began in the nineteenth century or prior, and histories pre-dating the Civil War have little to no photographic evidence, many science history films will need to utilize some of Morris's evocative techniques to illustrate their story.

Morris's arresting stylistic elements are what set him apart from other nonfiction storytellers of the time. The alarming reds and blues used in his reenactments are captivating. The sound design wavers from meditative to tension filled music with sharply executed sound effects to make the audience feel that they cannot even blink without missing something of fascination. Watching an Errol Morris film makes time stand still. His visual style and powerful soundtrack demands his audience's full attention. These same techniques can be applied to

science history films. When relevant B-roll is scarce or unavailable, a science filmmaker can lean on creative recreations to fill in the gaps. These re-creations do not have to be high production value theatrical affairs. Morris used a slow and ominous push into a rotating police siren as a powerful image to overlay with testimony. This allows the audience to fully focus on the narration while staying in the tension of the scene. Where Morris does obtain photographs to support his narrative, he uses them strategically. As he slowly zooms in closer and closer on the newspaper images of his convicts, the holes between the pixels become more visible until they are more present than the image itself. This is Morris's way of showing how truth changes depending on how close you get to it:

> Truth is "not guaranteed" and cannot be transparently reflected by a mirror with a memory, yet some kinds of partial and contingent truths are nevertheless the always receding goal of the documentary tradition. Instead of careening between idealistic faith in documentary truth and cynical recourse to fiction, we do better to define documentary not as an essence of truth but as a set of strategies designed to choose from among a horizon of relative and contingent truths. (Williams 14)

The more he investigates, the more convoluted the stories become, yet the cracks between each story are what leads to the eventual truth that is revealed: a convicted man is innocent. Morris's use of photographs demonstrates his central thesis of his film that the holes in the stories are more important than the stories themselves. The holes in the photos are more revealing than the images themselves. It is only by examining the entirety of the situation from a historian's perspective, that the grave error of the Dallas justice system is illuminated. The narrative that Morris presents in *The Thin Blue Line* was so convincing that it overturned Randall Adams' conviction. Without Morris's careful assembly of events, an innocent man would still be on death row in Texas. History films have extremely galvanizing capabilities.

The historian who lacks a basic scientific foundation may overlook the more subtly critical elements that lead to a discovery. Historians are research editors. They comb through thousands of materials relevant to their cause, and must choose only the most captivating, revealing, or necessary moments to support their narrative. It is only natural to assume a scientist and a historian would make slightly different artistic choices. If we focus only on the science, it can feel like a lecture; using only historically spectacular moments can become shallow, without offering any intellectual anchor points that won't increase the audience's scientific foundations. Therefore, it is best to embody both creative personas to make a captivating science history film.

FILMMAKER AS PHILOSOPHER

> "In the same way the great philosophers-those who have really renewed the thought of their age-have also considerably influenced the progress of science. They were not themselves creature scientists, but at least they possessed all the scientific knowledge available to them. Think of Plato, Aristotle, Descartes, Leibniz, Kant. Here again, it is indispensable to conceive a double stream of ideas between science and philosophy" (Sarton 325).

The term "philosopher" comes from a Greek word meaning "love of wisdom". The philosophers take a more personal approach to their story than the historian. They ruminate on the past to offer their insights and analysis. They often go a step further and can draw conclusions the rest of us fail to realize. The philosopher can use more speculative means to arrive at conclusions, while the historian relies on evidence. By nature, philosophers have more agency to comment on the morality of an issue than a historian. These traits in a filmmaker can be enrapturing for an audience and deeply inspiring. One such filmmaker philosopher is Agnes Varda.

When asked in an interview with Andrea Meyer in 2001 what Varda thought her films offered to people, her response is consistent with a philosopher's mindset:

> I would say energy. I would say love for filming, intuition. I mean, a woman working with her intuition and trying to be intelligent. It's like a stream of feelings, intuition, and joy of discovering things. Finding beauty where it's maybe not. Seeing. And, on the other hand, trying to be structural, organized; trying to be clever. (Meyer)

In essence, Varda is explaining how she balances her role as both philosopher and filmmaker. She follows her philosophical intuition while remaining conscious of her cinematic effect on the audience, allowing for an organically educational experience. Her film *The Gleaners and I* is a wonderful example of a philosophically motivated history film.

