DUMBING IT DOWN: MASS MEDIA AND SCIENCE LITERACY IN THE USA.

by

Casey Forest Kanode

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DEDICATION

This work is dedicated to my amazing parents and my loving sister, for whom I would certainly not be where I am today. Their support has been vital in the pursuit of my passions. I also would like to dedicate this paper to my dog Jackson, for he never judges me and helps me to be a better person everyday.

TABLE OF CONTENTS

LIST OF FIGURES

Figure Page

ABSTRACT

Science literacy is important to individuals and the societies in which they live because it enhances our health, well being, and ability to progress into the future. A society whose citizens do not have or appreciate the benefits of scientific literacy are at risk of falling behind economically, have a greater chance of health crises, and may find themselves ill-equipped to navigate the dangers of a modern, technological world. Science literacy in America, while not extremely low, is being negatively impacted by elements within popular media including, but not limited to, the politicization of scientific issues by news media outlets, the rise in fake or pseudo-scientific television programming, and misinformation through social media channels. These factors, when viewed collectively, have created a social environment wherein scientific curiosity and intellect are at risk of stagnating. There are multiple risks to this outcome and must be confronted in order for our society to continue to progress scientifically and culturally.

INTRODUCTION

"To be scientifically literate is to know when
someone else is full of bologna sandwich." --Neil Degrasse Tyson

Scientific literacy is defined by the National Research Council in its *National Science Education Standards* as the "knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (22). The topic of scientific literacy in America is one that has been researched and written about extensively by numerous scientists and journalists. Although they often address the issue in different ways, their goal is often the same: to shed light on whether or not the general public in America is capable of grasping scientific ideas and principles.

I'm not a sociologist or an education specialist, so therefore my goal is not to produce yet another study on public scientific literacy. I am a filmmaker. To be more exact, I'm a filmmaker who is most interested in how to successfully communicate science to the general public. In that vein, I am also interested in the ways in which the general public ingests information about scientific concepts and issues.

Informal learning, or learning outside of an official educational institution, is the most prevalent form of learning in adults (Merriam et al.). Due to the increasingly technological nature of our society, it's estimated that Americans consume media for an average of 15.5 hours per person per day (Short 7). At first glance, it would appear that the myriad of outlets in which an individual could access scientific news or information could only lead to a populace that is more scientifically literate. It is my aim, however, to

show that mere exposure cannot necessarily mitigate the dangers that arise from how this information is presented and/or ingested. Science literacy in America, when analyzed through a prism of the mass media, is being negatively affected by numerous factors including, but not limited to, the politicization of scientific issues, the rise in fake or pseudo-scientific television programming, and the spread of misinformation through social media channels.

THE IMPORTANCE OF SCIENTIFIC LITERACY

A Brief History

Until 1957, when the National Association of Science Writers (NASW) commissioned a national survey of public understanding of science in the United States, science literacy was not an idea that our government sought to quantify (Miller, "Civic Scientific Literacy: The Role of the Media in the Electronic Era" 46) The historical lack of quantification, however, should not be assumed to equate to a lack of understanding about the importance of civic scientific literacy. The early days of American history were filled with numerous scientific advancements such as the steamboat and telegraph that helped pave the way for a better and more productive society. It was becoming clearer to the American public that science would play a vital role in the expansion and progression of American life into the 20th century. In his book *The Body Politic*, Moreno muses that "It is fair to say that no nation has ever been founded by people who were more oriented toward the pursuit and propagation of knowledge than the United States (35)."

The commissioned survey by NASW was completed a few months before the launch of Sputnik, and found the public to be most knowledgeable about radioactive fallout, fluoridation in drinking water, the polio vaccine, and space satellites (Miller, "Civic Scientific Literacy: The Role of the Media in the Electronic Era" 46). From that list, only polio and space satellites are topics which might concern someone in the modern day United States. That being said, it's clear from those results that with the passing of time comes the need for public understanding of science to adapt and change

as to keep up with the scientific and technological progression of society. Considering that Jon Miller, a political scientist that has researched this topic extensively, has found that only about one in five Americans is "scientifically savvy" enough to read the Tuesday *New York Times* Science section, there is obviously work to be done (Russell 27).

Benefits to Individuals

As we advance further into the twenty-first century and technology becomes an even bigger part of our everyday lives, the need for civic scientific literacy will become even more important. For individuals, there is a great incentive to be scientifically literate. The Royal Society, as far back as 1985, efficiently summarized this in their report on public understanding of science, stating:

> Ignorance of elementary science cuts off the individual from understanding many of the tools and services used every day. Some basic understanding of how they function should make the world a more interesting and less threatening place. It is obviously not necessary, and hardly possible, for an individual to understand the functioning of everything from a bus to a ball point pen or a television set. But those who have never been stimulated to enquire about how things work and who lack the basic knowledge to pursue such an enquiry are surely at a disadvantage in the modern world. Scientific literacy is becoming an essential requirement for everyday life. (10)

The Royal Society's comments underscore the need for an inherent curiosity towards scientific learning and hint at how that can affect one's individual daily experiences. It is generally understood that this curiosity helps individuals to navigate the demands of daily life, making them more adept at analyzing decisions in regard to personal safety, diet, and

healthcare (Thomas and Durant 5). The Royal Society later described how scientific literacy might benefit one's health in offering that:

> Personal decisions—for example, about diet, smoking, vaccination, screening programs or safety in the home and at work—should all be helped by some understanding of the underlying science. Greater familiarity with the nature and findings of science will also help the individual to resist pseudo-scientific information. An uninformed public is very vulnerable to misleading ideas on, for example, diet or alternative medicine. (Council of the Royal Society 10)

Being scientifically literate also affords one the luxury of being a much more informed consumer. As more of the products we buy and use on a daily basis begin to incorporate more advanced technologies, it will become vital that individuals be able to make proper evaluations of their desirability, safety, and efficacy (Miller, "Civic Scientific Literacy: A Necessity in the 21st Century" 3).

