

GERMS: FRIEND OR FOE? HOW MEDIA INFLUENCES
OUR PERCEPTIONS OF DISEASE

by

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DEDICATION

This paper is dedicated to my family for their unconditional love and support.

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ABSTRACT

An accurate understanding of disease is vital to our society. In order for our public health system to protect us from new threats, we need to be adequately informed. Much of the information the public receives about infectious diseases comes from visual sources. With a shift away from broadcast media to internet-based sources, story becomes emphasized over accuracy. This sensationalizes diseases, leading to the spread of misinformation and the amplification of stigmas. Accurate portrayals of diseases are crucial to society's ability to fight them, and as content creators, filmmakers have a responsibility to limit the spread of misinformation. In this paper, I explore the effect sensationalism and stigma have on the perpetuation of disease outbreaks and the importance of accuracy and transparency in our media, including the news, Hollywood film, and documentary.

INTRODUCTION

Media has the power to educate us and influence how we perceive infectious diseases. When viewers are misinformed due to faster paced, sensationalized storytelling that values entertainment over accuracy, they are unable to critically understand the nature of infectious diseases. This makes it more likely that people will perceive threats that do not exist, stigmatize diseased individuals, and spread myths and misconceptions about disease.

Stigmatization and sensationalism impair our ability to understand disease. Without this understanding, we are unable to actively participate in the prevention of epidemics. Our public health safety depends on the accurate transmission of information about disease.

Art and science are taught as two separate and distinct studies. Art can help fuel imagination, and when combined with science, topics can be introduced in an exciting and engaging way (Pomeroy, 2012). When audiences have an experience that grabs them, they tend to pay attention. If science is portrayed as an accurate “exciting, dramatic story of discovery,” then it becomes more than a subject. It “is your ticket to understanding the world and the universe and then it’s with you for life. If you can have that experience, it changes everything” (Brian Greene).

Given the importance of visual learning, filmmakers have a responsibility to portray science and disease in a truthful way. If films are one-sided, it becomes crucial to make viewers aware of where biases lie. When films begin to “masquerade as some sort of ‘objective truth,’ which is ultimately elusive,” they spread misinformation and prevent

viewers from understanding disease in a meaningful way (Jack). The inaccurate portrayal of disease in media leads to the stigmatization of infected individuals, which adversely affects society's ability to effectively deal with disease. Through the accurate representation of disease, filmmakers can inform the public in a positive way.

In this paper, I examine how the visual depiction of information regarding disease is crucial to people's understanding of disease outbreaks and how filmmakers have a responsibility to portray illness truthfully. In order to accomplish this, I analyze the portrayal of disease through a variety of media outlets. First, I examine the sensationalized news headlines that followed the 2014 outbreak of Ebola. I then look at the strides Hollywood has made to incorporate accurate science into their films by analyzing the portrayal of disease in *Contagion* (2011). I also discuss the accuracy of documentaries by critically examining *Vaxxed* (2016), and conclude by analyzing my own film, *Illuminating Disease* (2017).

STIGMATIZING DISEASE

The way we describe, define, or explain illness and disease can determine how we view infected people. We have a long history of stigmatizing diseased individuals and the community to which they belong. According to Smith and Hughes, “Evolutionary psychologists argue that all stigmas and stigmatization processes evolved from disease-avoidance mechanisms” (133).

Evidence of stigmas in a variety of social species, such as ants and chimpanzees, points to an evolutionary basis. A study done by Rachel Smith and David Hughes indicates that there was a societal advantage to stigmatization. Prior to 11,000 years ago, our ancestors lived in very small family groups, upon which they depended for survival. It became important to emphasize social defenses from anything that posed a threat to the group. A prominent defense was the creation of stigmas, especially toward disease (Smith and Hughes, 132). Infectious diseases threaten our ability to function as a community because sick individuals are unable to perform their specific roles. Early on, stigmas protected uninfected members of society by ostracizing and quarantining those infected (Smith and Hughes, 134).

For tuberculosis, quarantines proved very effective. Before the bacillus that causes TB was isolated in 1882, it was suggested that the disease was inherited or brought about by the habits of the poor and unclean. In reality, tuberculosis is an airborne illness that is spread by coughing and sneezing, which meant it could rapidly move through the overcrowded cities of the 19th and 20th centuries. The preferred treatment was isolation, usually in areas believed to have “healthy air.” This resulted in the creation of

multiple sanatoria where individuals were encouraged or pressured to reside, and by the 1930's, 420 of them existed in Britain. Often referred to as the White Death or White Plague, the death toll from tuberculosis was massive and quarantines remained an effective way of limiting its spread until a vaccine was discovered in 1921 and an antibiotic in 1944.

