Keeping the Human in Digital Humanities: A Twitter Case Study

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Introduction

The rapid expansion of digital humanities has led to questions about how best to define this emerging field and how to harness the new approaches to knowledge that it offers. In this thesis, I explore key characteristics of digital humanities. I also hope to show ways that digital humanities methods can be applied with a case study related to vaccine conversations on Twitter. I will first discuss three key characteristics of digital humanities: interdisciplinarity, collaboration, and democratization. Next, I will explore how these characteristics influence the activities of this field, particularly the ways that computers and programs (machines) relate to humans through intellectual work. Finally, I will apply what I have discussed to analyze Twitter conversations with the hashtags, #vaccines, #vaccineswork, and #antivaxx. The goal is to use digital humanities approaches to understand how vaccine rhetoric is used on the internet and how misinformation can be spread.

Should Digital Humanities be Defined?

The definition of digital humanities (DH) has spawned contentious debates, even resulting in anthologies devoted to the effort.[1] While some might argue that defining digital humanities is essential to understanding the field, others suggest that the focus on finding a single conceptual framework limits our understanding and creates needless concern. Digital humanities is often labeled as a nontraditional field of academics, yet so many scholars focus on a traditional way of trying to understand DH by defining it.[2] While definitions can spur

[1] Terras, Melissa M., Julianne Nyhan, and Edward Vanhoutte. *Defining Digital Humanities: A Reader*. London: Routledge, 2016.
[2] Cordell, Ryan. "How Not to Teach Digital Humanities." In Debates in the Digital Humanities 2016, edited by Gold Matthew K. and Klein Lauren F., 461. Minneapolis; London: University of Minnesota Press, 2016. Accessed March 29, 2021. doi:10.5749/j.ctt1cn6thb.39.

conversations about the evolution of the humanities and the future of academics, this narrow focus limits possibilities.[3] Instead of focusing on what counts, what doesn't count, or who is or isn't a digital humanist, the emphasis should be on understanding the different contours of the field by studying characteristics, methods, and practices.[4] Perhaps the best way to understand digital humanities is to start with some of its key characteristics.

Interdisciplinarity

Digital humanities is about crossing boundaries, and this honors thesis is a great example. When you hear about a project focused on studying internet arguments on Twitter using a data spreadsheet, you probably do not immediately think of an English honors thesis. Studying arguments could be associated with English or even communications, but the use of data spreadsheets and Twitter could be associated with computer science or some kind of data analytics. However, as we shall see, the project is not diminished but gains strength from bringing together mixed methods and adjacent areas of knowledge.

One essential component of digital humanities is that it is interdisciplinary; it is not restricted to one field or even discipline. Digital humanities bridges the divide between the humanities/social sciences and science/technology. This divide has not always been so fixed in the world of academia. Galileo was a mathematician and philosopher; Sir Isaac Newton was a physicist, mathematician, theologian, and philosopher; and Charles Darwin's degree was in theology, despite being a major scientific figure.[5] These thinkers used their knowledge of the humanities to help support their scientific work.

[3] Cordell, "How Not to Teach", 462
[4] Cordell, "How Not to Teach", 463.
[5] Davidson, Cathy N., and Danica Savonick. "Digital Humanities: The Role of Interdisciplinary Humanities in the Information Age." Oxford Handbooks Online, January 26, 2017.

English novelist and physical chemist C.P. Snow indicates that the divide within academia began in the late nineteenth century.[6] Snow attributes the Industrial Revolution as the first step in the divide between what he termed the "two cultures."[7] The Industrial Revolution positioned science and technology at the forefront of advancement within society. Science and technology began to be viewed as the solutions to societal problems, and the humanities lagged behind as a more traditional academic discipline. Snow argues that this divide presents a danger to the "two cultures" and to society. If we become too focused on using science, data, and technological advances to solve societal problems, then we run the risk of losing human insights and priorities. To bridge the gap, Snow believed in a mediating third culture that would combine the best of the sciences with the best of the humanities.[8] While he believed that this third culture was coming, it was still a long way from being defined. This delay could be attributed to the established intellectual disciplines within education systems. Perhaps digital humanities is at last providing the bridge Snow imagined.

Formal education strongly reinforces the divide between science and the humanities. The final stages of undergraduate university education have become more specialized over the years.[9] It is common for children to pick between the worlds of science and the humanities as early as fourteen years old.[10] The only exposure that students get to the other world is through the general education credits that they are required to take. However, this is often not more than a few

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https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780198733522.001.0001/oxfordhb-9780198733522-e-14.

[6] Davidson & Savonick, "Digital Humanities"

[7] Snow, C. P. *The Two Cultures*, Cambridge University Press, 2012. *ProQuest Ebook Central*, https://ebookcentral-proquest-com.libproxy.lib.unc.edu/lib/unc/detail.action?docID=1864715.