In a society where science and technology becomes an integral part of life, more and more jobs will demand more advanced skills. These jobs will, as the National Research Council states, increasingly "require that people be able to learn, reason, think creatively, make decisions, and solve problems (1). Being scientifically literate will help a person be more proficient at all of those skills. In fact, you can see this in the workforce already as those who avoided educating themselves on computer based technologies are finding themselves either without work or forced to take up lower paying jobs which do not require computer training. According to the Bureau of Labor Statistics, of the top twenty highest paying occupations, only two(Chief Executives and Marketing Managers) did not require a background in science ("Highest Paying Occupations : Occupational Outlook Handbook: : U.S. Bureau of Labor Statistics"). My experiences in filmmaking

have proven that as we move forward it will be imperative that one not only be scientifically literate enough to handle current technologies, but also be able to make predictions about future technologies and actively educate themselves on these potential technologies and how they may play into their current field of expertise.

Individual Risks of Low Scientific Literacy

There are also substantial risks facing one who does not proficiently understand basic scientific concepts. Someone who isn't scientifically literate may not often resort to rational or logical thinking processes and therefore may not be as quick to make sound decisions when it comes to health and safety issues. At the risk of being anecdotal, I saw this first hand with a former neighbor. Due to extreme rainfall, flooding potential in our area was extremely high and eventually our area was instructed to evacuate. My neighbor actively refused, stating numerous times that "they don't know how high the water will get. They're just guessing." This type of reaction is a direct result of not being scientifically literate enough to understand how meteorology and historical flooding models work together to create scenarios for low lying areas.

Another risk factor that plays a role in people's day to day lives more often than not is that by being scientifically illiterate, a person is much more likely to fall for pseudo-scientific claims regarding diet or alternative medicine. This can hurt individuals on multiple levels. First, depending on the severity of the condition, opting for alternative methods or treatment over scientifically proven ones can most certainly be dangerous, and perhaps fatal, especially in situations concerning cancer or other major diseases.

Concurrently, ignoring scientific and medical data regarding the efficacy of vaccinations or the negative health benefits of certain foods may lead to a greater long term risk of disease or death. By not understanding the basic science regarding your body's processes and the need to take care of it on a daily level, an individual opens themselves up to greater potential for harm. These risks and how they are abetted by certain aspects of mass media will be discussed further but I found it important to mention them upfront as to highlight the importance of personal scientific literacy.

Benefits to Society

It is easy to see how the importance of scientific literacy transcends mere individual benefits and can have the ability to impact society greatly. Many of these benefits are directly related to the ability of its populace to perform the jobs that are needed to be competitive in the global marketplace. A society must maintain vigorous scientific research and development standards, which will require a steady supply of personnel that is scientifically and technically literate. Doing so allows the society to pursue research and development of technologies that can not only be marketed to the rest of the world, but also be of high enough quality that they become the global standard (Thomas and Durant). This argument can potentially be expounded to include our roles as consumers in society, suggesting that a viable and productive economy requires consumers that are able to make good decisions about new and upcoming technological tools that are offered.

One benefit that a scientifically literate populace offers society is one that will also become more relevant as our local, national, and global political stage becomes more saturated with important scientifically based issues. In a democratic society the people ideally wield great power over the decisions and policy that it's government makes. It isn't hard to see that a scientifically illiterate populace will fail miserably at encouraging their legislators to make informed decisions on scientific issues, whether they be something as small as protecting a local stream or something on a global scale, like rising sea levels or stem-cell research. It has also been argued that a scientifically literate populace will also wield its democratic power much more often, as being more educated on the threats that face society causes one to be more passionate about those issues and their gravity (Thomas and Durant 7). It's important to note as well that in the scope of government, "the public often serves as the arbiter of scientific disputes, especially when the scientific community and the political leadership are divided on a particular issue (Miller, "Civic Scientific Literacy: A Necessity in the 21st Century" 3)."

A scientifically literate society will also be much more powerful in the global political stage. The power of a public genuinely invested and interested in science is wholly evident when looking at the space race between the United States and Russia. Fueled by the launch of Sputnik by the Russians, and public fears that America was falling behind scientifically, federal funding to the National Science Foundation increased over $400 million in ten years and resulted in the creation of both NASA and the National Defense Education Act, eventually allotting around $1 Billion in incentives to encourage American students to pursue careers in science and engineering (Mooney,

Kirshenbaum, and Ebrary 27). The impact this had on the economic and political power of the United States is immeasurable when looking at the scientific advancements that arose out of the creation of NASA. In lieu of stepping outside of my academic expertise, I would venture to guess that had the public themselves not been invested in these endeavors, even ones born out of fear, these advancements might never have been made.

Societal Risks of Low Scientific Literacy

In relation to the "citizens as workforce" argument, a society which lacks enough citizens who are scientifically literate will eventually have to start looking for workforce participants in other countries or evaluate the potential need for outsourcing of those jobs. This will inevitably result in a damaged economy on a local or national scale, or both. It is genuinely in the best interest of a nation to ensure that their own citizens are equipped to tackle the issues and problems that face their communities without the need for outside assistance.

Another potential risk of a scientifically illiterate populace is the risk of gullibility. Some may be quick to dismiss this idea with the old saying "A fool and his money are easily parted," ignoring the true societal risk that a nation full of "fools" might actually present. A perfect example of this would be with the recent increase in parents who have decided to forego vaccinations for their children in lieu of a perceived threat of autism. By not having adequate scientific literacy to understand how to properly evaluate the claims being made by those who suggest that vaccines cause autism, these parents are putting their communities, and society as a whole, at risk. Similarly, a society wherein its

citizens are not educated on germ theory and therefore forego washing their hands will be at greater risk of illness as studies show that hand washing alone can reduce respiratory illness in a population by twenty-one percent (Aiello et al.).

