

ECSTATIC TRUTH THROUGH FICTION:  
RE-FRAMING THE SCIENCE FILM TO ENGAGE A WIDER AUDIENCE

by

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## ABSTRACT

Americans obtain a majority of their information about science through science films, primarily in the form of documentaries on television. However, despite the recent proliferation of these films, there is much discussion in the science filmmaking community about how ineffective these films have been lately at informing the public about science and compelling viewers to act. It is time to look at the underlying definitions of the genre from a different perspective and determine whether the current standards are the best way to successfully convey messages about science to the widest audience. To explore the possibilities for increasing the effectiveness of science filmmaking, one needs to look at the basic assumptions that come into play during the process of producing science films by re-framing the major components of the science film: goals, subject matter, audience, and format. This new set of paradigms reveals the possibility of another avenue – fiction.

## INTRODUCTION

Modern science has drastically altered what we eat, how we work, and how we communicate. Satellites high above provide us with cell phone coverage, GPS navigation, emergency triangulation, and hurricane tracking, among other things. Furthermore, many applications of science have also dramatically transformed our environment on a global scale. Whether these effects are positive or negative, and whether or not we need to change our ways is not debated here. Unfortunately, discussions regarding these topics cannot be properly conducted on a national scale because so few people seem to understand science and its processes. This lack of understanding suggests that many people may not regard science as relevant in their lives – a dangerous denial considering just how dependent our society is on science to function on a daily basis.

### How “Irrelevant” is Science?

In a recent study conducted on behalf of NASA, Dittmar (2006) found that 32% of respondents were “completely unaware” of the existence of the International Space Station. While this lack of knowledge about a particular mission may be understandable, the denial of a program touted as one of the most dramatic engineering feats of all time provokes pause: among young adults (ages 18-24), “27% expressed some doubt that NASA went to the Moon, with 10% indicating that it was ‘highly unlikely’ that a Moon landing had ever taken place.” For those that lived through the Apollo era, these numbers may be appalling. However, young adults today did not grow up in an era where scientific progress was linked to the emotional, heart-pounding experience of millions of

people simultaneously watching a man step on the moon. Science and technology today are ordinary, everyday necessities, lacking the sense of awe and wonder that they once had. NASA, for the younger set, is inextricably linked to failure and loss, with the explosions of two shuttles, the deaths of 14 astronauts and the continual troubles with Hubble - hardly anyone paid attention to the amazing engineering feats necessary to repair and enhance the satellite multiple times. In true modern media fashion, the Hubble mission's problems, rather than its astounding achievements, have stuck in the public's mind like a needle skipping on a broken record.

It is no wonder that 51% of the polled young adults "regard NASA as irrelevant or very irrelevant" to their daily lives, with 39% indicating that "nothing useful has come out of NASA." While relevancy is not always the largest factor in public support for science, (many believe in the pursuit of science for its own sake, for example), Dittmar (2006) did find that "those Americans who believed NASA programs were relevant to their day-to-day lives were much more likely to support increased NASA funding than those who do not." This finding suggests a direct causal link between an awareness of science, an understanding of its role in daily life, and public support for its funding and continuance. NASA's relevance certainly remains a worthy topic of debate; however, there is a deeper issue present here that provokes concern. We cannot have an informed debate about NASA's relevance if a considerably large portion of the general public does not know the International Space Station exists, or if the next generation of adults believes the moon landings were faked. Furthermore, Dittmar (2006) did not even ask respondents if they were aware of NASA's other contributions, such as weather

forecasting, hurricane path predictions, forest fire monitoring, and additional earth science endeavors of high importance to people's everyday lives. Even a basic awareness of NASA's role in these scientific arenas could dramatically alter the debate about NASA's relevance.

While the public's (mis)understanding of and ignorance about NASA's science missions may seem trivial, consider other areas of scientific pursuit that readily demand an informed public debate for critical decision-making. Stem cell research, human evolution, abortion, and global climate change are just a few hot topics of major scientific - even ethical - debate where a better-informed public could make a substantial difference in how those in power handle these issues. Whatever an individual's political, ethical, religious or intellectual beliefs may be, the presence of an informed public has always been key to a functioning society.

### Enter the Science Filmmaker

One of the key ways Americans obtain information about science is through the media. Science films are one of these primary media outlets. Mainly shown on television networks such as Discovery, National Geographic, and PBS, "science films" encompass a wide range of styles of programming aimed at conveying science to a general audience. The genre over the last century has loosely included exotic travelogues, conservation-focused documentaries, blue-chip wildlife programs and hard science documentaries, among others. The range and availability of science films has grown considerably since the early 1990s, inspiring the creation of nearly a dozen cable networks covering a range

of topics, from the personal lives of wild animals to human health, and from futuristic technologies to survival skills in the wild.

However, despite the recent proliferation of science films on television, there is mounting discussion in the science filmmaking community about how ineffective science films have been in the last few decades at informing the public about science and compelling viewers to act. Many environmental and wildlife filmmakers point to the general state of the environment and the so-called “death of environmentalism” as potential indicators of how unsuccessful science films have been. (Shellenberger 2004) Others point to research such as the previously mentioned NASA study and the current levels of science education in our country. Charles Siebert (1993) has even blamed wildlife documentaries *themselves* for the destruction of the environment. He suggests that the nature shown on television is unreal and provides the ultimate let-down to nature’s visitors, creating a world on television that cannot be matched in real life. Derek Bouse (2000) further asserts that the conventions and manipulations of wildlife films “may do less to acquaint us with nature than to alienate us from it, and that repeated exposure to nature and wildlife through a shroud of cinematic conventions may help make us less, not more, sensitive to it.” It is possible that despite the noblest intentions of science filmmakers, their very efforts may be detrimental to their causes. Perhaps it is time to look at the underlying definitions of the genre from a different perspective and determine whether the current standards and formats are really the best way to convey desired messages about science to widest audience.

## RE-THINKING THE SCIENCE FILM

To explore the possibilities for increasing the effectiveness of science filmmaking, one needs to look at the basic assumptions that come into play during the process of producing science films by re-framing the major components of the science film from a different perspective. What are the goals of science filmmakers and how do they attempt to achieve them? What is the subject matter and how do they treat it? Who is the audience and what do filmmakers assume about them? Finally, as derivation of the answers to these initial questions, what is the best format to use?

### Re-framing the Goals

What are the goals of the science filmmaker? Science films, from programs about technology to wild animals, have been made for a myriad of purposes – to inform, to entertain, to educate, to market products, to take people to other places, to change opinions, to make or raise money, to inspire and to motivate people into action. This plethora of motives suggests that the science filmmaker is like every other filmmaker - the only difference being that the subject matter is science. However, some science filmmakers disagree. They view science filmmaking as a higher calling based on an honest desire to inform the public about the world around us. Chris Palmer, a veteran wildlife and conservation filmmaker, puts it this way, “The public needs to know [about vital conservation issues], and filmmakers have a responsibility to take on those issues. Conservation films can play an important role in producing an informed and active citizenry, which is what keeps our democracy thriving.” (Palmer 2002) This belief in a

responsibility to inform the public about conservation can be broadened to include all of science, as there are many issues raised, and problems potentially solved, with scientific research about which an informed public ought to know.