As the human population grew exponentially, people frequently traveled long distances, having widespread contact with other cultures. Ostracizing and quarantining sick individuals was no longer as effective. Stigmatization did not have the same evolutionary value. Holding true today, stigmas do not result in stemming the spread of infectious diseases and often hinder a community's ability to stop epidemics. As noted by Smith and Hughes,

Stigmas do not increase the ability of modern societies to survive infectious diseases but, in fact, may be important drivers of problematic disease dynamics and act as catalysts for failures in protecting public health (137).

Leprosy, for example, is a disease with a long history of stigmatization. In serious cases it can lead to nerve, bone, and skin damage and is often associated with disfigurement. The visibility of leprosy's symptoms served as a distinguishing mark that resulted in stigmatization and led individuals to be isolated from society. In 1873, Gerhard Henrik Armauer Hansen identified the bacillus that was causing leprosy, which is now called Hansen's Disease. Before then, many thought leprosy was highly contagious. This resulted in the creation of hospitals, known as leprosaria, and colonies to care for and separate those suffering from the disease. These were abundant throughout the 19th and 20th centuries.

In 1866, a colony was set up on the island of Molokai, Hawaii. Lack of treatment and a general fear of leprosy led to the introduction of laws allowing the arrest of infected individuals and their forced removal to colonies or hospitals. Many people were sent to Molokai as children. By 1873, there were approximately 800 individuals who had been removed to the island (Senthilingam).

The United States also had a leper colony in Carville, Louisiana. It was designated as a place of refuge and treatment, but like many other colonies, there were strict segregation policies. A barbed wire fence separated the leprosarium until 1948 and up until 1952 patients couldn't get married or have contact with non-patient spouses or family members. Patients' outgoing mail was sterilized and they were not permitted to vote in elections. This kind of treatment and isolation emphasized that the disease was something to be feared, which perpetuated the stigmatization of leprosy (Dobson, 26).

The effects of this are still evident today. For example, when individuals contract leprosy in Southeast Asia, they are ostracized and rejected. This results in a loss of self, in addition to loss of employment, loss of respect from their community, loss of an income, the restriction of their education, and for women, loss of bonding with their children. This is in addition to a decrease in the well being of families whose caretakers and breadwinners have fallen ill. Even after they are cured, reintegration into society can be complicated. The spread of misinformation about the cause of leprosy is partly to blame, as some believe it to be a punishment from God for wrongdoing while others view it as a sexual disease. Both imply that the person with leprosy is somehow to blame for their illness (Rafferty 120).

These effects of stigmatization are often more devastating than the disease itself, which impede the administration of public health protocols. Stigmas can cause individuals to hide their symptoms and avoid medical care. This hinders society's ability to detect an outbreak early, in turn increasing the number of infected people and ultimately the death count. Stigmas lead to the social marginalization of affected individuals, which places them outside society and can lead to the poverty and neglect of not only them, but also the populations of which they are a part.

Due to the fear surrounding diseases and the growth of misinformation, stigmatized individuals are often untrusting of healthcare authorities. This is the case in Africa where Ebola causes a virulent hemorrhagic fever and, depending on the strain, can have a 50-90% death rate. While individuals in villages are fearful of the disease, they are also fearful of hospitals where loved ones are taken and never seen again. In addition to not wanting loved ones to die alone, families often have many burial customs and death rituals of great cultural importance. Ebola is spread through direct contact with the blood and body fluids of infected individuals, which is unavoidable both when taking care of Ebola patients and preparing bodies for burial. Often families hide sick individuals from health officers in an attempt to prevent their hospitalization. This only prolongs outbreaks as family members themselves become ill and the disease spreads through villages (McCormick et al. 126).

Stigmas can also distort the perception of risk for a particular disease. This often results in mass panic and the misallocation of health resources and funds (Barrett and Brown, S35). AIDS is a prime example. During the late 1970's and early 1980's there

was an increase in Kaposi's sarcoma and rare forms of pneumonia in gay men. Some patients were found to have very low white blood cell counts, leaving their immune systems defenseless. This new syndrome was initially labeled GRID, or Gay-Related Immune Deficiency, but by 1982 it became known as AIDS. This new disease took several years to classify and during this time, in part because of its long incubation period, it spread around the world.