Additionally, an electorate that suffers from low scientific literacy, or worse, actively disdains scientific knowledge as a virtue, will inevitably elect government representatives whom share the same lack of knowledge or virtue. This could then potentially lead to that elected official, due to the desire to cater to his/her electorate, voting on important scientific issues in a way that does not take into account the research or data that has been presented in regards to the issue at hand. A perfect example of this would be the ongoing debate surrounding climate change and the numerous issues that may arise from congressmen and congresswomen ignoring the scientific data that is overwhelmingly being presented in order to initiate political action towards addressing the greater problem. Using this example, it's easy to see why a scientifically illiterate electorate will inevitably result in scientifically illiterate representatives which will in turn put everyone, not just that community, at risk.

Once you understand the benefits and risks, it's easy to see the importance that scientific literacy has on not only the current population, but future generations as well. I feel it is our duty as citizens in this nation to ensure that the future we leave for our children and grandchildren is one in which they aren't left trying to repair the damage we did because we didn't take it upon ourselves to maintain a respectable level of scientific literacy. Some of this responsibility lies on us as individuals. However, some of it also

lies in the hands of those whose job it is to educate and inform society on the scientific issues at play in our modern world.

THE NEGATIVE IMPACT OF MASS MEDIA ON PUBLIC SCIENTIFIC LITERACY

Mass Media's Role as Educators

Mass media is generally understood to include any and all modes of communication which are capable of reaching large numbers of people at once. Since the mid 1990's, mass media has included books, films, newspapers, magazines, radio, television, and the Internet. Since that time, the share of viewers for each of those sources has changed dramatically. Data from the Pew Research Center (see fig. 1) shows a distinct changing trend in how Americans get their news.

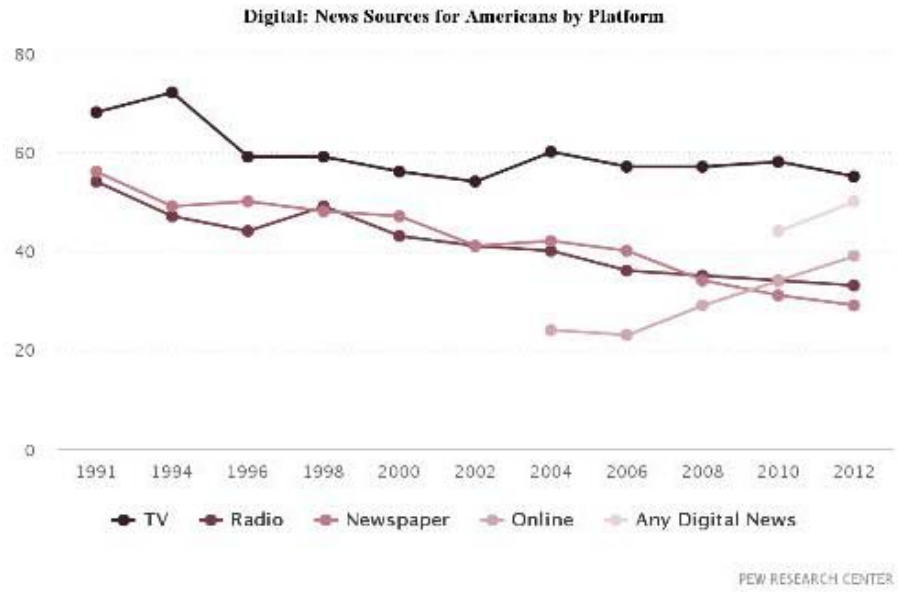

Figure 1. News Sources for Americans by Platform. Pew Research Center. "In Changing News Landscape, Even Television is Vulnerable." September 27, 2012.

It's clear that online and "any digital" news are rising sharply while radio and newspaper are declining. Television has maintained its share consistently since the early

1990's. This marks a clear path for the future of mass media and how it will be ingested by the public in the future. Younger people, specifically those in the millennial generation, are increasingly getting their news and information from digital sources. In fact, sixty-one percent of millennials say they get their political news from Facebook, more than any other potential news source available to them (Mitchell, Gottfried, and Matsa). However, it is important to keep in mind that even as trends shift into the future, a significant portion of Americans currently still look to television, film, and print media for their news and information and therefore those sources must also be included in any analyzation of mass media's impact on the scientific literacy of the general public in the present time.

Since this paper aims to show the effects of mass media on the general scientific literacy of the public, we will focus on information presented by mass media that centers around science and technology. The classical types of media like television have historically not focused heavily on S&T news. Since 1988, the major broadcast networks (ABC, CBS, and NBC) have never spent more than five percent of total newscast airtime on S&T news and have averaged closer to two percent of airtime in that same timeframe (National Science Board 7). This has left a huge gap in S&T news that the Internet and other digital sources have begun to fill. The data suggests that the public is taking advantage of these new sources of information, with a 2012 poll showing that forty-two percent of Americans cite the Internet as their primary source of S&T information, a seven percent rise from 2010 (National Science Board 7). Meanwhile, those who say that television is their primary source of S&T news has steadily declined in the same time

frame. Another statistic that is very important to the discussion of public scientific literacy and how it is affected by mass media has to do with how people say they get their information on specific S&T issues, like climate change, vaccines, etc. In 2012, sixty-three percent of Americans said that they would go online to find information on a specific scientific issue they were interested in (National Science Board 7). This indicates that many people are active in their scientific learning and are willing to seek out more information about issues when they feel that they aren't as knowledgeable on them as they would like. On one hand, this exemplifies a true "democracy of learning" in which the public can decide which topics are of interest to them, seek out news about those topics, and come away with a better overall understanding of the science behind them. In fact, a 2006 poll may show evidence of this. It found that eighty-one percent of those who had gotten S&T information online say that they have a good idea of what it means to study something scientifically (Horrigan 12).