This primary goal of science filmmakers is not readily disputed. Without it, it would be difficult to set science filmmakers apart from any other set. What have been a major source of debate for decades are the methods used to attain this goal – primarily the clash between education and entertainment. It seems to some that education cannot be successful if made too entertaining, and to others that entertainment all too often gets bogged down with educational messages and lessons to be learned. The belief that education, school, learning, and the like cannot possibly be fun and entertaining is centuries old. Meanwhile, the suggestion that entertainment degrades and defiles issues of substance is not uncommon either. Within the science filmmaking world, this dichotomy is further strained by the need for ratings and salable programs. Regardless of the possibility that entertainment may in fact help audiences learn something, many science filmmakers feel forced to make their films entertaining in order get broadcast:

Networks are interested in ratings, not causes, no matter how important or noble they might be. To get such films aired, we need to change the way we think about conservation films and how we make them. The problem is not the subject of conservation but rather how conservation is presented.... The immediate customer is the network, and producers have to figure out what broadcasters want and then deliver it. Needless to say, broadcasters want to reach the largest possible audience with the best possible demographics. Therefore, filmmakers have to focus on ratings and demographics – and that means entertainment. (Palmer 2002)

It is almost as if making programs entertaining is a forced hand, hence the quick fixes attempted by many science filmmakers, such as enticing viewers with programs showing animals behaving badly, or worse, humans behaving badly around animals. However, it is

possible that this centuries-old battle between entertainment and education may not even be relevant to the determination of the goals of science filmmaking and how to attain them.

An underlying assumption here is that audiences need to be *educated* about science. Perhaps this business of teaching through television or film is a dead end street. Is it really necessary to teach an audience science? Does one need to learn special relativity to appreciate Einstein? A science filmmaker would never attempt to teach the mathematics of relativity through a television set. To even approach understanding Einstein's work requires years of advanced scientific training. (Sagan 1996) Rather, what is palpable here is the ability of Einstein's work to inspire awe and wonder in an audience. One feels a connection to him because "he's a lot like me," and it is this emotional connection that keeps him on everyone's personal list of the greatest minds of all time. The fact that few people can accurately explain the specifics of what he did or how it actually affected science may be beside the point, particularly if overall awareness of his accomplishments grows regardless of in-depth knowledge. As the previously cited NASA study suggests, it is imperative that the public understand a specific subject's *importance* to feel that it is relevant. However, recognizing importance does not necessarily equate to an in-depth academic understanding of a subject.

Perhaps instead of attempting to teach people, science filmmakers should strive to inspire wonder and awe through emotional connections. As Chris Palmer (2002) suggests, "The best way to reach people (and thus to achieve high ratings) is through emotion rather than reason. People want passion after a long day's work, not rational

arguments.” In fact, many science filmmakers themselves became involved in their profession because they were *inspired* by science, not because they learned equations and read research papers. However, one cannot fault science filmmakers for attempting to persuade their audiences with arguments and facts - the rational thought process is at the root of all science. But if they are to reach an audience and get their films broadcast, science filmmakers need to approach the problem as artists, not as scientists.

In his study of television culture, John Fiske seems to be speaking directly to the science filmmakers of the last few decades:

If those with a public or social motivation wish to intervene effectively in the cultural economy, they need to devote more attention to understanding popular tastes and pleasures than they have in the past. It is all too easy to arrive at a set of values that are deemed to be in the public interest, but submitting those values to the test of popular pleasure and subcultural pertinence is a much less comfortable enterprise. The reconciliation of the sense of the public good with the diverse demands of popular pleasure may not be easy, but those that wish to attempt it have much to learn from Hollywood and its ilk, for these industries are sometimes adept at achieving an equally difficult reconciliation – that between an industrially centralized, economically efficient mode of production and a multiplicity of dispersed, subculturally determined... moments of reception. (Fiske 1987)

The goal of educating the public may be in direct opposition to the need for popularity, entertainment and ratings. However, if one re-frames that goal as an attempt to engage the public in science – to evoke wonder, awe, and admiration through emotion - rather than an attempt to educate through didactic and rational arguments, suddenly, this goal is not only made possible, but falls in line with the dramatic, emotional nature of television and film. With this re-framed goal towards public engagement, it becomes possible to maximize the potential of the medium to convey a message because emotional engagement is what film and television do best. Here, the medium becomes the message.

### Re-framing the Subject Matter

Science as a subject matter has taken many different shapes and forms. However, science filmmakers tend to portray science in a positivist light with the following underlying assumptions: science is a worthwhile endeavor; scientific progress is good for society; scientists are objective observers; and scientific findings are generally always correct. This default mode of portraying science is not a product of science filmmakers. Rather, filmmakers are merely espousing the preferred portrayal of science by the science community itself. Whether or not the role and value of science in our culture is taken for granted, its portrayal in the media seems to have backfired. The general public, on some level, has turned its back on science - no one likes a know-it-all. By simplifying or “dumbing down” science and making scientists appear completely objective and infallible, filmmakers and scientists alike have alienated the general public. Audiences seem to feel slighted by the condescension and, in retaliation, have begun to doubt science as an institution, suggesting that it is indeed a subjective endeavor. Carl Sagan calls this line of attack “antiscience” and argues against it vehemently:

We have biases; we breathe in the prevailing prejudices from our surroundings like everyone else. Scientists have on occasion given aid and comfort to a variety of noxious doctrines... Scientists are often reluctant to offend the rich and powerful. Occasionally, a few of them cheat and steal. Some worked – many without a trace of moral regret – for the Nazis. Scientists also exhibit biases connected with human chauvinisms and with other intellectual limitations... Scientists are also responsible for deadly technologies – sometimes inventing them on purpose, sometimes being insufficiently cautious about unintended side effects. But it is also scientists who, in most such cases, have blown the whistle alerting us to the danger. Scientists make mistakes. Accordingly, it is the job of the scientist to recognize our weaknesses, to examine the widest range of opinions, to be ruthlessly self-critical. Science is a collective enterprise with the error-correction machinery often running smoothly. (Sagan 1996)

It seems that scientists' subjective nature is exactly why science is such a powerful tool – through the scientific method, society is able to rise above the subjective leanings of human nature. Science may indeed be our greatest tool to help save us from ourselves. However, science's greatest achievement, its very *method* of overcoming our greatest obstacle, has been lost in translation to the general public. The very oversimplification of science meant to help bring it to the masses has, in effect, initiated its decline. Perhaps it is time that science filmmakers portray scientists as they truly are. Through this more realistic rendering, an attempt can be made to convey the ways in which the scientific method actually balances the effects of human subjectivity and emotion.