Initially the individuals affected were only from high-risk groups, mainly homosexuals and drug users. Already marginalized by society, these groups were further stigmatized by the disease. By 1983, several hemophiliacs were diagnosed with AIDS. This led to the dubbing of sufferers as the "4-H Club" since homosexuals, Haitians, heroin users, and hemophiliacs all seemed to contract the new disease. Haitians were included since they were erroneously thought to have introduced AIDS to the U.S.

The syndrome became an illness of sin and foreigners and as such was overlooked; nobody saw the impending crisis. All of the stigmatizing blame and discrimination helped fan the flame of disease, allowing it to spread unchecked. As an increasing number of individuals became infected, including heterosexuals, women, and children, shock and fear replaced denial. Sensationalized reports in the media led to the spread of misinformation causing undue panic. Confusion about how AIDS was transmitted led to unwarranted fear. For example, individuals believed items as innocuous as toilet seats could be deadly (Dobson, 192-194).

Schlozman claims that "the truly insidious danger of infection" is our natural response to it – fear. This contributes to the personification of disease, which further adds

to the stigmatization of infected individuals. They are no longer viewed as people, but are defined by their illnesses. “Typhoid Mary” is a classic example.

In the early 1900’s, Robert Koch, a German bacteriologist, proposed that individuals who were cured of typhoid could still shed the disease in their feces. Mary Mallon was an Irish cook whose dishes were delectable. However, while she was perfectly healthy, she carried the deadly disease wherever she went. Mary changed jobs several times and caused multiple outbreaks of typhoid fever. She was eventually captured and interned on North Brother Island in New York’s East River. It was there that she spent the last 23 years of her life, isolated with her dog (Dobson, 59). She was used to make the case that all new immigrants into the U.S. should be vaccinated.

Stigmas are persistent, often remaining long after an individual is cured. This acts to marginalize whole populations. From a medical viewpoint, quarantines were often effective, but throughout history they have become a social policy. In 1892, cholera emerged in the Middle East and Russia and spread to continental Europe. Americans, having experienced cholera in 1832, ‘49, and ‘66 were fearful of a new outbreak. Memories of a past typhus epidemic in Russian Jewish immigrants, combined with news of a current mass exodus of Russian Jews, resulted in the quarantine of mainly Jewish immigrants immediately upon their arrival to the U.S. In addition, New York officials felt it necessary to inspect 39,000 homes and blockade any found “suspect.” Although all immigrants were affected by new restrictions, European Jews were seen as the most objectionable. They were affected the most, resulting in stigma that lasted for years after the outbreak (Perry and Donini-Lenhoff, 226).

Personification and stigmatization of disease make it hard to recognize when other mechanisms are at play. This was true for an outbreak of Hanta virus in 1993 that occurred in the Four Corners area of the U.S. It quickly became labeled as the Navajo flu by many media sources. This not only stigmatized the Navajo, but also allowed the disease to spread unchecked because the actual illness and its source were overlooked. It turned out that Hanta is a virus that was spread by mice. The stigma of the Navajo remained long after the outbreak officially ended (Smith, 136).

While the media's coverage of diseases has evolved over time from print to visual campaigns, the perpetuation of misinformation and stigmatization remains the same. In order for our preventive disease programs to be effective, we must have substantial ways of addressing stigma. Sensationalism exacerbates stigmas, causes undue panic and fear, and furthers the spread of misinformation. To help combat this, the public must be empowered with accurate information about disease. Media influences the public in a profound way. While responsible for disseminating negative images of infections, media can also spread positive portrayals of illnesses. In Sri Lanka, a previously damaging view of leprosy was replaced by its depiction as just another disease. In addition, an array of media sources highlighted individuals who were cured of leprosy (Rafferty, 124). Media has an important role in the education of the public, and its dispersal of factual information through positive word choices has the potential to increase the public's knowledge of disease.

A PANDEMIC OF FEAR

When there are outbreaks of diseases like Ebola, Zika, and H1N1, the information the public receives about them comes from a wide array of sources. While some might find scientific articles engaging to read, the majority of people turn to the television or films as their major source of information for science and disease. In 2002 a Kaiser survey showed that 72% of Americans turned to TV, newspaper, and radio as their primary sources for AIDS information, instead of healthcare providers. The influence of the media on health is not limited to respected media sources or non-fiction shows and films. Often, made for TV movies, tabloids, sitcoms, dramas, and mainstream fiction films all greatly influence the public's perception of diseases (Treichler, 97).