It's important to note, however, that there are other potential factors, like education, that may be involved in the correlation between the perceived scientific literacy of those searching online for S&T information. One intriguing point of data that Horrigan discovered is that seventy-one percent of those who say they got S&T information from the Internet did so because it was easy and convenient (6). The importance of this should not be missed. We are a society built on the need for immediate feedback and the Internet provides us with extremely quick and easy access to a wealth of scientific information that only fifteen years ago was much harder to seek out.

However, there are some dangers to this “quick and easy” online revolution of S&T learning. In deciding to look to the Internet for S&T news, the general public is relying on the news sites and blogs they find through Google or elsewhere to be objective and unbiased. Encouragingly, sixty-two percent of those who got S&T news or information online say that they look for other online sources to check the reliability of information they have found (Horrigan 6). However, that leaves a significant portion of the population that assumes the information they find to be scientifically accurate and without the need for verification. This, coupled with the ability of anyone to create a blog or website that purports itself to be scientific in nature, whether or not they have the credentials or data to do so, creates a potential for scientific misinformation on a massive scale.

While the Internet has clearly opened a new frontier for scientific learning, especially among the younger generations who have grown up within the framework of a digital world, there exists in our mass media numerous pockets where the efforts to advance scientific literacy are potentially at risk. From the rise of the twenty-four hour news cycle that forces cable news networks to fill time and create controversy wherever they can, to the rise of social media networks and the plague of misinformation that comes with them, we are assuredly at a crossroads in our country’s future regarding the scientific education of our citizens. While there are aspects that provide hope for a better, more informed populace, we must be willing to confront the problems we face as well.

Creating Conflict: How the Media Politicizes Scientific Issues

Science has always been polarizing. Galileo was exiled and lived the latter years of his life under house arrest for simply advocating that the Earth was not the center of the universe. The word “Eugenics” alone stirs up emotions and incites debate amongst even the most prominent thinkers in our time. In the 1950’s, tobacco companies fought vehemently against the scientific community that was beginning to show the link between cigarettes and lung cancer. However, despite these and other cases of polarizing science, the general public often views science as both admirable and a worthy endeavor (National Science Board 7).

However, those feelings often get tested in our current hyper-political society where everything, including First Lady Michelle Obama’s initiative to improve childhood nutrition, gets viewed through a polarizing, “red/blue” lens. In this environment, the mass media, often looking for more viewers on their channel, website, or social media platform, aim to use this dynamic to their economic benefit. Coupled with the persistence of people on both sides of the political aisle to hold fast to their cultural identification, this often leads to negative consequences. Scientific issues that should be viewed collectively as a risk to all of us end up being portrayed more like a sporting event, where we feel the need to “take sides” and the result is that the underlying science gets ignored.

The clearest example of this is with the issue of climate change. According to the IPCC, the science clearly suggests that human activities are largely responsible for the majority of recent warming and climate change is already disrupting human and natural systems (Stocker et al.). However, even in the face of overwhelming consensus from the

community of climate scientists, only fifty percent of Americans say that the Earth is getting warmer because of human activity. The other fifty percent either think the warming is due to natural patterns(twenty-three percent) or that there is no solid evidence that the Earth is getting warmer(twenty-five percent) (Funk and Rainie, *Americans, Politics and Science Issues* 37). In order to understand the discrepancy between what climate scientists and the public believe and how the climate change discussion is altered by the mass media, you need not look any further than cable news coverage of the issue. These media outlets often align themselves with one political ideology or the other and therefore their particular viewers are much more likely to define themselves accordingly (Funk and Rainie, *Americans, Politics and Science Issues*). While political ideology may be one defining factor, it's clear that the media isn't doing the public any good when they do decide to report on climate change.

The damage done by television news outlets is two-fold. On one hand their coverage of climate change and the science behind it is often riddled with factual errors or misleading statements, either by accident or on purpose as to fulfill a political agenda. A recent survey by the Union of Concerned Scientists on the three most popular cable news outlets (CNN, Fox News, and MSNBC) found that all three had inaccurate statements on climate science. Fox News had the most inaccurate segments while MSNBC had the least. Fox News' misleading statements overwhelmingly understated the reality or effects of climate change or disparaged the idea all together while all of the misleading statements on MSNBC were ones in which the effects of climate change were overstated (Huertas and Kriegsman 4). A majority of CNN's misleading statements came

from debates in which some participants disputed established science. According to the UCC survey, had CNN not hosted any debates on climate science, their accuracy would have increased by sixteen percentage points (Huertas and Kriegsman 6).

These debates illustrate how mass media has altered the discussion surrounding climate change, effectively taking a scientific issue with vast amounts of credible data to back it up and turning it into another issue that is supposedly still debatable. Traditional journalistic methods involve giving both sides of a controversy equal chance to have their side of the argument heard. However, by taking an issue such as climate change, where the science is effectively settled in the minds of those who have made it their lifes work to study it, and treating it as if it were an issue that is unsettled, the media creates a false drama. This is very misleading to those in the public who have either not been exposed to the scientific consensus or to those who hold steadfastly to their political beliefs and allow them to affect their viewpoint on issues such as climate change. Although comedic in nature, a recent segment on *Last Week Tonight with John Oliver* on HBO aimed to highlight this discrepancy between how the issue is perceived in the scientific community and how it is perceived in the media. He called it a “mathematically representative climate change debate” wherein three panelists advocating that climate change is not real or human influenced were matched up against ninety-eight scientists (Perota). Behind the humor of the segment was the somber truth that science is poorly represented by the mass media.