Indeed, behind the very clean, white coat of the scientist lies a hidden world of drama that can rival a typical soap opera. This drama, quite paradoxically, is what drives scientific progress:

A few saintly personalities stand out amidst a roiling sea of jealousies, ambition, backbiting, suppression of dissent, and absurd conceits. In some fields, highly productive fields, such behavior is almost the norm. I think all that social turmoil and human weakness aids the enterprise of science. There is an established framework in which any scientist can prove another wrong and make sure everyone else knows about it. Even when our motives are base, we keep stumbling on something new. (Sagan 1996)

In science filmmaking, there is a tendency to keep this aspect of science from the public, for fear that it might confuse the issues and confound the audience. However, as Sagan (1996) notes, "Such criticisms amount only to the charge that scientists are human."

While it is certainly human nature to want to hide mistakes, perhaps this *humanity* is exactly what the public needs to see. It provides exactly what they want - a realistic hero

to whom they can relate and connect. Unfortunately, science filmmakers often portray scientists as more akin to intellectual robots than recognizable human beings.

This need for an audience to connect to the protagonist has resulted in the use of more energetic, outgoing hosts, such as Steve Irwin (aka The Crocodile Hunter), or the employment of famous actors as program hosts, such as Ed Norton in National Geographic's *Strange Days on Planet Earth*. However, these "quick fixes" do not really work in the grand scheme. There is an obvious difference between the exciting host/actor and the still predictably dry scientists, so the disconnect still exists. The overly-excited host or fawning celebrity can even worsen the effect by making the scientists look drab by comparison. It is clear that he or she is not truly a scientist, but rather a television personality, included on the program because scientists are supposedly boring, gray-haired men in lab coats. Meanwhile, the drama is not real either, but rather a ploy to gain the audience's attention. If science filmmakers truly want to engage their audience, they need to start showing the real drama involved in the scientific endeavor, rather than creating false drama to draw in the audience.

A similar effect can be seen in the anthropomorphizing of animals for wildlife programs. As hard as they try to portray animals *as animals* in their natural state, wildlife filmmakers continually apply human virtues and values to animals to make it easier for the audience to understand them and have an emotional connection with them. However, the need to assign human traits to animals so audiences can connect only highlights just how un-human animals are. In effect, it widens the gap *further* between humans and nature. As Charles Siebert (1993) points out, "The more facts we compile about animals'

days, the more human the tales we tell of them. We've come so far from actual nature.” Perhaps filmmakers need to portray animals in their realistic *relationship* to humans, not *as* humans.

People in general are truly only interested in people, in themselves. Audiences want to watch programs about humans and human drama, so that they can connect, obtain catharsis through the characters, and ultimately escape the realities of the drama (or lack thereof) in their own lives, perhaps learning something about themselves in the process. There are not many, if any, television programs or movies aside from science films that do not focus on people. Perhaps by re-framing the subject matter in science films, by shifting the focus towards humans and their relationships with each other and to the natural world, science filmmakers can obtain a closer connection with the audience. They could allow themselves to cast science as the very human, very emotional endeavor that it truly is. Drama does not need to be forced upon science and scientists, nor do human traits need to be forced upon animals. The true drama and human story already exists in science because it has been a human endeavor from the beginning. Applying dramatic band-aids, such as the exciting host or animal with a human name, to a subject matter that does not need them is easy. The truly difficult job of the science filmmaker is to uncover the true depths of the scientific story and reveal them to the audience.

### Re-framing the Audience

An effective filmmaker tries to determine the desired audience for his or her film before setting out to make it. This process involves a great deal of assumptions about the

demographics of the potential audience, including their level of intelligence and their current relationship to the subject matter. In this regard, there has been much discussion within the science filmmaking community about two particular topics – the “dumbing down” of science and making programs that merely “preach to the crowd.”

Science programs on television have become increasingly simplistic and repetitive over the years. On the Discovery Channel, for example, many one-hour programs deliver less content than they could because they spend so much time recapping the previous segment after each commercial. It seems that these changes have been made to hold the attention of a supposedly ADD-ridden, remote-happy and unintelligent audience. One reason for this pigeonholing is that when public opinion of certain scientific issues or topics has not changed or is not a particular way, many science filmmakers assume that the message must be too hard to comprehend. The effect is the same as attempting to yell louder in an argument because the other person is not readily agreeing. In their essay, “Science on TV: A Critique,” Gardner and Young discuss this presumed role of the science program audience:

The conventions of television’s presentations of science are those of the informative lecture. The viewer is expected to be interested, but unsophisticated... The assumption (intention?) seems to be that the audience is not expected to become more sophisticated as viewers of science, technology and medicine. The audience is itself constructed as a group of simpletons to be “better informed”, which is not the same thing as being challenged by subtle and demanding ways of presenting issues. Still less does the prevailing mode of presentation invite genuine engagement or comment on the part of the watching millions. All this is in contrast with the growing assumption that viewers can deal with great variation in modes of presentation in films, drama series, spy stories, westerns, cop shows: a degree of unexplained cutting, lack of resolution, paradox, irony, comedy, etc. (Gardner 1981)

As Gardner and Young so aptly pointed out 26 years ago, these viewers for whom filmmakers feel they must “dumb down” science are the very same viewers that sit nightly through other, much more complex, programming. Audiences not only pay attention to and comprehend complex stories and hi-brow humor on television, but they also manage to relay and relive every single detail to their friends and co-workers the next day around the water cooler and in their personal blogs. They are able to follow the winding and weaving paths of a typical season of *24*, a program that takes place in real time and often shows more than one location on screen at a time. Audiences also intelligently discuss the numerous plotlines and plethora of characters on *Lost* - what worked, what could have been done differently, and what the possibilities are for future episodes. These audiences are able to take in a large amount of information and recall minor details weeks, sometimes even *seasons*, later. They are also able to reason their way through the possibilities for what could happen next on shows with several potential outcomes, such as *Heroes*. Despite the success of these intricate and (über)multi-character shows, science filmmakers do not seem to ascribe this same level of intelligence to these same viewers. Gardner and Young suggest that, “Science broadcasting is ‘educating’ viewers in one sense – the nature of scientific ‘progress’ – while firmly keeping them in the role of school children in relation to visual and critical sophistication.” (Gardner 1981) Perhaps science filmmakers need to begin trusting that their audience can handle the complexities and realities of scientific subject matter, beyond the didactic facts and figures.