Visual learning plays a fundamental role in the formation of our worldview. Visual media then, is an extremely important teaching tool and should be treated accordingly. A study by Jan Van den Bulck and Kathleen Custers found "a strong relationship [...] between levels of television viewing and anxiety about new viruses such as avian influenza" (373). While more studies are needed, this indicates that media is highly influential in our perception of and reaction to diseases.

As the "press" became the "media" and "showbiz" merged with "newsbiz," the value of the image far surpassed that of the information presented (Schechter). With multiple channels offering a veritable smorgasbord of news, it is often hard to distinguish information from misinformation. Each station slants the information they present based on biases they deny they have. In an age when opinions can be tweeted in 140 characters

or fewer, televised news stories have become faster paced, relying on sensationalized headlines and dramatic storylines to capture viewers' attention.

Stories presented in ways that peak public interest at the expense of accuracy are good for networks' bottom lines – more viewers equals more money (Zhang). However, they are not always beneficial for viewers, especially when they misrepresent science and disease. Ransohoff and Ransohoff summarize this well:

Media constraints of time, brevity, and simplicity preclude the careful documentation, nuanced positions, and precautionary qualifications that scientists feel are necessary to their work. (186)

In the process of molding the information into a simple, captivating story, the producers often lose the necessary reference points that the public needs to make informed decisions. Dramatizing diseases can cause the public to perceive that threats exist where they do not. Sensationalized news appeals to our emotions and not our rational thoughts. This leads to both unjustified fears and false hope, ultimately preventing the public from knowledgeably comprehending and participating in discussions of disease (Ransohoff and Ransohoff, 185).

A consequence of this is that we make scientifically and politically irrational decisions. In the recent case of Ebola, this equated to imposing travel restrictions both to and from West Africa. This type of policy actually increases the risk of Ebola entering our country as individuals still find ways to leave affected areas, making it much harder to “contact trace” the disease (Clifton, 2014). When an individual moves from one location to another using a mode of travel that requires a check-in or has a manifest, the people with whom they come into contact are easily identified. If the individual was to

fall ill, tracing who they may have had contact with is easier than if the person in question traveled by foot or by car. Prohibiting flights to an infected area can also prolong an outbreak, as the flow of aid to countries already suffering from a lack of infrastructure is severely restricted.

Media journalists are not scientists. As a result, the media is often plagued by scientifically inaccurate portrayals of diseases and their outbreaks. When research findings are misinterpreted and information is used out of context, sensationalism occurs. Comments from high profile people, while their opinions, often corroborate sensationalized news stories, further feeding the public's fears. This makes it less likely that people will objectively research diseases (Ransohoff and Ransohoff, 135). Universal access to unfiltered media disseminates misconceptions and myths about illnesses, which reinforce fears and doubts (Zhang).

Sensationalized headlines exacerbate the spread of misinformation as exemplified by the 2014 outbreak of Ebola. Two aid workers infected with Ebola were brought back to the United States for treatment, sparking a controversy that played out across TV channels. CNN chose to title a segment "Is Ebola the new Isis?" Another headline asked whether Ebola would sink the Democrats' chances at the polls. Many viewers never research beyond, demonstrating that sensationalized headlines are enough to cause alarm and influence how people form their opinions (Parrish, 2014). Figures 1 and 2 further highlight how sensationalized the media was over Ebola.

Nurses in safety gear got Ebola, why wouldn't you?

By By CONNIE CASS

Wednesday October 15, 2014 4:00 PM
UPDATED: Wednesday October 15, 2014 5:37 PM

Figure 1. Article headline from Columbus Ohio's News Channel 10 WBNS



Figure 2. New York Post article headline October 2014

The real threat was not bringing infected aid workers into the U.S.; it was letting our fears prevent us from stamping out the disease at its source. In a global world, an outbreak anywhere is a potential risk everywhere. However, it is a risk we can be prepared for if we re-direct our energies from delaying flights and making the public anxious to correctly and accurately discussing diseases.