When asked about the theory of evolution, ninety-eight percent of scientists connected to the American Association for the Advancement of Science (AAAS) say that

humans have evolved over time due to natural processes (Funk and Rainie, *Public and Scientists' Views on Science and Society* 37). Since Darwin first laid out his theory, the amount of evidence discovered to back it up is astounding. Fossil records, comparative anatomy, species distribution, and other scientific research have all come to the same conclusion: Evolution is overwhelmingly supported by the scientific evidence at hand. A prominent geneticist in 1973 famously wrote that "Nothing in biology makes sense except in the light of evolution (Mooney and Nisbet 32)." With that in mind, one would tend to believe that the general public, with even a basic understanding of biology, has come to accept evolution as scientific fact as well. However, in America that is definitely not the case. According to a 2014 Pew Research Poll, only thirty-five percent of Americans believe that humans have evolved due to natural processes (Funk and Rainie, *Americans, Politics and Science Issues* 88). When you break down that survey into the underlying demographics, a clear pattern emerges. Seventy-six percent of those who were found to have "more knowledge" about science agreed that humans had evolved over time, whereas only fifty-four percent of those with "less knowledge" about science agreed with that statement (Funk and Rainie, *Americans, Politics and Science Issues* 91).

These numbers all suggest very clearly, in my opinion, that one of the most important factors in whether or not someone accepts evolution due to natural processes is whether or not they have been educated on the underlying science behind the theory of evolution. However, it is important to note the tremendous impact that one's religiousness has on whether or not they are willing to accept the theory of evolution. This is obvious not only from social research like the Pew studies, but also from the

fervor in which those from the religious right in America have begun to attack the theory of evolution and its place in the American public education system.

With this renewed effort to challenge the theory of evolution and push for educational teaching standards that are complicit with "intelligent design" and creationism, there is a need for the mass media to fill the role of educators. Unfortunately, they seem to instead opt for the role of inciters. As Mooney puts it, "In strategy-driven political coverage, reporters typically tout the claims of competing political camps without comment or knowledgeable analysis, leaving readers to fend for themselves (34)." When the news reports on issues like evolution in this manner, they lend enough credence to the opposing view that proponents of creationism and intelligent design are bolstered and see their agenda gain traction in the eyes of those viewers who don't take it upon themselves to research the issue further. By eliminating facts from the reporting so as to continue the "debate," the media too often allows for individual bias to take over. Charles Pierce, in *Idiot America*, a scathing account of current American culture, sums up this phenomenon quite well:

> In fact, there is so much information that "fact" is now defined as something believed by so many people that television notices their belief, and truth is measured by how fervently they believe it. Just don't be boring. And keep the ratings up, because Idiot America wants to be entertained. In the war on expertise that is central to the rise of Idiot America, television is both the battlefield and the armory. (34)

The way in which the media presents the discussion of evolution fits right in with the creationist and intelligent design proponents' belief that we should "teach the controversy" in our public school systems. The news media, historically looked upon by

viewers as a source they can trust to bring them the truth regarding the issues facing our culture, is all too quick to jump in head first to use this "controversy" in order to drive ratings up. A news segment featuring multiple scientists from numerous fields of study discussing the scientific evidence and research they have done which supports the theory of evolution and why it should be the basis of a public school science education wouldn't drive ratings for a news channel. So instead they opt for the dramatic, giving the stage to both sides of the aisle while they idly reap the economic benefits.

By opting to choose a role not as educators, but as mere messengers of controversy, the mass media fails its viewers. We look to journalists and the news for information that is important to our lives and for facts that we can use to better understand the world around us. We rely on them to educate us and make us a better informed populace. Instead, they offer virtual soapboxes to whomever speaks the loudest and gets the most viewers. This hurts the scientific literacy of our country by allowing those on both sides who are most divisive to control the discussion. Dan Kahan, a law professor at Yale Law School has done research into what he calls the "cultural cognition theory." His work on this theory primarily deals with how members of society assess risk concerning specific issues. He has argued that contrary to popular belief, people who are more educated scientifically but identify strongly with a specific group or "tribe" of society become less likely to assess risk appropriately on certain issues (Kahan, "What Is the 'Science of Science Communication'?"). After reviewing his findings, I noticed that his data regarding the amount of risk those who ascribe to particular political parties assign to certain topics shows an interesting disconnect between issues which are often

discussed and politicized by the media and those that are largely ignored or viewed through a non-political prism(see fig. 2). The three issues at the top which show distinct polarization in how political groups assess their risk are arguably the three which are most prominently discussed and politicized in the realm of the mass media.