Meanwhile, another common audience problem pervades science filmmaking. It is always the same viewers: a “science-attentive” crowd who are self-selected to watch science programs because they are already interested in the subject matter. Filmmaker Chris Palmer suggests that after “conservation shows are broadcast, letters arrive from viewers saying what a great film it was and what a big impact it had on them. But my guess is that virtually all those letters are from people who were predisposed to agree with the film’s message before they started watching.” (Palmer 2002) Science filmmakers, especially those interested in conservation and environmental issues, need to reconsider the effectiveness of their programming if they are only “preaching to the crowd.” That said, it is certainly important to continue to inform the “crowd” about science and scientific issues and not discount them. Without this dedicated audience, science filmmaking would not have survived over the last century, and there certainly would not be multiple cable channels dedicated to science programs. However, given the goals of science filmmakers to keep the general public engaged in science and scientific issues, they certainly are missing a large portion of the public – those viewers who are not predisposed to watch science programs from the start. It would be and has been a grave error in science filmmaking to leave these audience members behind. In the past, science filmmakers have attempted to gain this “other” audience, mainly by tricking potential viewers into watching science programming, instead of changing the nature of the programming itself. They have tried to dangle good-looking actors in front of potential viewers and tease them with amazing footage of animals behaving badly – predator-prey moments that draw onlookers like an accident scene. They have even

resorted to carnival-like oddity programs and what-if shows about asteroids hitting the earth to gain attention from the uninterested masses. A perusal of the television line-up for Discovery Channel and Animal Planet says it all: *Man vs. Wild*, *I Shouldn't Be Alive*, *Deadliest Catch*, *The Most Extreme*, *Animal Crime Scene* – and the list goes on. While these programs might initially capture the attention of that desired “other” audience with the immediate spectacle of the opening credits, most viewers will not have any investment in continuing to watch unless they become emotionally engaged in the story and a true interest in the scientific subject matter is piqued.

Unfortunately, as a result of the many assumptions made about film and television audiences, science filmmakers have essentially locked themselves into making the same programs they have always made and attracting the same audience they have always attracted. If these filmmakers were to re-frame their desired audience as intelligent viewers who desire a complex, emotionally engaging storyline that allows them to think for themselves, suddenly the possibilities for programming widen.

### Re-framing the Format

When it comes to format, science filmmaking initially appears to be firmly rooted in documentary. It is a natural marriage of themes. Science and nonfiction film both appear as objective endeavors based on facts and rational arguments. However, if one explores this relationship further, one finds several disconcerting assumptions that beg reconsideration: that documentary somehow achieves objectivity and truth more readily than fiction by its very nature; and that science films are documentaries.

Derek Bouse struggles to categorize wildlife films, specifically, with mixed success: “The question of what [wildlife films] *are*, let alone of their relation to documentary form and to the documentary genre, has never really been adequately addressed... For now they remain suspended somewhere between representation and simulation of nature – between truth and fiction, science and storytelling.” (Bouse 2000)

Bouse rests his argument on the notion that wildlife films are as constructed as fiction films, using narrative and other conventions borrowed from Hollywood. However, many science filmmakers have defended the use of these techniques, claiming an ultimate objectivity and truth because the intent of the filmmaker remains true to the subject matter. Early documentary filmmakers, such as Robert Flaherty, were known to have staged events for the camera and David Attenborough has even commented that, “on occasion *unnatural* history is one of the most potent ways of revealing natural history.” (Bouse 2000) Bouse sums up this argument, “So long as the ingredients are “real” and “natural,” the assumption seems that whatever is made of them must, in the end, also be.”

This ends-justifies-the-means attitude is made possible because filmmakers and audiences alike judge the validity of a documentary by content and not form. Bill Nichols (1981) comments, “documentary films seldom receive analysis that attempts to describe their structure rigorously, since their content is taken to be of paramount importance.”

Most science filmmakers take this to heart - conventions and format are not as important as actual content in achieving a sense of validity. It is the facts contained in a program that serve as a litmus test for truth in scientific storytelling. However, these beliefs come into question when one considers possibly divergent meanings for truth and fact.

Few have been as vehement about the meaning of truth in film as Werner Herzog, who readily applies fiction techniques to his documentaries, and vice versa. Herzog's works are not simply attempts at blurring the boundaries between forms. Rather, he aims to show that there is no such boundary line at all, and that the real dividing line here is the one between fact and truth:

For me, the boundary between fiction and “documentary” simply does not exist; they are all just films. Both take “facts”, characters, stories and play with them in the same kind of way... so I fight against cinema verite because it reaches only the most banal level of understanding of everything around us. I know that by making a clear distinction between ‘fact’ and ‘truth’ in my films, I am able to penetrate a deeper stratum of truth most films do not even notice. The deep inner truth inherent in cinema can be discovered only by not being bureaucratically, politically, and mathematically correct. In other words, I start to invent and play with the ‘facts’ as we know them. Through invention, through imagination, through fabrication, I become more truthful than the little bureaucrats. (Cronin 2002)

Herzog seeks what he calls an “ecstatic truth,” which, he believes cannot be found in the replaying of mere facts. (Sterritt 2005) His ideas suggest that truth cannot be found in content alone, but must be created using form as well.

Questions about the blurred boundaries between fiction and documentary, and between fact and truth have been thoroughly debated and will continue to be discussed in the future. What is important here is that these questions *exist*. Science filmmakers' belief in a seemingly solid boundary between fiction and documentary has leashed science filmmaking to a very narrowly defined genre for more than a century. It has limited science filmmakers creatively and forced them to work within the expected boundaries of the genre. However, if science filmmakers recognize just how blurry all of these

boundaries are – that the definitions of *documentary*, *fiction*, *science films*, *truth*, *fact*, and *objectivity* are not set in stone – then perhaps it is possible to re-frame the format of science films to include other possible types of storytelling.

## THE NEXT STEP IN SCIENCE FILMMAKING

In order to re-think the science film entirely from its core, rather than make mere cosmetic changes as has been done in the past, a new framework is needed:

- To engage the public in science by evoking wonder, awe, and admiration through emotion
- To portray science as a very human, very emotional endeavor
- To reach viewers outside the “crowd” and view them as intelligent people who desire a complex, emotionally engaging storyline that allows them to think for themselves
- To include other possible types of storytelling for science stories, recognizing that documentary films and the telling of facts do not always equate with truth

Given the possibilities revealed by this new set of paradigms, one option in particular rises to the top – fictional programming. If one major concern with science films today is that the audience fails to recognize the conventions of deceit used in documentary, perhaps it makes sense to become unequivocal about the issue, and make fiction films. Science filmmakers over the years have attempted to apply fiction techniques to their films to make them more palatable, yet there is still an overarching denial of fiction – an imagined need for science filmmakers to be seated within documentary. In this attempt to achieve validity of fact, these films actually portray *less* truth than they otherwise might. The audience is less engaged. Story and meaning are lost in favor of this overblown necessity to *appear* objective and true. Science filmmakers need to get their priorities in order, and start making films that reach a larger audience. Fiction is the perfect vehicle.