Varda's approach to *The Gleaners and I* is notably less like a historian and more of a philosopher seeking to understand an endangered way of life. Her methods allow for some extraordinary educational potential which we should examine. The most striking element of the film is Varda's profoundly personal influence on it. Given her lifelong recognition as a filmmaker, it makes sense that she uses herself as a sort of protagonist. Her willingness to fall down the rabbit hole towards any thought provoking idea is an exciting element that provides a totally novel documentary experience. Her film feels like taking a ride in the mind of Varda. We are at the mercy of her whim and fancy, and we never want it to end. Her curiosity is the driving force, as is evident with her thoughtful narration, adaptable story structure, and provocative visuals. Varda coined a term to describe her approach as a filmmaker which she calls *cinécriture*. She describes it as something "which is not a screenplay. Which is not only the narration words. It's choosing the subject, choosing the place, the season, the crew, choosing the shots, the place, the lens, the light. Choosing your attitude towards people, towards actors. Then choosing the editing, the music. Choosing contemporary musicians…You know, it's a handmade work of filmmaking — that I really believe. And I call that cine-writing" (Meyer). I agree with Varda that a filmmaker who creatively influences all aspects of their film from pre-production, production, and throughout post-production will create a film with a unified tone and provide a more philosophical experience for the audience. Using cinécriture can help the audience appreciate the filmmaker's role in adapting a historical narrative by drawing attention to the stylistic and narrative choices the filmmaker has made.

Agnes Varda is a philosopher at heart and on screen. I believe a true philosopher is curious for curiosity's sake. They do not find their satisfaction in *knowing,* and would take more

delight in asking questions that no one has asked previously. This rare and peculiar mindset is a boon to filmmakers if they are able to wield it responsibly. This film could have easily become a disjointed mess in the hands of a less masterful filmmaker. Varda possesses a once-in-a-generation voice, and she uses it both carefully and cleverly. If she had tried her hand at science communication, I think she could have invented brilliant new metaphors for science concepts to help reach, say, the art school audience. Her philosophical musings allow us to glean historical information about her subject, which happens to be gleaning, echoing the thesis of the film. It's a brilliant strategy for a filmmaker.

Another strong suit of Varda's is her skill at vox pop interviews. She achieves a powerful narrative aid by editing together multiple people all speaking on the same subject. It mimics the heuristic learning experience in a quasi-detective way. We learn the pertinent information *alongside* our filmmaker. We follow her curiosities and watch her find clues. The message she eventually evokes never feels forced or rhetorical. This is the perfect state of mind for an audience to welcome in new understandings.

Let us analyze how Varda creates this philosophical trance. Beginning immediately with the opening title, featuring an extremely *laissez faire* house cat, the audience is relaxed and at ease with the tone of the film. They are lulled into complacency to journey wherever her mind wants to wander. So Varda takes us to memorable places and under-appreciated times in order to tell the history of the French gleaners.

Varda's history documentary offers filmmakers plenty of inspiration for creative B-roll. One of the difficulties of retelling more distant history stories is the lack of captivating B-roll for a modern audience. To introduce the rare solitary gleaner, an obvious parallel of herself, she

uses an artwork in a museum, but goes a step further to include the dozens of curious gallery peepers as they whisper and admire the painting. She coaxes her subjects into performing small natural actions which she immediately echoes in the archival footage she pairs with it. This strongly evokes connections between our history and today. She introduces each subject in its natural environment feeling relaxed and authentic. She lets them float about the frame as they enthusiastically expound about their gleaning exploits. The audience cannot help but get drawn in, and without any resistance they happily learn about the history of gleaning in France for an hour and a half. Imagine if this could be applied to science history films.

One scene in particular has extremely useful implications for science communicators because it features a rarely seen moment of genuine awe. She lets us watch, on camera, the very moment her curiosity sparks. While sorting through discarded potato piles, one subject casually mentions the existence of some misshapen potatoes. Varda is immediately overcome with desire and practically lunges towards the heart-shaped potato: “I want the heart!” she exclaims, and quickly snatches it up as if someone might steal it from her. “I am pleased,” she unashamedly admits in her narration. We delight in the pleasure as well. She chose in her edit to let us see this curiosity overtake her. It is intoxicating to watch. As she muses on and on about the love of her heart-shaped potato, we can’t help but fall in love with it too. There is no historical or scientific significance to her heart-shaped potato. Yet it is one of the most memorable moments of the film. I believe this scene is a rare moment in cinema where a filmmaker successfully transferred a personal philosophical breakthrough to her audience. It is an organically human moment caught on film. One of the perks of documentary is the potential to capture these raw discoveries in the moment like Varda has. These scenes are impactful. Her verite style supports the organic feel of

the moment. It is too powerful not to be swept up by it. Science historians should never shy away from including their own personal attraction to the story to help the audience find interest in it as well.