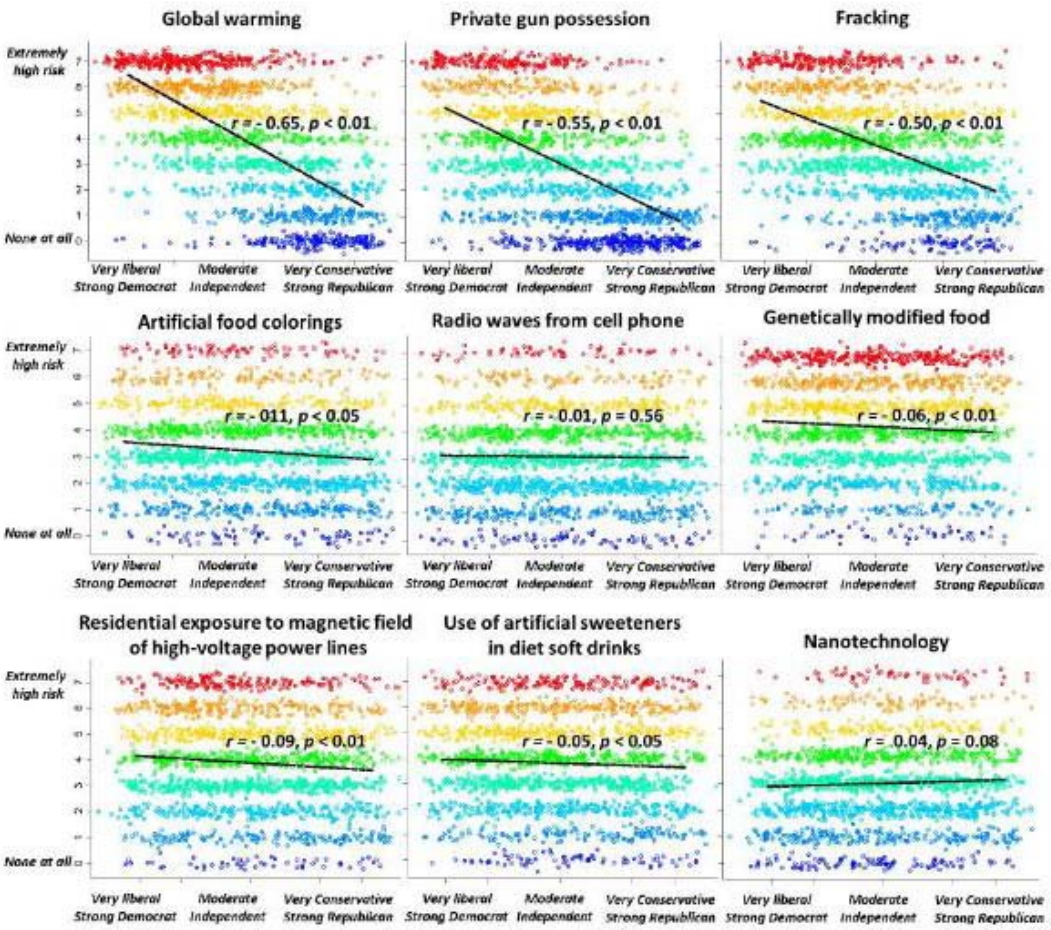

Figure 2. "Polarized" vs. "unpolarized" risk perceptions. Kahan, Dan. "What is the "science of science communication"?" *Journal of Science Communication.* 14.3 (2015) 1-12. Web. Nov. 2015

The other issues show very little polarization and with the exception of genetically modified food, rarely get discussed in the media. Kahan's research does not necessarily look into media patterns and how they may be affecting these results, but I think it's very

clear that by deeming certain issues “hot-button,” the media fans the flames of controversy when the science behind the issues has the potential to bring us all together for a common goal. By taking the discussion away from the underlying science of issues and putting it on the political discord between the opposing viewpoints, it causes those on both sides to move farther from the middle ground where diplomatic, science-based discussion of issues would be more possible.

Playing Loose with The Facts: Faux-Documentaries and Trust in Science

When it comes to the public and how they view science, and consequently scientists, there are many variables at play. Religion, educational background, and economic standing can all play a role in how much trust a person places in science (Gauchat). Since the inception of nature programs around the 1950’s, viewers have looked to channels like BBC and PBS to provide them with content that is not only educational but also entertaining. Cable television brought about the advent of niche channels that provided specific content aimed at a particular demographic of people. Discovery Channel was launched as one such channel, aimed at providing content for viewers interested in nature, science, and exploration of our world. From its inception in 1985 to the current time, it grew more popular and eventually expanded to include numerous other channels like The Science Channel, Animal Planet, The Learning Channel, and the Travel Channel. In that time, Discovery Channel and it’s off-shoots developed a reputation amongst the public for providing trustworthy, fact-based content that would educate its viewers on various topics. It kept viewers coming back through its

ability to mesh education with entertainment. However, the entertainment aspect largely arose from the compelling stories which were being told and often centered around unique creatures or places that many viewers had never seen and most likely would never see in their lifetime other than through these programs. As the number of channels and programs rose and more viewers started watching, the push to go bigger and more exciting grew as well.

Around 2005, a program called *Dragons: A Fantasy Made Real* aired on Animal Planet. For television natural history programming, it was one of the first steps in the direction of less education and more entertainment. Although it was made in the same style as other natural history programs at the time, it was a fictional account of scientific research into dragons as if they had existed at one point in time (Hardy). The program used phrases like “what if?” or “if dragons existed” to ensure that viewers would not be confused as to the veracity of the claims and information being presented. While it made sure to keep the boundaries between science and fiction somewhat clear to its viewers, it did walk a fine line between fact and fiction, and laid the framework for programming that would make its way into viewer’s homes ten years later that would not be as innocuous.

To understand why the programs I am going to discuss are so problematic, it’s important to remember the foundation that was laid by Discovery Channel through their programming from its inception in 1985. For almost seventeen years people watched Discovery Channel or it’s partner channels and knew that what they were viewing was, for the most part, true. The animals and the science behind them were real, even if the

stories they told might not be. Some may debate the ethics of using selective editing to weave a tale about animal behavior that wasn't exactly captured that way on camera, but overall what viewers saw was based in science. Then, with one single program in 2011, that all changed. Sometime that May, Animal Planet aired *Mermaids: The Body Found*, a fake documentary about a research team investigating clues that eventually lead them to discovering the existence of mermaids. This program was filmed, edited, and distributed in a manner that mirrored the hundreds of factual programs that had aired on Animal Planet before. It used language and footage that in no way ever hinted at the fictional aspect of the events being portrayed. In fact, the only true disclaimer as to the programs non-fictional standing was at the very end during the credits. Any viewer that happened to be flipping channels and stopped to watch would have been completely led to believe that what they were watching was real, especially considering the channel it was on. Some may say that to harshly criticize this program is unnecessary and that any viewer with a basic science education would immediately be able to recognize that it was fictional in nature. However, there is much evidence to the contrary. At two million viewers (3.4 million counting the late-night airing), it was the most watched program on Animal Planet since a 2006 Steve Irwin memorial special ("Animal Planet Slays With Best-Ever May In Network History"). It quickly became apparent that many of those millions of viewers were in fact swayed by the program into believing it was real, as Twitter exploded with users tweeting about mermaids being real (Shiffman). Even more damning was the fact that NOAA, the government agency that was wrongfully portrayed in the program was so inundated with demands from viewers for more information about

its mermaid discoveries that it eventually had to release a formal statement on their website, stating “No evidence of aquatic humanoids has ever been found (de Moraes, “Animal Planet Clocks Biggest Audience in Network History with Mermaids Documentary”).” Animal Planet, and by default, Discovery Communications, had willfully misled millions of viewers whose trust they had earned over years of television programming and the results posed an obvious threat to the scientific literacy of those viewers who blindly trusted that what they were watching was real. Many in the scientific community lambasted the show and held it up as a prime example of all that was/is wrong with television programming and the never ending search for ratings gold.