Fiction films and television programs have long been more successful at engaging large audiences through dramatic storylines. This is due in part because viewers are able to attach themselves to fictional characters – they can imagine themselves as the protagonists. However, they *cannot* imagine themselves as a person in a documentary because that person already *is* that person. They cannot be this real person, and therefore, they have a harder time empathizing with the documentary subject. There have been many documentaries about people who live in horrible situations. The audience naturally feels terrible for the subjects, but when the show is over they go home and on with their lives. If anything, they feel a greater sense of appreciation for their own situations. Yet, when two fictional characters, Rory and Jess, broke up on the Warner Brothers television show *Gilmore Girls*, there was outrage among its viewers. In addition to starting websites revolving around the characters and writing concerned letters to the producers, fans re-cut moments from the program into Rory/Jess tribute videos and posted them on You Tube. What if viewers had this kind of attachment and reaction to science films? The recent success of shows like *24*, *Heroes* and *Lost* prove that an audience can become emotionally attached - even addicted - to fictional programming. Science filmmakers should be striving to add science programs to that list.

Meanwhile, if science filmmakers wish to portray science in human terms - as emotional, subjective and complex - it may not be as easily done with documentary. Real people, and especially scientists, are not as amenable to appearing overtly emotional and dramatic. The complexities of human relationships, and the complexity of science as it relates to greater society, could be better approached in the context of a multi-character

storyline in a fictional program. Here, the writer and producer have the ultimate control to untangle issues for the viewers. This type of audience understanding of complexity has been achieved with the show *Law and Order* using the justice system as its subject matter. The show is by no means a factual account of how the justice system works, yet every show leaves its viewers with a palpable, emotional understanding that behind society's laws are often complex issues that need to be thought about and addressed. As each episode ends and viewers see producer Dick Wolf's name appear on screen, they know they have been left with yet another unresolved ending that creates a lump in the back of their throats, and yet at the same time, a desire to discuss the issue further. These same methods can be applied to science filmmaking.

Fictional programs also fall in line better than documentaries with the realistic, economic challenges of science filmmaking. They attain higher ratings, wider demographics, and keep an audience coming back over and over again. Compare the massive audience of a show like *CSI: Crime Scene Investigation* to the small "crowd" that watches a single science documentary about the study of forensics, such as Court TV's *Forensics Files*. It is economically easier to sell fictional programming from the start, and major broadcasters are more likely to be interested in it. Science filmmakers need to stop fighting this system of broadcasting by peppering documentaries with sellable "entertaining" elements and start making the kinds of programs broadcasters want in the first place.

There are certainly many disagreements to be had about whether or not fiction is appropriate for the telling of science stories. A few years ago, the so-called "*CSI Effect*"

saw prosecutors claiming that the show was misleading viewers by dilating time and providing an unrealistic view of how processes like DNA-matching work. However, it is not as if audiences are watching what they believe to be a documentary and are receiving false information. Viewers are fully aware that *CSI* is a fictional program. Meanwhile, the time dilation and fudging of real life is not at all unlike the contortions of nature seen in wildlife films. The exciting, action-packed day of the lion on the Serengeti is not that unlike the adventure-filled workday of the forensic scientist on *CSI*. This time dilation is a result of the conventions of filmmaking, not of a particular genre. Fiction cannot be said to be misleading for this reason, if the same exact elements are already found in science documentary. Furthermore, the use of such conventions is more egregious in documentary because of the audience's expectation of fact and authenticity.

Even so, many science filmmakers and scientists ultimately question the ability of fictional programming to teach science. Then again, most educators question the ability of *all* television to educate, science documentary included. While education and learning have their place, it is certainly not on television. Instead, the real challenge for science filmmakers is to determine how best to utilize television and film as a medium to involve the general public in science. It could be that fictional programs are indeed the best way to engage a large audience and give them ways to discuss science in all of its complexities.

## CASE STUDIES: WHEN FICTION WORKS

Many fictional programs and films have successfully engaged the public in science over the years. Anecdotal evidence suggests that many scientists had their interest piqued because of the fictional programming they watched in their youth. *Star Trek*, *Sea Hunt*, and *ER* have spawned countless astrophysicists, marine biologists and doctors. More recently, an animated fiction film had an immediate effect on children. *Finding Nemo* inspired kids all over the world to “free” their pet fish by flushing them down the toilet – the result of one catch phrase in the film suggesting that “all pipes lead to the ocean.” While many of these programs were not created with these particular goals in mind, the effect nonetheless exists, suggesting that there is power in fictional programming. Science filmmakers need to harness this power with programming *specifically directed* towards engaging its audience in science. While much of the evidence for these effects is anecdotal and cause and effect are hard to prove, there have been several recent examples where the evidence is compelling. Meanwhile, one can learn from these case studies how to work with the film and television industries rather than against them.

*A Night at the Museum, a Lifetime of Learning*

Rarely do science filmmakers see a direct, tangible impact from their films. Viewers do not generally watch a program and take action the very next day. However, one recent fiction film had a direct and noticeable impact within days of its release. *Night at the Museum* stars Ben Stiller as a security guard at the American Museum of Natural

History (AMNH) in New York who has all kinds of laughable, crazy misadventures in the science museum with its residents (Teddy Roosevelt, Sacagawea, and T. Rex, among others) who come to life at night. After the December 2006 release of the film, attendance at AMNH soared above its regular numbers. An additional 50,000 visitors (20% more than the average for the same timeframe) attended the museum in the two weeks following the film's December 22<sup>nd</sup> release, (Spears 2007) setting a museum attendance record of 32,000 visitors in one day. (Snyder 2007) As one reporter noted, "A hit movie has helped turn a musty museum into the coolest kids hang-out in town." (Dominguez 2007) The museum was so flooded with film fans that the museum staff had to create a special handout with movie FAQs, informing visitors where they could find exhibits from the movie, and which exhibits did not actually exist. (Spears 2007)

Many of the museum's inhabitants in the film were fictional, and the film was actually shot on a soundstage in Vancouver. Only the exterior shots of the museum and a handful of others were shot on location. However, museum officials were not worried about this discrepancy between fact and fiction; rather, they embraced the chance it gave them to engage children in science and natural history:

"From our point of view," said Ellen Futter, the museum's president, "it was always a movie about the spirit of the museum rather than a literal representation of it. I know that's pretty sophisticated for a kid, but we feel strongly that once people are here, they're pretty excited about what they're seeing." (Spears 2007)

The educators at AMNH, much like Werner Herzog, believe in an "ecstatic truth," beyond the accounting of facts and figures, which can engage the public. Furthermore, because these educators embrace and encourage their connection to the fiction film, they are able to continue to bring in more visitors beyond the December surge. A new evening

program allows 250-300 children and parents to spend the night at the museum, touring the exhibits by flashlight and sleeping under a giant whale replica in the Hall of Ocean Life. The museum has managed to sustain the initial rush of the movie's release and use it to their advantage. The monthly event is sold out through June with a full waiting list. (AMNH 2007) Meanwhile, the movie and the overnight event have spurred many museums, zoos and aquariums to develop their own sleepover programs. (Snyder 2007) In addition to the numbers recorded in New York, countless additional children dragged or will drag their parents to museums all over the country because of one fiction film that successfully blends fantastical figments of the imagination with excitement about science to fully engage its audience.