By approaching a science history film from the mindset of philosopher, a filmmaker could ask engaging questions which generate interest in science and effectively change an audience's attitude towards science:

> A deeper knowledge and a greater diffusion of the history of science will help to bring about a new "humanism" ... The history of science, if it is understood in a really philosophic way, will broaden our horizon and sympathy; it will raise our intellectual and moral standards; it will deepen our comprehension of men and nature. (Sarton 357)

This humanizing of science can only help to communicate it. Though the world was robbed of Varda's potentially groundbreaking contributions to science communication, we did receive one irreplaceable science philosopher as consolation. The infamous Carl Sagan.

FILMMAKER AS SCIENTIST

> "The history of science and the media is the history of a growing mesh: increasing use of media by science, increasing attention to scientific ideas by media institutions, and increasing tensions caused by the rising interaction" (Lewenstein 163).

The scientist takes a methodical and organized approach to understanding his or her surroundings. He or she determines a reasonable sounding idea and sets out to prove it by successively eliminating all possibilities. The scientific method is the most effective tool humanity has devised for determining truths about our environment. Carl Sagan articulates this flawlessly in his book, *The Demon Haunted World*:

> Science is far from a perfect instrument of knowledge. It's just the best we have. In this respect, as in many others, it's like democracy. Science by itself cannot advocate courses of human action, but it can certainly illuminate the possible consequences of alternative courses of action. (27)

Science history is an examination of humanity at its most clever.

By showcasing science using modern entertainment techniques, science communicators could generate more public interest in their subject, help viewers appreciate the value of the scientific method and thus improve science literacy:

> ...the history of science- even more than ordinary history- is a general education in itself. It familiarizes us with the ideas of evolution and continuous transformation of human things ; it makes us understand the relative and precarious nature of all our knowledge; it sharpens our judgment. (Sarton, 353)

Filmmakers must tread carefully with how they depict scientists and their findings if they do not wish to repeat the mistakes of the last century of science communicators.

Science and the media have suffered a lasting tense relationship, often at odds with each other. This conflict dates back to the beginning of science communication, before science was even recognized as its own discipline:

> Since the late seventeenth century, natural philosophers had relied on print media, particularly professional journals…as tools for disseminating the results of their investigations. These publications were not only records of experiments or philosophical investigations, but also served as active carriers of the rhetorical structures that enabled natural philosophers to convince people outside their immediate vicinity of the truth of their claims. (Lewenstein 163)

Academic journals began as a showcase for new ideas and a way to convert the public to the significance of one's findings. Now that media has evolved into the current cultural behemoth that it is, it should be wielded accordingly to help champion our most useful new thoughts and theories. But instead, the way in which science is portrayed in popular media creates undue stress on the already tensile bonds between our experts and the public. Overhyping medical breakthroughs (without explaining the lengthy timeline they need to reach the public), standoffish scientist testimonies (without giving them context they become dehumanized), and long boring lecture-style educational films all helped to create a negative association with science in general. Scientists returned the favor by blanketing disapproval over nearly all mainstream media depictions of science: "...from about the mid-century onward, no matter what media were involved, many working scientists perceived presentations in non-technical media to be incorrect, oversimplified, or sensationalized. Thus, tensions developed between the institutions of science and those of the media" (Lewenstein 163). So how can media rectify their poor representation of one of humanity's most valuable institutions? I argue we should start with science history films.

Science history films can help humanize scientists and the limitations within which they work to help the public understand that proper science is not affected by politics or popularity. As Sagan said, "The scientific way of thinking is at once imaginative and disciplined….Science invites us to let the facts in, even when they don't conform to our preconceptions…This kind of

thinking is also an essential tool for a democracy in an age of change" (27). Now that the internet has introduced thousands of pseudoscientific advisors, the public is especially susceptible to being misled by charismatic fallacies. It is up to science communicators to help the larger public learn to distinguish good science from ideas masquerading as such.