Unfortunately, due to these extremely high ratings and viewership the program received, Animal Planet followed up the next year with a sequel titled *Mermaids: The New Evidence*. That year also saw Discovery Channel, as a kick-off to their extremely popular Shark Week, air a program called *Megalodon: The Monster Shark Lives*, which implied that the ancient species of shark still exists today and followed the exact same patterns as the two mermaid programs: actors as scientists, fake re-enactments of purported real events, and stylistic choices which implied factual accuracy throughout the entire show. Most importantly, no disclaimer as to the fictional underpinnings until the end credits.

These types of programs are an assault on not only the scientific literacy of the general public but also on the overall trust of the general public in science and scientists. By presenting absolutely fictional material in a manner that implies it is real, these programs challenge the ability of the public to discern real from fiction and aid in the

spread of misinformation and pseudoscience that pervades our culture. Additionally, these programs all had elements of their stories which involved government scientists covering up evidence of their research or keeping information from the public as to "protect" them from the truth. This sort of writing and storyline development does incalculable damage to viewers' potential trust in real life scientists and science research. Even if many of the viewers eventually come to realize that the shows are fictional, it then becomes much easier for them to be skeptical of scientists and their research as a result of how they were portrayed in those programs.

In addition to the fake science documentaries, another style of television show that I would refer to as "Pseudo-science Monster Shows" also impacts our society's grasp on scientific issues and research as well. One of the most popular shows of this type, *Finding Bigfoot*, also airs on Animal Planet. This show revolves around a group of "researchers" who travel around North America looking for evidence of Bigfoot, a supposed large hominid that roams the wilderness whose sightings have been a part of urban legend for a long time. They also interview eyewitnesses who claim they have either seen or had an experience that they are sure was a Bigfoot encounter. Contrary to how they are presented, only one of the team has any academic scientific background and she is the "skeptic" of the group meant to temper the group's expectations about their discoveries. By focusing on anecdotes and utilizing unscientific modes of research in their quest to find a mythical creature, this show devalues the scientific process and how it is utilized by real scientists to determine the reliability of a hypothesis. In doing so, it allows its viewers to have a false understanding of how actual scientists go about

researching scientific questions regarding the natural world. It also gives credence to the idea that belief and anecdote are as powerful as detailed, structured scientific analysis. This is something that many in our society already wrongfully believe. Therefore, television outlets that have historically been scientific in nature airing shows like this only gives those people validation that their own personal beliefs or pseudoscientific views might warrant truth as well. In a time where television is already saturated with non educational programming like “reality TV” and other shows that are strictly entertainment driven, channels such as Discovery and Animal Planet have an obligation to provide content that aims to educate its viewers.

The ratings that this show has enjoyed further elevate the danger and underlying problem with this type of programming. In its second season in 2012, it averaged 1.3 million viewers per episode and was, at that time, one of the top three performing series ever on Animal Planet (“Animal Planet Finds Mammoth-Sized Ratings For ‘Finding Bigfoot’ : Discovery Press Web”). Animal Planet and other channels owned by Discovery, in realizing the ratings potential of these shows, have in the past few years ramped up their efforts to get shows or programs like this in their lineup. However, earlier this year the chief of Discovery Communications, Rich Ross, made a statement suggesting that Discovery would be moving away from this sort of programming, but time will tell if this holds true (de Moraes, “Fake Stuff Out At Discovery Channel, Promises New Chief Rich Ross: TCA”). In the meantime, the damage has already been done by this type of programming. There isn’t much data on historical belief in things like Bigfoot or other pseudoscientific threats such as ghosts, but a recent Chapman

University survey on American fears gives some indication to current levels of belief ("The Chapman University Survey on American Fears"). Compared with data pulled from an AP poll regarding people's statements on scientific issues, the numbers are alarming (see fig. 3). Considering the number of people who "believe in Bigfoot" is around the same number who are "confident the universe began with a big bang," and more people "believe houses or rooms can be haunted by spirits" than are "confident vaccines are safe and effective," we clearly need more fact based television programming, especially on channels meant for educating the public.

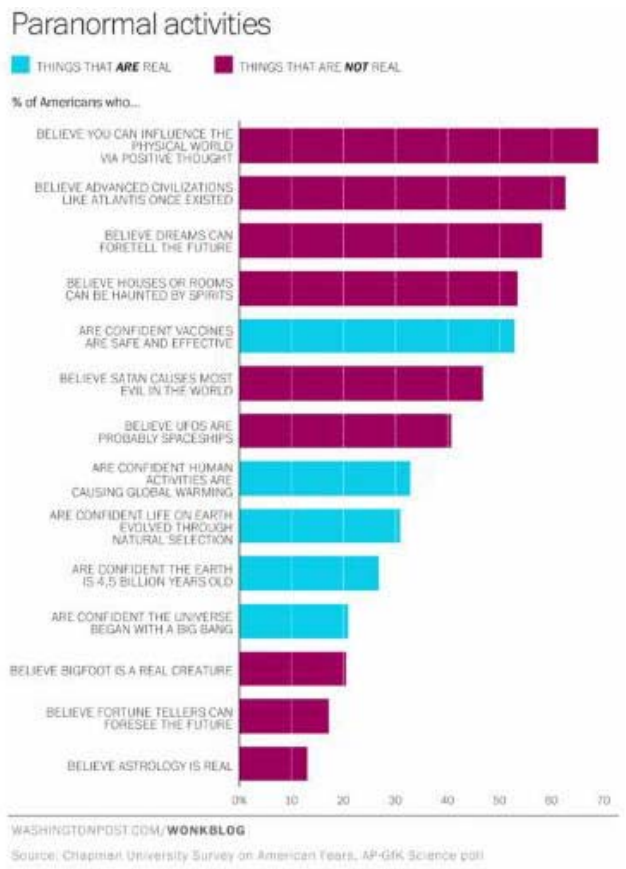

Figure 3. Belief in the Paranormal and Scientific. Ingraham, Chistopher. "Study: Americans are as likely to believe in Bigfoot as big bang theory." *The Washington Post*. October 2015. Web. November 2015.