### The Other CSI Effect

The television crime drama, *CSI: Crime Scene Investigation*, is readily the most applicable current example of science-infused fiction programming and how it can affect viewers. The impact of the show was so prevalent, it was given its own name roughly two years after the show first aired in 2000. The press went wild with reports of the "CSI Effect." Prosecutors and defense attorneys alike are still blaming the show today for unrealistic demands and expectations from juries (Willing 2004) and are reportedly screening potential jurors to determine if they are fans of the show. (Franzen 2002) Law enforcement experts have made claims that criminals are now smarter because of the show and its spin-offs, while others suggest it has an adverse effect on crime, having sent a message to criminals that forensics will catch you in the end. (Cole 2005) The "CSI

Effect” even spawned a special session at the annual meeting of the American Association for the Advancement of Science in February of 2005 to discuss the show’s ability to portray forensic science and its impact on the field. (AAAS 2005) At this special session, another “*CSI* Effect” was discussed, a positive one previously ignored by the negative-hungry media.

Max Houck, an expert forensic scientist-turned-educator, announced that the interest in forensic science among matriculating students since the premiere of the series has dramatically increased, so much so that new departments at universities have been created. West Virginia University, as Houck reported, had 4 graduates in the forensics program as of 1999. Since the original airing of *CSI* in 2000, the program has grown to be the largest on campus, drawing 13% of incoming freshman. (Boyle 2005) As Houck noted in 2005, “Today it’s the largest major program on campus with about 400 undergraduate students.” (Boyle 2005) Additionally, there have been reports of overwhelming applications to forensics laboratories (Smaglik 2007), and on the other end, high school guidance counselors are hearing more about it from their students. Eric Chancy suggests that, “Ten years ago, you didn’t have students walking into your office inquiring about forensic science, but now they do.” (Krishnan 2007) Just as all of the lawyer, doctor, and cop shows before it, *CSI* has sparked an interest in young adults searching for a career that might be right for them. Critics of this form of stylized, Hollywood recruiting suggest that it creates a false expectation of the career and that many students will leave after finding out how un-glamorous poking around dead bodies tends to be. (Lovgren 2004) Jay Siegel, of Indiana-Purdue University’s new

undergraduate forensics department, suggests that, “the field is so competitive that it attracts the very brightest students, though many come with unreasonable expectations.” (Lovgren 2004) Max Houck and others are attempting to lessen the effect of the glamorized portions of the career with training and outreach programs that give students a real feeling for what working in forensics is like. The prospective student webpage for the forensics department at West Virginia University even carries a disclaimer, talking about *CSI* specifically and how it is and is not related to realistic work in the field. (WVU 2007)

Aside from inspiring this new population of future forensic scientists, *CSI* and its spin-offs have had a number of other positive effects, stemming largely from engaging its audience in the science. Many have suggested that it has finally given the public a working forensic vocabulary. One article suggested that:

Many lawyers, judges, and legal consultants say they appreciate how *CSI*-type shows have increased interest in forensic evidence. “Talking about science in the courtroom used to be like talking about geometry – a real jury turnoff,” says (Robert) Hirschhorn, of Lewisville Texas. “Now there’s this almost obsession with the shows, you can talk to jurors about (scientific evidence) and just see from the looks on their faces that they find it interesting.” (Willing 2004)

While there are other prosecutors and defense attorneys who have blamed this newfound jury interest for ruining their cases, it seems that what they are actually faced with is the challenge of doing their jobs more effectively. The public’s engagement with forensic science due to *CSI* has only heightened the stakes and created a greater expectations and a more urgent demand for justice. Like those at the American Natural History Museum, and Max Houck via West Virginia University, the forensic science community needs to learn how to use this engagement to inform the public about forensics, to draw attention

to their needs for funding (Boyle 2005), and to encourage the next generation of scientists. Instead, many have used the publicity to defend themselves in lost court cases and to complain about something that everyone already knows is true: fictional television is not good at educating and it certainly does not portray real life.

### Saving Lives, One Show at a Time

The forensic community could indeed take a cue from the world of health and medicine. Doctor shows and other medical fictions have been portraying characters and their health problems for much longer than the recent glamorization of forensic science. The major difference is that health professionals have found positive ways to use the medium to promote their own messages, instead of becoming victims of their own popularity. Prompted by overwhelming evidence that soap operas and prime time television affect the general public's interest in and awareness of health issues, many organizations have been created over the years to promote accurate representations of health issues, to award those filmmakers who successfully engage the public in health issues, and to study the effects that fictional programming has on the medical profession and the public's awareness of health issues.

Many in the health industry call these initiatives an attempt at "entertainment education" - the belief that useful information about a social issue can be successfully disseminated through mass media, such as fiction television. (Kaiser 2004) One such group is the Media Project, formed in 1980, which strives to get the entertainment industry to infuse more information about sexual health for adolescents into popular

teenage-oriented films and television shows, such as *Dawson's Creek* or *Felicity*. They offer seminars on current issues for producers, a helpline for writers to call if they need factual information, and one-on-one consultations for production companies. The Last Acts Writers Project is another foundation whose specific mission is to provide Hollywood screenwriters with more information on terminal illness and death, in an attempt to create more accurate depictions on television. Hollywood, Health and Society (HH&S) is another such organization that has had an impact on the inclusion of useful health information in fictional television shows. A partnership between the Centers for Disease Control and the USC Annenberg Norman Lear Center, HH&S provides fact sheets to producers and has created awards for the portrayal of health issues on television. One of the oldest and most well-known groups is the Entertainment Industries Council, a non-profit established in 1983 to provide the entertainment industry with information and awareness about health and social issues: "EIC is the link between the science and the entertainment, and enables communication between scientists and the creative community, and facilitates communication from them to the public." (EIC 2007) EIC works in partnership with the CDC, National Institutes of Health, FX Networks, News Corporation, and others and has an impressive list of trustees from Aaron Spelling to Stan Lee to Leslie Moonves, the CEO of CBS. (EIC 2007) As Larry Deutchman, executive VP recently said, "We're the folks who got actors to put their seat belts on for driving scenes." (Brink 2006)

Through these organizations, the health industry has managed to offer easy access to information and professional consultants, while also attempting "issue placement" on

television programs. (Kaiser 2004) Similar to the idea of “product placement,” health advocates essentially lobby for writers to talk about health issues in their programs by piquing their interest in particular issues, true stories, and diseases. These successful alliances with the film industry have resulted in a plethora of health issues gaining the spotlight in fictional television. (Mishori 2007) A few recent surveys stand out in suggesting that the connection between fiction and science engagement is undeniable, and that making sure fictional shows include accurate information is paramount to viewers’ health.