Of the filmmakers compared thus far, Carl Sagan most perfectly encapsulates the characteristics of historian, philosopher, and scientist. Given that he specialized in science communication, his hit 1980 series *Cosmos: A Personal Voyage* is a perfect case study for our objective. Sagan presents his understandings of space as if he were on an intergalactic safari, serving as the guide, artfully explaining the amazing phenomena he encounters on his journey. "Come with me" he says in the flagship episode, inviting the viewer to accompany his expedition. Sagan gives us a beautiful invitation into space sciences by relating complex scientific theories to his audience in a friendly easily-understood manner. This approach is crucial for introducing science to the public. He wants to include viewers in his awe and wonderment for the cosmos and understands that using complicated scientific jargon will only dissuade his audience from being drawn into the mysteries. He uses poetic metaphors and similes to relate to viewers: "Every globular cluster is like a swarm of bees bound by gravity. Every bee, a sun" ("The Shores of the Cosmic Ocean"). These comparisons demonstrate Sagan's philosophical mindset while scripting the narration to the series. I believe metaphors and similes are useful tools in helping distill down scientific information and make it more relatable. Though they may not provide an in-depth understanding, they help generate interest and early comprehension. "The cornerstone of *Cosmos* is the belief that human beings are intelligent, that it is a joy to understand the world," said one reviewer, "and that science can be conveyed in a

way which is comprehensible and exhilarating, but does not compromise accuracy" (Dockery 83). The lasting and overwhelming popularity of Sagan's Cosmos supports my claim that well produced science media can enrapture all audiences.

Another element of *Cosmos* that can be used by science communicators is the thorough presentation of context. Before gleefully showing off the wonders of an exciting scientific concept, I argue that the audience will be more captivated by witnessing the struggle it took to develop it. Sagan does an excellent job of providing this crucial context during his own science history sequences. To accomplish this, Sagan uses his $6 million budget for artistic renderings and beautiful historic re-creations with period costumes, lavish sets, 100 exotic location shoots, as well as computer graphics to help the audience visualize his science narrative (Beatty). These painstaking efforts paid off by elevating his series, and thus science communication, to new heights. 700 million people watched Sagan's 13 part series; the most successful show PBS had ever aired (Beatty). Watching him walk through the doors of the Library of Alexandria was a striking moment for lovers of history and likely all audiences at the time. He takes this moment to address the preciousness of human knowledge and how easily it could all be lost. A philosophical moment set inside a historical spectacle. The effect is profoundly educational and deeply moving. Sagan comes the closest to embodying the scientist, historian, and the philosopher in his series. This is likely why it remains a revered classic. His passion for the material is tangible in every frame. He himself would be the first to say we need more programming like it.

After the success of Cosmos, Sagan appeared on the October 1980 cover of Time magazine accompanied by the header “Showman of Science”. Time describes the varying sentiments towards Sagan at the time of its publication:

> Watching with wonder—and no doubt a little envy—the whirling star named Sagan, some of his colleagues feel that he has stepped beyond the bounds of science. They complain that he is driven by ego. They also say he tends to overstate his case, often fails to give proper credit to other scientists for their work and blurs the line between fact and speculation. But they probably represent a minority view. Most scientists, increasingly sensitive to the need for public support and understanding of research, appreciate what Sagan has become: America's most effective salesman of science. (Golden)

Despite blowback from the scientific community, Sagan’s contributions to science communication were revolutionary, and his techniques should be replicated if we are to bridge the gap between the public and the sciences.

Use of green screens can create a similarly memorable experience for science history audiences today, and filmmakers not privileged with Sagan’s PBS budget do not have to prioritize detailed historical re-creations but merely need to strive for an evocation of the time and circumstances. Spectacle is the specialty of a filmmaker and as such should be wielded responsibly in a way that keeps the audience focused on the information being presented rather than distracting from it. To help weed out needless information in a science history film, one should consider the editing mindset of the scientist and eliminate possibilities one at a time, until only the most effective narrative remains.

THE GREAT FRENCH WINE BLIGHT

Lastly, I compare my film, “The Great French Wine Blight”, to the historian, philosopher, and scientist framework which I have proposed. I also will explain how my film attempted to add a meaningful contribution to science communication efforts. At its best, science history will help us understand the biases that hold us back from learning novel materials. The historical story I chose to tell involved a lot of biases and rigid thinking, which had dire economic consequences. By being exposed to various stories of scientists overcoming the cultural obstacles of the moment, the audience can gain a richer understanding of how we navigate the unknown in the future.