Lies in a Sea of Truth: Social Media and Misinformation

Thanks to the Internet and the rise in digital information sources, information and data have never been easier to access. What used to involve a trip to the local library or at the very least a newspaper subscription can now be accessed in a matter of seconds. Considering this, one might think that our society would be more informed and educated on various issues and topics than they ever have before. There is certainly some data out there to suggest that this is true on some level and recent polling shows people do feel that the internet has made them more informed than they were even five years ago (*Americans Feel Better Informed Thanks to the Internet*).

However, there is a toxic side effect to this ease of access to information. Just because the information is out there and easy to find doesn't mean it's true. "If you saw it on the Internet, it must be true" is a popular tongue-in-cheek catchphrase that serves as a jovial warning to those who quickly cite information they read from an online source without searching for the validity of that information. Although some misinformation that spreads rapidly through social media may be pop culture rumors and gossip, there is also a large amount of misinformation that is legitimately dangerous. In fact, the spread of this type of misinformation is prevalent enough that a recent World Economic Forum report on global risks cites "Digital Wildfires," the name given to the viral spread of misinformation or propaganda, as one of the top ten risks facing the global economy (Howell). The power of social media to misinform the public in a way that affects scientific literacy in a dangerous manner was evident during the Ebola outbreak that happened in late 2014. After news first broke about a potential case in the United States,

Twitter and Facebook lit up with posts discussing the situation. Many posts incorrectly stated that you could contract the disease through the air or water while others simply spread false rumors of confirmed infections where there had been none (Luckerson). The dangers that this presented were immediate and put strain on health officials trying to convey the truth to the public through other means of mass media.

Medical conspiracy theories have always been threat to the public health and safety. However, social media now allows those ideas to flow freely between millions of people at once. A recent study showed that forty-nine percent of Americans agreed with at least one medical conspiracy theory out of six that were presented to them (Oliver J and Wood T). Of those six, four focus on topics which have garnered a lot of attention on social media outlets. Those most often found on social media focus on vaccinations and genetically modified foods. The spread of these conspiracy theories through social media outlets is a prime example of how public scientific literacy can be affected to the point in which it begins to threaten the wellbeing of those who choose to believe in them as well as the people around them. Parents who choose to not vaccinate their children endanger their community as much as they do their own children.

Although research into the effects of social media on real world issues like vaccinations is in its infancy, there is early indication that there may be a negative link (Neil Seeman). However, there is research into how information on social media outlets goes viral and why lies may be quicker to spread than truth. Craig Silverman, in a report for the Tow Center for Digital Journalism, highlighted numerous reasons why this may be the case. He states that stories or posts on social media that are lies or rumors are often

more exciting tales than what the truth really is and therefore users are much quicker to share them. This, combined with the ability of lies and misinformation to tap into our emotional fears or lend themselves to confirmation bias results in a wide-ranging availability of such stories online. Additionally, when users read an article or post that they immediately deem worthy of re-sharing, we can do so with a quick push of a button (*Lies, Damn Lies and Viral Content: How News Websites Spread (and Debunk) Online Rumors, Unverified Claims, and Misinformation*). This all amounts to misinformation often being spread much quicker and easier than the truth. Scientific literacy has never benefited from the spread of misinformation or lies, and is assuredly being affected by the recent surge in social media use. Silverman, in an attempt to both further research this phenomenon and combat it, started a website called Emergent, which aims to curate false news stories or rumors that have begun spreading online, correct them, and then track the number of shares the false information gets versus the amount his or other sites debunking stories receive (“Emergent”). Efforts like this may go a long way in helping stem the tide of misinformation that threatens our scientific literacy and ability to properly research and investigate claims made online before we quickly share them.

CONCLUSION

We are at a crossroads in this country. We can either continue to allow the media to control the narrative and polarize us into debating scientific issues with emotion and insults. Or, we can demand that they provide us with information that is factual and based on scientific research. Doing so will allow us as a society to confront our issues together in a manner that is civil and level headed. There is evidence that doing so can help even the most politically polar among us come to an agreement about what needs to be done to protect ourselves and our communities (Kahan, "Climate-Science Communication and the Measurement Problem"). We can continue to endorse by way of our money and time the programming that aims only to entertain us and does nothing to advance our knowledge and curiosity of the world around us. Or we can voice our desire for programming that is filled with fact based content which inspires and educates the public through stories that our natural world has to tell. The overwhelming popularity of series like *Planet Earth* and *Cosmos: A Spacetime Odyssey* are perfect examples of how such programming can be economically viable and scientifically accurate. We can continue to share stories and information online that we never took the time to verify and sit by idly as those in our social media communities spread fake news stories, pseudoscience, and other misinformation that we know isn't true without speaking up. Or, we can make a concerted effort to ensure that anything we share online can be backed up by a reputable source or has a basis in real scientific research. Additionally, we can be less hesitant to point out to others when they share misinformation and lies. These are all ways in which

we can take it upon ourselves to improve our own scientific literacy and therefore the scientific literacy of our society as well.

We live in a time when science and technology are advancing at a rapid rate. In many ways, it will continue to make our lives better. In some ways, it may make life a bit more dangerous. Our ability to navigate these dangers to ensure the safety of ourselves and society depends on how well we are able to understand the underlying forces at work. We can make an individual effort to educate ourselves and those around us, but the ways in which mass media affects our scientific literacy and education depend largely on how we respond to the environment that they put forth. We have a duty to demand more from them and from ourselves. The dangers of scientific ignorance are too high for us not to demand more.

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