The Centers for Disease Control conducted a study in 2000 to determine how effective prime time television is at engaging its audience in health issues. Here are some of the results:

- A majority of viewers (52%) report picking up health information that they trust to be accurate from prime time television shows, and 1 in 4 say that these shows are among their top three sources for health information.
- Nine of out 10 (90%) regular viewers report learning something about diseases or how to prevent them from television, and almost half cite prime time (47%) or daytime entertainment (48%).
- Almost half (48%) of regular viewers who heard something about a health issue on a prime time television show say they took one or more actions: told someone about the storyline (42%); told someone to do something or did something themselves, such as use a condom or exercise more (16%); visited a clinic or doctor (9%); or called a clinic, health care facility, or hotline number for information (5%). (Kaiser 2004)

The numbers in this study and numerous other reports suggest that fiction television has a profound impact on its viewers and their health. Turow (2002) states, “What has become increasingly clear in recent years is that fictional television can also play a significant role in shaping public images about the state of our health care system and policy options for

improving the delivery of care.” In addition to disseminating simple information about health, the authors of this report, “As Seen on TV: Health Policy Issues in TV’s Medical Dramas,” suggest that science filmmakers can indeed re-frame their audience as intelligent individuals who are able to weigh the information they receive and digest complex scientific issues:

One likely take-home message for viewers: health care policy arguments often do not lend themselves to easy solutions... Physicians struggled with one another, and themselves, to find the best course of action. Answers were not obvious, and the plots even seemed to purposefully want to challenge, even jar, viewers emotionally and intellectually about such issues. (Turow 2002)

Another study of the prime time medical drama *ER* found that 51% of regular viewers later had conversations with family and friends about health issues raised on the show, while one of every five viewers say they have sought out additional information about a health issue raised on the show. (Brodie 2001) For those who doubt the usefulness of fictional television in engaging the public in science and the discussion of scientific issues, the authors replied:

Entertainment television reaches a wide audience, and in the end, whether one feels that entertainment television does more good or more harm, it will continue to convey health information to its audience whether by design or by default. This study shows that the content has an impact on that audience. It seems, therefore, worth the effort to try to make the content as accurate and science-based as possible, and to take advantage of opportunities to convey public health messages that can improve health and sometimes save lives. (Brodie 2001)

Science filmmakers certainly could learn volumes from the health industry and its realistic framing of television’s role in society.

## CONCLUSIONS

Television exists to entertain, so that broadcasters, advertisers, and corporations can sell products and make money. These motives are intrinsic and will not change. Television is what it is. The ongoing, long-fought debate between education and entertainment on television is a delusional dichotomy with no end in sight. It is time for science filmmakers to recognize that there is no battle to be fought here, but rather an opportunity to utilize a powerful vehicle for reaching the public. They must learn to use television and film in their most effective modes. The science film needs to be re-framed so that it can be utilized on television and in theatres to its greatest potential. The key word here is *engagement*. In a sense, this re-framing calls for educators and science filmmakers to beat television at its own game. Engage the audience in a message, in science, so that when viewers turn off the television, they head out to the nearest science museum, ask their doctor about a health issue, or learn more about a career that might suit their talents and interests. These kinds of results become more and more possible and easier to attain when filmmakers work *with* television and its modes of production, rather than against it.

This way of thinking is not new. The health industry has already long-recognized the value of aligning itself with Hollywood and has reaped measurable benefits. Meanwhile, several other organizations have also recognized the value of fiction for engaging the public in science. The Alfred P. Sloan Foundation, for example, has created several avenues to production funds for filmmakers whose scripts focus on science-related themes or on scientists as characters. They distribute grant money through film

schools, such as the American Film Institute, UCLA, USC, and NYU's Tisch School of the Arts. They are also attempting to increase the visibility of science-related feature films by aligning with several prestigious film organizations, such as the Sundance Film Institute and the Tribeca Film Institute. (Alfred 2007)

Even the Pentagon recognizes the value of using fiction filmmaking to engage the general public in science. A recent grant from the Air Force and Army for \$350,000 over three years has provided the opportunity for middle-career scientists to learn the art of fiction screenwriting through special seminars with the American Film Institute in Los Angeles. While it may seem like an inappropriate use of military funds, the Pentagon has a clear and distinct goal in mind:

Fewer and fewer students are pursuing science and engineering. While immigrants are taking up the slack in many areas, defense laboratories and industries generally require American citizenship or permanent residency. So a crisis is looming, unless careers in science and engineering suddenly become hugely popular... And what better way to get a lot of young people interested in science than by producing movies and television shows that depict scientists in flattering ways? (Halbfinger 2005)

With the ability to turn just about anywhere, the Pentagon did not look to engage young adults through schools, education, public service announcements, or even science filmmaking in the form of documentary. Rather, like many health industry advocates, they turned to fiction filmmaking and television shows because they *also* believe that fiction is the most powerful way to engage the public in science and to inspire the next generation of homegrown scientists.

If these examples and case studies do not already serve to suggest that fiction films and programs are an incredibly effective way to reach the public about science,

consider the following imperative: the fiction world *needs* science filmmakers. Fiction films and programs will continue to use scientists and scientific themes as their subjects, regardless of the level of involvement of the scientific community at large. Science filmmakers are highly proficient, and now even academically trained, at speaking to the scientific community, the film industry and the general public. If they do not participate in the creation of fictional programs, much will be lost in translation.

When I heard the learn'd astronomer;  
When the proofs, the figures, were ranged in columns before me;  
When I was shown the charts and the diagrams, to add, divide,  
and measure them;  
When I, sitting, heard the astronomer, where he lectured  
with much applause in the lecture-room,  
How soon, unaccountable, I became tired and sick;  
Till rising and gliding out, I wander'd off by myself,  
In the mystical moist night-air, and from time to time,  
Look'd up in perfect silence at the stars.

- Walt Whitman, 1865

## BIBLIOGRAPHY

- Alfred P. Sloan Foundation. "Public Understanding of Science and Technology." Sloan website as of February 2007  
Available at: [http://www.sloan.org/bios/edu\\_public\\_2007.shtml](http://www.sloan.org/bios/edu_public_2007.shtml)
- American Association for the Advancement of Science. "The CSI Effect: Forensic Science in the Public Imagination." Pamphlet from the AAAS Annual Meeting, February 20, 2005
- American Museum of Natural History. "New! AMNH Sleepovers: Be among the lucky few to spend *A Night at the Museum!*" AMNH website as of February 2007  
Available at: <http://www.amnh.org/kids/sleepovers/>
- Barnouw, Eric. Documentary: A History of the Non-Fiction Film. Oxford University Press, 1983
- Bouse, Derek. Wildlife Films. University of Pennsylvania Press, 2000
- Boyle, Alan. "Crime Sleuths Cope with CSI Effect: Forensic experts dogged by TV expectations." MSNBC.com, February 20, 2005  
Available at: <http://www.msnbc.msn.com/id/7003715>
- Brink, Susan. "Prime Time to Learn: In law dramas, medical shows, and comedies, science is invading TV story lines. Good thing they try to get it right." Los Angeles Times, November 13, 2006  
Available at: <http://www.aegis.com/news/lt/2006/LT061104.html>
- Brodie, Foehr, et al., "Communicating Health Information through the Entertainment Media." *Health Affairs* (Jan./Feb. 2001), at 192-99  
Available at: <http://content.healthaffairs.org/cgi/reprint/20/1/192>
- Centers for Disease Control and Prevention, "Prime Time Viewers and Health Information." 2000 Healthstyles Survey Executive Summary, October 24, 2001  
Available at: [www.cdc.gov/communication/healthsoap.htm](http://www.cdc.gov/communication/healthsoap.htm)
- Cole, Simon and Rachel Dioso. "Law and the Lab: Do TV shows really affect how juries vote? Let's look at the evidence." The Wall Street Journal, May 13, 2005
- Cronin, Paul. Herzog on Herzog. Faber and Faber, London, 2002