When sensationalism in the media involves diseases, it can have a direct effect on the public's decisions. When Andrew Wakefield published an article in the *Lancet* journal claiming that the mumps, measles, and rubella (MMR) vaccine caused autism, many parents decided not to vaccinate their children. This article was later retracted, but not before his research was cited by a variety of news media sources. The spread of misinformation continued even after Wakefield was discredited. If people cannot critically analyze the media before them, as is the case with the spread of inaccurate

information, they miss such distortions. The public's perception is that vaccines are much riskier to their health than they actually are. As many parents refuse to vaccinate against MMR, society is ultimately harmed. These decisions have led to measles outbreaks in multiple countries including the U.S. (Zhang).

The South Wales Evening Post overly sensationalized Andrew Wakefield's findings, which resulted in a 14% decrease of vaccinated children in their distribution area, as compared to 2.4% in the rest of Wales. This statistic is alarming and indicative of a larger problem. We need to start changing the way we discuss science and health not only in the news, but in all media. "Unfortunately," Willingham states, "we have yet to develop a vaccine against simple human venality."

WHERE SCIENCE MEETS ART: SCIENTIFIC ACCURACY IN HOLLYWOOD

Mainstream fictional stories, the hallmark of Hollywood, are traditionally lax when it comes to the accuracy of science and disease. The goal of these films is to create a dramatic story between 90 and 120 minutes long. There is no pretense about whether the information they present is truthful. Viewers, not expecting the accurate representation of science, are not misled. However, with studies showing that even fiction films inform the public about diseases, there has been an active effort to change that. The Science and Entertainment Exchange was created in 2008 (O’Leary, 2008). As a program of the National Academy of Sciences, they match a variety of “entertainment industry professionals with top scientists and engineers to create a synergy between accurate science and engaging storylines in both film and TV programming.” Science opens up a new world of creative possibilities and inspires compelling and unique stories (“About the Program”).

Perhaps for Hollywood, it is less about getting every fact right and more about portraying the scientific process and the excitement of discovery accurately. For example, many scientists are willing to overlook the inaccurate portrayal of a Martian storm in *The Martian* (2015), due to the main character’s accurate demonstration of the scientific process. For example, he thinks his way out of problems, makes mistakes, and ultimately learns from them, a side of science films do not normally show. Physicist Clifford Johnson describes film as “the most powerful form of communication ever invented.” It is comforting, then, that Hollywood is trying to be “well-informed enough to create a

convincing and credible portrait of a believable world” (King). One film that serves as a good example is *Contagion*.

Contagion (2011)

Directors often play with our fear of the invisible and unknown. This has been the trend used most often for films about diseases, especially viruses. *Contagion* is one of the latest films to undertake infectious disease. Unlike some previous films, which feature viruses turning humans into zombies, *Contagion*’s world is more realistic and plausible. In this film, a deadly airborne virus spreads rapidly across the world after a woman is infected in Hong Kong and brings the virus to the U.S. Her story intertwines with those of the epidemiologists and healthcare workers who attempt to track the source of the disease, prepare to deal with and quarantine those who are infected, and search for a cure. The societal impacts that such a virulent disease would have, including food rationing, violence, looting, and vaccine rationing are realistically portrayed. By the end of the film, we learn that the virus originated in bats. Due to deforestation, the bats took up residence in pigpens. The disease then passed to pigs and made the jump to humans from there.

In order to ensure that the disease outbreak in *Contagion* was portrayed accurately, the film employed three science advisors. With science so integral to the storyline, the challenge to the filmmakers became providing enough “how” and “why” without losing viewers (The Exchange). They succeeded in finding a balance between accuracy and entertainment with their truthful portrayal of the public health response to a novel disease. In addition, the filmmakers illustrated how journalists can contribute to the spread of misinformation, thereby negatively impacting outbreaks.

W. Ian Lipkin, a professor of epidemiology and consultant on the film, worked with the screenwriter, consulted on set design, and designed the virus. While fictional, the virus was created by taking known viral sequences and morphing them into a new disease. The virus itself is a zoonotic disease, meaning it passes from animals to humans (Krisberg). According to Lipkin, “More than three-quarters of all emerging infectious diseases originate when microbes jump from wildlife to humans” (The Exchange).

The movie also looks at how society would respond to a viral threat of this kind. Public health author Laurie Garrett helped to ensure the policies and political responses in the film were as realistic as possible. She also cautioned the film to “not reflect any illusions of the readiness of industry.” The reality is that vaccines can take a long time to prepare, especially if the virus cannot be easily cultured. In addition, enough vaccine for millions of people would take a long time to prepare, resulting in not enough vaccine for everyone in need. This is exactly what the viewer sees in the film.