[8] Snow, *The Two Cultures*

[9] McGinnis, John O. "Bridging C. P. Snow's Two Cultures." City Journal, April 24, 2018. https://www.city-journal.org/html/bridging-c-p-snows-two-cultures-15837.html.

[10] Snow, *The Two Cultures*

humanities or science/math courses that most students finish within their first year as an undergraduate.[11] These requirements do not give students the necessary skills for critical evaluation that can be used to help address dilemmas facing society that need both a scientific and humanistic viewpoint.[12]

Along with this divide, a hierarchy has been put in place with science at the top. As technology continues to develop and society becomes more reliant on it, more weight is being placed on the scientific/technological over the humanistic. Humanities students have gotten used to defending their major, whether to their parents or peers. We have arrived at a moment where (for many) the humanities are perceived as a place for those who are not able to pursue the well-paying careers of the sciences. This hierarchy with science at the top has resulted in a scramble among social sciences (and areas within the humanities) to define their methods as more "scientific" to gain legitimacy.[13] While digital humanities is not going to fix the balance between these two academic worlds, it can bring to light the insights humanities can give to the scientific world and vice versa.

The humanities provide perspectives that help us understand our place in this new, technological age. The use of cultural analysis that is often a core component of the humanities can provide important correctives for scientific fields.[14] Within the medical field, the humanities helps to develop skills of observation, analysis, empathy, and self-reflection to provide insight into the human condition.[15] The use of cultural studies, women's studies, race studies, etc. within

[11] McGinnis, "Bridging C.P. Snow's"
[12]McGinnis, "Bridging C.P. Snow's"
[13] Snow, *The Two Cultures*
[14] Cohen, Benjamin R. "Science and Humanities: across Two Cultures and into Science Studies." *Endeavour* 25, no. 1 (2001): 8–12. https://doi.org/10.1016/s0160-9327(00)01335-1.
[15] Ayers, Edward L. "Where the Humanities Live." *Daedalus* 138, no. 1 (2009): 32. Accessed April 1, 2021. http://www.jstor.org/stable/40543870.

the medical field has revealed the benefits of the humanities and interdisciplinary studies within higher education.[16] Humanities can help the world of data, technology, and scientific thought approach their disciplines with a better understanding of what it means to be human. (The dangers of a fully digital, data-based world will be discussed in a later section.)

At the same time, technology and the methods of scientific fields can also provide powerful tools for humanists. The use of big data allows humanists to test their claims and interpretations with statistical methods that can be applied over hundreds of works beyond the capability of a single human being.[17] For example, a humanist might study the impact of rhetorical appeals and may need to be able to map the use of specific words or modes of argument (ethos/pathos/logos) over time or across large collections of texts. Using computer programs that have the capability to scan through thousands of books or posts on a website, can enable us to analyze the rhetoric at speeds and scales that would be impossible without the help of technology.[18]

Collaborative

Digital humanities is a deeply collaborative endeavor that complements its interdisciplinary nature with the co-production of knowledge.[19] There are numerous interactions or collaborations that can occur within digital humanities, but for our purposes, we can concentrate on three: human-human, human-machine/material, and machine/material-

[16] Ayers, "Where the Humanities", 32.
[17]McGinnis, "Bridging C.P. Snow's".
[18]McGinnis, "Bridging C.P. Snow's".
[19]Griffin, Gabriele, and Matt Hayler. "Collaboration in Digital Humanities Research – Persisting Silences." DHQ: Digital Humanities Quarterly, 2018. http://digitalhumanities.org/dhq/vol/12/1/000351/000351.html.

machine/material interactions.[20] I will be mainly focusing on human-human and human-machine/material interactions in this project. However, I will briefly discuss machine/material-machine/material interactions as well.

Human-human interaction is collaboration primarily between the individuals working on a project together, but it can also include the producers of the project and the audience.[21] Collaboration is driven by the different views, backgrounds, and experiences of the individuals working together. This interaction can produce a feeling of "being the other."[22] Melissa Terras argues that as collaboration occurs and work becomes interdisciplinary, individuals can begin to feel a sense of otherness as their work is defamiliarized.[23] This destabilization can have positive impacts that open perspectives; at the same time, it can create challenges as power struggles between disciplines can occur.

The key to successful collaboration is communication. Within that communication there needs to be an understanding of each discipline, a clear understanding of tasks and goals, and a lack of hierarchy.[24] When it comes to digital humanities, the key collaborations are often between those concerned with humanistic subject areas and technical methods, and several benefits and challenges follow. The humanities and the computational sciences are distinct fields with their own languages and norms. This lack of a common language can create tension. For a team to function well, there needs to be a mutual understanding of both disciplines' cultures and subjects.[25] Successful teams will also have clearly defined tasks and goals. When each person