According to the suggested framework I have outlined, the strongest voice in my film is the historian followed by the scientist and then, weakly, the philosopher. As a dutiful historian, I assembled as much primary evidence as I could access, read every available article, one novel, a few French periodicals, and interviewed the world’s leading (and last remaining) expert on grape phylloxera in order to most faithfully present the narrative I wanted to tell. During my research, I encountered a challenge similar to what Errol Morris faced in *The Thin Blue Line* when I discovered some of my sources were peddling falsehoods. Many articles confidently purported that the invention of the steamship was the inciting incident which kicked off the wine blight. However, upon interviewing the world expert on grape phylloxera, I learned that there is zero evidence to support that claim. We simply do not know how the phylloxera crossed the Atlantic, so historians have no authority to assume the steamship was the cause. I chose to remove this element from my narrative to avoid introducing any contentious historical elements to the film. It

is vital that filmmakers uphold the perceived trustworthiness of documentary, so sometimes they must remove tempting narrative elements which could be later disproved.

Most of the YouTube videos on the subject included heaps of minor falsities and incorrect correlations. They also offered zero B-roll or any relevant visuals at all. The most engaging of these videos, *Saving Grapes: The Great Wine Blight* by "The History Guy", is predominantly a direct-to-camera address by the presenter. It features a slight amount of B-roll, but uses no music or emotional elements to captivate the audience. The story of the Great French Wine Blight was begging to come to life in cinema.

Since the story of the wine blight occurred between 1863 and the turn of the century, there is little to no photographic evidence to use as B-roll. I used self-created graphics of vintage newspapers to distill chapters of the volatile history into one or two punchy, more memorable, semi-fabricated headlines. This was my effort to evoke the public attitude or government approach to various events as they unfolded in the film. I held long slow zooms over archival photos of Planchon in an effort to mimic Errol Morris's use of visuals. I also used archival footage that did not directly correlate to the narration but rather matched the tone with which I wanted the audience to consider my narrative. With a bigger budget I would have loved to include more production value in my re-enactments because I believe they are extremely effective.

As for filmmaker as scientist, I did my best to accurately present the botany behind grafting, while keeping the terms colloquial and the visuals simple yet descriptive. In my effort to channel Sagan, I edited out most of the science jargon that I was so tempted to include in my

original narration. I am glad I listened to my advisors and simplified the language, so I could better communicate the spirit of the science and thus keep my audience engaged.

At a time when the role of science in society is being debated, it is vital that we create media which encourages appreciation for committed scientists and their work. I used the French botanist Jules-Émile Planchon as my main historical character to anchor the story. His determination and reluctance to shy away from public criticism was a major factor in stopping the total collapse of global wine regions. Using a voice actor for his roles helped to emphasize his important role in this scientific breakthrough.

Further considering the effect of misinformation of public perceptions, I gently correlated the events of the wine blight with the public reactions to the Covid-19 pandemic. I did not want to spook the audience by drawing obvious comparisons that could trigger a defensive reaction in some viewers. I attempted to structure the narrative in a way that gently alluded to the Covid-19 pandemic (invisible illness, distrust of science, popularization of "every man for himself" solutions, demonization of alternate viewpoints, etc.) as a way to set up my eventual takeaway at the conclusion of the film: if they had listened to scientists sooner the effects would not have been so catastrophic. My intention here was to create a sort of "Trojan Horse" for delivering scientific information and drawing controversial connections to our present behaviors while retaining entertainment value.

The viewpoint of my film I would most want to strengthen is the philosophical. I tried to use a technique similar to Agnes Varda's to capture my subjects in their natural setting rather than a staged interview. My limited budget did not allow for much in terms of run-and-gun production value, so I was not able to produce any of the organically electric results that Varda

did, but it is something I aim to keep pursuing in my films. I did permit Varda's absurdist spirit to influence some of my narration and allowed myself to get creative when describing some events, like the infomercial of ridiculous blight solutions for the public.