Overall, *Contagion* is an act of fiction; a look at what could happen if a new disease appeared in a population. The film weaves science seamlessly into its backbone. “Each explanation, each bit of scientific fact resides in dialogue that belongs in the film and belongs in that exact moment” (The Exchange). Audiences should leave with an appreciation of what it takes to prepare for and eliminate a disease on a pandemic scale.

As Garret so eloquently stated,

When an epidemic hits and things begin to deteriorate, lives depend on the ability of the community to care for itself and each other versus isolating individuals out of fear or stigmatizing people. I hope that people come away from the movie realizing that [...] the ability of society to respond properly is going to depend on the notion of “are you your brother’s keeper?” (Krisberg).

This accurate portrayal of disease in a Hollywood film is a heartening sign and a step in the right direction.

DOCUMENTARY TRUTH?

In contrast to fiction films, viewers look to documentaries as accurate representations of the world around them. *Vaxxed: From Cover-Up to Catastrophe* is an example of what happens when filmmaker biases are not disclosed.

Vaxxed: From Cover-Up to Catastrophe (2016)

Vaxxed is a documentary about the CDC's alleged cover-up of the link between the MMR vaccine and autism. The film, directed by Dr. Andrew Wakefield, covers his research, the stories of parents with autistic children, and of course, the CDC cover-up. It is alarming in the way it presents a topic that has been debunked repeatedly. Scientists have collectively shown that vaccines do not cause autism (DeStefano, Price, Weintraub, 563). The film fails to adequately address the biases of the director and producer, instead presenting the information provided as objective truth. Pulled from the Tribeca Film Festival after an uproar in the scientific community, *Vaxxed* has since been shown in select theaters and can be rented from multiple video providers.

Andrew Wakefield has a starring role in the film. His lower thirds indicate he is an MB, BS Gastroenterologist. This was true prior to his being banned from practicing medicine in Britain for "ethical lapses, including conducting invasive medical procedures on children that they did not need." The General Medical Council responsible for conducting the investigation found him guilty of more than 30 counts of unprofessional

conduct. For example, part of his research costs were paid by lawyers who represented families seeking to sue vaccine manufacturers (Burns).

Wakefield published an article in the *Lancet* in 1998, which suggested a link between vaccination and autism. This article was later discredited and retracted from the journal, a fact Wakefield does address in the film. He mentions that his study found an association between the presence of novel gut bacteria and autism in previously normal children. The parents of these children indicated their behaviors changed after receiving the MMR vaccine. Wakefield says his duty was not to censor families' stories but to provide the information accurately in the hope that further studies would be conducted. His paper, he argues, never proved an association between autism and vaccines and instead indicated that more studies were necessary. He mentions his view that single dose measles, mumps, and rubella shots should be asked for instead of the triple MMR, indicating he was never anti-vaccine. Regardless of his original view on the matter, or how he tries to refute the *Lancet's* treatment of his research, by the conclusion of the film it is clear that Wakefield believes a correlation exists between vaccines and autism.

In addition to interviews with scientists and doctors, *Vaxxed* includes the emotional stories of parents whose lives changed in a matter of days as their healthy, happy babies became "damaged, vaccine-injured" children. Autism is a disease that manifests in multiple ways leading to a spectrum of symptoms ranging from more mild to severe. Labeling affected children as "damaged" acts to place them outside of the family. They become "others" and as such are more likely to be stigmatized throughout their

lives. The film does not address the public health concerns of viewing autistic children in this way.

The main focus of the film is the CDC's publication of a study which did not establish a link between the MMR vaccine and autism risk. According to a whistleblower named William Thompson, the CDC ignored data that indicated there was an increased risk of autism when children were vaccinated before 36 months of age. Thompson's interviews were all conducted over the phone and recorded, as stated directly in the film, without his knowledge. This revelation should diminish the credibility of the film, but unfortunately makes it more likely to appeal to those who already distrust governmental agencies.

Thompson passed the data from the study to Brian Hooker, a former bioengineer. Hooker re-analyzed it and published his own paper. The film does not focus on the statistics Hooker used or how he conducted his analysis, all of which are important in the public's understanding of whether his results are scientifically significant. Instead, the viewer's learn data was withheld and when the study is re-analyzed with the missing data, there is a 340% increased risk of autism in African-American boys who receive the MMR vaccine before 36 months. This oversimplifies the methods and statistical analyses with which scientific studies are conducted, and removes the context from both the original study and the re-analysis. Without it, viewer's are unable to decide for themselves the validity of Hooker and Wakefield's argument.