Dittmar, Mary Lynne. "Engaging the 18-25 Generation: Educational Outreach, Interactive Technologies, and Space." American Institute of Aeronautics and Astronautics, 2006

Dominguez, Robert. "Sleepover with T-rex and Attila the Hun: Night at museum a hot ticket in N.Y., thanks to film." San Jose Mercury News, January 14, 2007  
Available at: [www.mercurynews.com/mld/mercurynews/living/16459298.htm](http://www.mercurynews.com/mld/mercurynews/living/16459298.htm)

Entertainment Industries Council, Inc. "About EIC." EIC website, Feb.12, 2007  
Available at: <http://www.eiconline.org/about/index.php>

Fiske, John. Television Culture. Routledge, 1987

Franzen, Robin. "CSI Effect on Potential Jurors has Some Prosecutors Worried." Newhouse News Service, December 16, 2002

Gardner, Carl and Robert Young; "Science on TV: A Critique." Popular Television and Film. London: BFI, 1981

Halbfinger, David M. "Pentagon's New Goal: Put Science Into Scripts." The New York Times, August 4, 2005

Herzog, Werner. "Minnesota declaration: truth and fact in documentary cinema." Originally published April 1999.  
Available at: [www.wernerherzog.com](http://www.wernerherzog.com)

Kaiser Family Foundation. "Entertainment Education and Health in the United States." Issue Brief #7047, Spring 2004  
Available at: <http://www.kff.org/entmedia/7047.cfm>

Kaiser Family Foundation. "The Impact of TV's Health Content: A Case Study of ER Viewers," Survey Snapshot, June 2002  
Available at: [www.kff.org/entmedia/3230-index.cfm](http://www.kff.org/entmedia/3230-index.cfm)

Krishnan, Anne. "CSI Effect: Teens' career choices follow shows." The News & Observer, February 15, 2007  
Available at: <http://www.newsobserver.com/104/story/543390.html>

Lovgren, Stefan. "CSI Effect is Mixed Blessing for Real Crime Labs." National Geographic News, September 23, 2004  
Available at: [http://news.nationalgeographic.com/news/2004/09/0923\\_040923\\_csi.html](http://news.nationalgeographic.com/news/2004/09/0923_040923_csi.html)

- Mishori, Ranit. "How TV Docs Can Keep You Well." *Parade Magazine*, Jan. 28, 2007  
Available at: [http://www.parade.com/articles/editions/2007/edition\\_01-28-2007/TV\\_Doctor](http://www.parade.com/articles/editions/2007/edition_01-28-2007/TV_Doctor)
- Newcomb, Horace. Television: The Critical View. Oxford University Press, 2000
- Nichols, Bill. Blurred Boundaries. Indiana University Press, 1994
- Nichols, Bill. Ideology and the Image. Indiana University Press, 1981
- Nichols, Bill. Representing Reality. Indiana University Press, 1991
- O'Connor, Michael. "The Role of the Television Drama *ER* in Medical Student Life: Entertainment or Socialization?" *JAMA*. 1998; 280:854-855  
Available at: <http://jama.ama-assn.org/cgi/content/full/280/9/854>
- Palmer, Chris. "Conservation is too important not to be made entertaining." International Wildlife Film Festival and Media Center circular, June 2002
- Palmer, Chris. "From witness to judge: are documentaries becoming too subjective?" Presentation given on RealScreen panel on January 31, 2006 Available at: <http://environmentalfilm.org/palmer.html>
- Palmer, Chris. "How to strengthen and revitalize the environmental movement." Speech given at Green DC Week, April 19, 2006  
Available at: <http://environmentalfilm.org/palmer.html>
- Sagan, Carl. The Demon-Haunted World: Science as a Candle in the Dark. New York: Ballantine Books, 1996
- Schneider, Mike. "NASA Trying to Get Teens Hooked on Mars." *San Francisco Chronicle*, January 7, 2007
- Shellenberger, Michael, and Ted Nordhaus. "The Death of Environmentalism: Global warming politics in a post-environmental world." Self-published, Oct. 2004  
Available at: [http://www.thebreakthrough.org/images/Death\\_of\\_Environmentalism.pdf](http://www.thebreakthrough.org/images/Death_of_Environmentalism.pdf)
- Siebert, Charles. "The Artifice of the Natural: How TV's nature shows make all the earth a stage." *Harper's Magazine*, February 1993
- Skweres, Mary Ann. "Herzog on Grizzly Man" *Film & Video*, June 2005  
Available at: <http://www.studiodaily.com/filmandvideo/searchlist/4439.html>

Smaglik, Paul. "Media publicity for science can be a double-edged sword." *Nature*: 445, 789 (February 2007)

Available at: <http://www.nature.com/naturejobs/2007/070215/full/nj7129-789a.html>

Snyder, Steven. "A Sleepover Makes History: Natural history, that is, as museum puts parents and kids up for a night." *Newsday*, January 23, 2007

Available at: <http://www.newsday.com/entertainment/localguide/kids>

Spears, Dorothy. "The Reel and the Real." *The New York Times*, January 14, 2007

Sterritt, David; "The Ecstasy of Truth: Werner Herzog seeks new horizons, coalitions and ways of making movies." *MovieMaker* 59:12, Summer 2005

Turow and Gans (2002). "As Seen on TV: Health Policy Issues in TV's Medical Dramas," Report to the Kaiser Family Foundation, July 2002

Available at: <http://www.kff.org/entmedia/3231-index.cfm>

West Virginia University. "Forensic Science Gateway: Frequently Asked Questions." Website as of February 12, 2007

Available at: [http://www.wvu.edu/~forensic/Frequently\\_Asked\\_Questions.html](http://www.wvu.edu/~forensic/Frequently_Asked_Questions.html)

Willing, Richard. "CSI Effect has juries wanting more evidence." *USA Today*, August 5, 2004

Available at: [http://www.usatoday.com/news/nation/2004-08-05-csi-effect\\_x.htm](http://www.usatoday.com/news/nation/2004-08-05-csi-effect_x.htm)