Using expository narration allowed me to cover decades of historical information and context in a prudent amount of time. It also helped to keep the tone of the piece light and allowed for a quicker pace for the film. I had initially attempted to portray personal connections around each interview subject, because I idolize those moments in Varda's film, but I realized any personal stories were too distracting from the core conflict being described. Perhaps a longer format film would support more personal and philosophical explorations from both the subjects and myself.

Finally, and perhaps most importantly, I wanted to show that science histories are entertaining! Watching humans circle around the inevitable solution and seeing every misstep along the way makes for good drama, full of suspense, and even humor. As we follow each logical progression they make, it is like cheering on the rats in a laboratory maze. We know where the cheese is and watching them approach everlasting glory only to turn back at the last moment should make the entire audience groan with excitement and frustration. Like Sagan, I also believe there are many science lovers who have yet to discover their love of science, and I want to do my best to present this gift to them. In order to create an entertaining narrative for a non-science audience, I chose to use a fair amount of humor to draw attention to the outlandishness of some people's actions in the film. One of the aspects of the wine blight that drew me to the story was the lack of dire consequences (ie. there were no casualties to honor). The impacts of the wine blight were primarily cultural and economical, and, most notably, no

one was killed. This allowed me to introduce humor into the film without the risk of becoming offensive or insensitive. Many documentarians will argue that humor does not belong in a history narrative if it is to retain its integrity. My film “The Great French Wine Blight” explores using humor as a way of highlighting the often outlandish public and institutional reactions to the events as they unfold in the film. Hopefully the humor disarms the audience from any bias and lets them enjoy the twists and turns of the narrative. My success at achieving any thrilling suspense in “The Great French Wine Blight” is debatable, but keeping the story entertaining is my first priority as a filmmaker, while always remaining faithful to the history and to the science. We need more meaningful and attention-grabbing narratives to help bring public interest back to science. Audiences today are dubious, at best, of new science, so finding captivating narratives about popular subjects can help stir up fresh interest in the scientific method and those that utilize it. As for “The Great French Wine Blight”, the most enticing element of the story is probably wine.

CONCLUSION

> "The history of science is an ancient pursuit, but a relatively young discipline. From Aristotle through the early nineteenth century, practitioners of one or another branch of knowledge have variously used the history of their field to argue for its dignity and importance, introduce it to beginners, situate it within a broader cultural milieu, summarize the literature to date, position themselves in relationship to that literature, praise and blame predecessors, give evidence of progress, extrapolate a program for future research, and draw lessons concerning the nature of knowledge and the conditions for its flourishing" (Daston 241).

History science films help introduce new audiences to science, deepen understanding by providing additional context, and improve public attitudes towards science. Filmmakers who want to tell a science history story in order to improve engagement in a field should utilize the most effective techniques developed by their predecessors. Allow me to elaborate on my analysis and delineate a few suggestions for using Sarton's recommendations.

By approaching a film's pre-production as a historian, the narrative will honor the subject matter and provide fuller context to the historical event. This approach allows for the opportunity to sympathize with scientists during times of controversial discoveries. This result aids in improving attitude towards science, and helps the audience apply these sympathies to modern scientific controversies.

While in production, it is best to embody the philosopher. Approach all subjects with openness and curiosity. Allow the story to follow the path of least resistance and enjoy the process as it unfolds. This attitude gives the filmmaker the greatest likelihood of capturing one of the magical lighting-in-a-bottle verite moments with which Agnes Varda delighted us.

The mindset of the scientist is helpful in post-production, especially while editing. A filmmaker often hypothesizes that a specific editing choice- an image paired with a certain auditory mood and thoughtful narration- will accomplish the emotional goals of the scene. Sometimes, however, this attempt does not work as planned. This is where the filmmaker as scientist most effectively steps in. When an editor is stuck creatively, I recommend this approach. By altering one variable at a time until just the right combination is discovered, the filmmaker uses the essence of the scientific method to his or her own artistic advantage.

The history of science is important to preserve in documentary because it can describe the total atmosphere of science by incorporating the governmental, media, and public pressures on scientific work. Science does not exist in a vacuum and is at the mercy of the social climate of the times. This could help an audience sympathize with the myriad of obstacles a good idea must navigate before it is adopted. Understanding the interactions among these entities is crucial to appreciating the sciences and increasing science literacy in general. If we are to accomplish our goal as successful science communicators, it is best to employ these creative devices in order to produce the most entertaining, historical, philosophical, and scientific documentary possible.

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