The film does not inform the audience that Hooker's re-analysis was later removed from publication due to competing interests and questions concerning the

validity of the statistical analyses and methods used in his paper. It also fails to address that the data was originally rejected from the study because the researchers had no birth certificates and could not adequately account for confounding factors in the onset of autism, such as birth weight, in those children.

The film emphasizes the risk of the MMR vaccine and the CDC's role in suppressing this knowledge to advance their own agendas and vaccination schedules. Hooker accuses the original researchers of fraud. He blames them for maiming children and debilitating his son, who is Caucasian. This blame might be well placed, except his re-analysis found a supposed link to autism in African American boys but did not find an association with any other group, including white males.

If this film was used to inspire viewers to dig deeper into studies that address autism and vaccines, it might have a place in film festivals. Neither the film, nor marketing by the Tribeca Film Festival, indicated the director and producer's biases, leading to its presentation as an impartial look at autism and vaccines. This misrepresentation of the film prevents viewers from objectively understanding the issues and contributing to societal discussions in an informed way.

LOOKING AT DISEASE ONE FRAME AT A TIME

Using Animation To Explain The Unknown

Animation can be used to educate, entertain, or both. We are used to animated cartoons telling us engaging stories or weaving tales that inspire our imaginations. Animations can also help us visualize things we cannot otherwise see, or comprehend ideas too theoretical to completely understand. As a result, animations are becoming increasingly popular in documentary films. Science films are especially suited for animations and many make use of Computer Generated Imagery (CGI) to convey important information.

CGI replaced the traditional hand drawn, or cel animation style, typical of early films, including Disney features like *Snow White and the Seven Dwarves* (1937). Today, many films both fictional and educational make use of computer animations. Stop-motion is another technique used to tell stories. Still photographs are shot in succession as characters are moved incrementally across a set. The images are pieced together and as one shot flows into the next, the characters seem to come alive.

Stop motion is not a new technique, but dates back to the late 1890's. Its first use was mainly to create special effects. Willis O'Brien created the creatures for the 1925 film *The Lost World* and in 1933, he created the dinosaurs and giant gorilla used in *King Kong*. The miniatures were filmed with stop motion techniques and rear projected into the live action sequences. Ray Harryhausen followed in O'Brien's footsteps and put his mark on *Mighty Joe Young* (1949), *Jason and the Argonauts* (1963), and *Clash of the Titans* (1981) (Dawson).

Today, claymation and puppetry are the most recognizable forms of stop motion. Nick Park reached success with his clay characters, Wallace, Gromit, and Shaun the Sheep. Tim Burton's *The Nightmare Before Christmas* (1993), *Corpse Bride* (2005), and *Frankenweenie* (2012) all use puppets, much like Laika Studios' films *Coraline* (2009), *Paranorman* (2012), *Boxtrolls* (2014), and *Kubo and the Two Strings* (2016). When using puppets or clay, the world created by the directors and writers is three-dimensional and usually requires massive sets, as seen in figure 3.



Figure 3. *Boxtrolls* Street Set (2014)

Stop motion films also make use of other techniques, for example, paper cutouts. Lotte Reiniger was at the forefront of this method, making around forty films between the 1910s and 1970s. Inspired by the art of shadow puppetry, she created silhouette fairy tales and one of the first feature length animated films, *The Adventures of Prince Achmed* (1926).

Reiniger's articulated characters and scenes were cut from black paper. Each appendage that required movement was cut out separately and tied together with thin wire clasps. The backgrounds were cut out of transparent papers that she layered on top of each other and covered with a fresh piece of transparent paper. She filmed her scenes from above using a dining table with a hole cut in the middle. Over this hole, she placed a glass plate on top of which she put the transparent papers and finally her characters. By placing a light underneath the table, she created a large light box that silhouetted her work. Later on, she used a more intricate set up with multiple planes of glass at different distances to give depth to her shots (Hutchinson).

The main filming technique used in stop motion is to place a camera at a ninety-degree angle to a well-lit table. The motion of the paper characters is captured as they are moved incrementally across the flat surface and are momentarily held in place with repositionable gum.

Illuminating Disease (2017)

My animated film, *Illuminating Disease*, explores the history of disease, focusing on the scientists whose work helped shape our understanding of modern medicine. My film begins with Terrance, who fell ill and is being taken to the hospital in an ambulance. The narrator explains that when we become sick, we usually get better. However, this was not always the case. The viewers follow Terrance into the past where he travels from the 1600's to present day, meeting important scientists along the way. These remarkable scientists contributed to our modern understanding of germs and medicine. It is because

of their hard work that Terrance is able to survive. My film finishes with a look at the internal structure of cells, the replication processes of germs, and a quick peek into how our immune system flushes them out. I chose to use animation because I felt it was the most relatable way to represent the history and the microscopic world of germs to a wide audience.

Shot entirely in stop-motion, my film represents microscopic organisms as mechanical objects made from various hardware, while the visible world is made of paper and cardboard. I decided to hand draw every aspect to ensure that each piece was crafted in the same scale. I was greatly inspired by Lotte Reiniger's work and decided to emulate her effect by making every inanimate object out of black paper and every living object out of blue paper. I quickly realized that my scientists were not "whole" when I made them this way. I was not captured by them and did not relate to them. I decided that the scientists should be made as realistically as I could draw them and would be clothed in the style of the times.

One decision animators must make is whether or not the mechanisms of character movements will be visible. Laika productions uses frames to hold their characters in certain positions. These are removed from the final version of the film. Sweet Fern Productions uses paper cutouts to create intimate portraits of scientists and scientific concepts through a series called "Animated Life." Their scientists are made of paper with articulated joints that the filmmakers move about via a variety of poles and strings. I made each of my characters articulated and used tiny brads to hold their limbs together. I

included the strings I used to animate them as a cue to the viewers that my film is a constructed representation of history.



Figure 4. Finished and Assembled Cutouts

My film is unique in the way I create depth in each scene. I filmed perpendicular to the table rather than from above by creating two frames from PVC pipe and attaching the end posts with large wooden dowels. Between the two frames, I glued multiple dowel rods, which I used to hang the characters and set pieces. These rods gave me the option of hanging cutouts at different distances from the camera, giving me the depth of environment that I wanted.



Figure 5. Behind the scenes of *Illuminating Disease*

In order to make my characters walk, I moved their limbs incrementally as I slid their strings across the dowel rods. The cutouts are not as clean cut as computer animation, which makes each piece unique. This crafted nature allowed me to create powerful images that will hopefully resonate with my audience long after the narration ends.

I chose to represent bacterial cells and viruses in a mechanical way with familiar hardware, which reduces the possibility that they will instill fear and ensures that they are not anthropomorphized. I focused on the stories of the scientists and carefully chose my narration, making sure that I did not sensationalize either their stories or their contributions to the study of diseases. Because of the historical nature of my film and my

desire for accuracy, each piece was carefully crafted from photos of the real objects. The information in my script was equally well researched and I made sure each fact could be found in at least two reputable sources, usually from biographies, collegiate web pages, or museum pages. It was important that my portrayals of the scientists and the science of disease were accurate, so as to not spread misinformation to my viewers.

My film is novel not only in its visual presentation, but also in its presentation of disease. Many short animated videos focus on specific scientific concepts, such as cell division. Very few discuss the history of medicine or infectious diseases, and those that do tend to use sensationalized dialogue, such as *Disease! Crash Course World History 203 (2014)*. *Illuminating Disease* offers a new take on history that will hopefully inspire viewers to learn more about disease and the remarkable people who made modern medicine possible.

CONCLUSION

Media has the power to educate in influential ways. Visual learning is an important part of human understanding. The misrepresentation of facts and the sensationalism of science and disease result in the public's inability to critically analyze information and contribute positively to the prevention of epidemics. The spread of misinformation can determine how society views those infected with disease. This leads to stigmatization, which erodes the ability of our public health systems to act in a timely manner to a variety of outbreaks.

When science informs the art of film, the result is educational as well as entertaining. Complex ideas can be broken down in understandable ways that enhance storylines and create a richer world for the viewer. The accurate portrayal of disease within a broader storyline, fictional or documentary, limits the spread of misinformation and reduces the public's fear of illnesses.

When it comes to explaining technical scientific concepts and intricate microscopic worlds, animation is a powerful tool. My film, *Illuminating Disease* (2017), is an example of how stop-motion animation can be used to provide viewers with accurate information about disease.

With today's instant access to media we, as content creators, have a responsibility to ensure the stories we deliver are accurate. As long as we keep in mind the impressionable nature of our audiences and the power of our words, we can actively reduce the fear and stigma surrounding disease.

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