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[20] Griffin and Hayler, "Collaboration in Digital".
[21] Griffin and Hayler, "Collaboration in Digital".
[22] McCarty, Willard, and Deegan, Marilyn, eds. *Collaborative Research in the Digital Humanities*. Farnham: Taylor & Francis Group, 2012. 224. Accessed March 31, 2021. ProQuest Ebook Central.
[23] McCarty and Deegan, *Collaborative Research,* 213.
[24] McCarty and Deegan, *Collaborative Research,* 224.
[25] McCarty and Deegan, *Collaborative Research,* 224.

clearly understands their own tasks and responsibilities within a project, everyone can collectively work towards meeting the goals.[26]

A lack of hierarchy is also an important component of collaboration. As discussed above, there can be perceived notions of status within the academic world. Perceived status within a team can result in a lack of understanding, unbalanced power dynamics that foster resentment, and an unwillingness to see other viewpoints.[27] Within digital humanities projects, each of the disciplines validating the perspectives of the other is essential to the outcome. When collaboration is productive, it can help to generate new knowledge that would not have been possible without disciplines interacting with one another. It can provide new insights into old problems within the humanities; it can lead to new approaches being explored within computational sciences; and it can be personally rewarding.[28]

Within digital humanities, perhaps the most prominent collaboration is the relationship between humans and machines. This relationship has become more prevalent as technology and computers have become more central to humanistic work. This relationship can be anything from a hyperlink, a social media platform, or even a program that collects data for humans to analyze.[29] Digital humanities have been key in recognizing that collaboration is not purely a human activity. An example of this is Cecilia Lindhe et al.'s "Curating Mary Digitally," which explores how medieval representations of Mary might be refined digitally.[30] The goal of the team in this project was to move away from simply creating a mimetic reconstruction of representations of Mary. They decided to "direct attention to physical interaction and to the

[26]McCarty and Deegan, *Collaborative Research,* 224.
[27] McCarty and Deegan, *Collaborative Research,* 224.
[28] Griffin and Hayler, "Collaboration in Digital".
[29] Griffin and Hayler, "Collaboration in Digital".
[30] Griffin and Hayler, "Collaboration in Digital".

materiality of the work."[31] They did this by creating digital interfaces that reacted to their viewers' movements. In this project, the digital work is shifted from simply being a product to being an active agent. In this case, it is still a secondary agent because it relies on the human viewers' movements to determine how it is seen and reproduced.[32] Still, the material aspects of the project participate in the exchange of meaning. While this project shows how digitalization can be used to reproduce and reframe material in new and interesting ways, it also shows the struggle over how humans and technology can be integrated or created, without having a hierarchy that defines their roles.[33] While there might be primary and secondary actors, they are still co-equal in their importance to the project's creation. This is because neither would exist without the other. This project also reveals that within human-machine collaboration, there are two sub-categories.

These sub-categories help us consider the relationship between a digital producer and their tools/project and between a digital production and its viewers.[34] In looking at the above example, Lindhe et al. created a digital project that they then used to help develop digital representations of Mary.[35] The relationship between a digital producer and their tools/projects evokes familiar humanistic questions of authorship, yet is still collaborative.[36] In a sense, the human producers can be seen using a hierarchy of creator and created. However, the material affordances of the digital also shape the project. In the above example, Lindhe et al. would not be able to develop their project without the specific functionality made possible by digital tools.

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[31] Lindhe, Cecilia. "Curating Mary Digitally: Digital Methodologies and Representations of Medieval Material Culture." Essay. In *Research Methods for Creating and Curating Data in the Digital Humanities*, 147. Edinburgh: Edinburgh University Press, 2016.
[32] Griffin and Hayler, "Collaboration in Digital".
[33] Griffin and Hayler, "Collaboration in Digital".
[34] Griffin and Hayler, "Collaboration in Digital".
[35] Lindhe, "Curating Mary Digitally", 147.
[36] Griffin and Hayler, "Collaboration in Digital".

This interactive collaboration similarly applies to the relationship between a digital production and its viewers.[37] This relationship also reveals how hierarchies between humans and machines break down in digital realms. The digital production in Lindhe et al.'s project works with the viewer to produce images based off the viewer's movements. The familiar pattern of author, text, reader no longer holds, as the movements of the audience are key to activating the project.

The last type of relationship is material/machine-material/machine collaboration. It is important to note that this collaboration often requires some type of prior human-material/machine interaction and possibly human-human as well, and that human audiences may also be at play as machines and materials interact.[38] This means that this type of interaction is reliant on the other types of collaboration. For example, my own project (that I will discuss in more detail later) uses a TAGS v6.1 set of scripts that result in a Twitter Archiving Google Sheet. TAGS was developed by Martin Hawksey and is free to use. It lets researchers set up and run an automated collection of search results from Twitter using hashtags. After the human inputs whichever hashtag they want to search, TAGS "interacts" with the Twitter application to pull tweets. The initial collaboration is human-machine in more than one way. The input of the searchable hashtag in the TAGS spreadsheet and the posting of tweets on Twitter are both human-machine forms of collaboration. However, (once established) the interaction between TAGS and Twitter does not involve any input from humans.

The distinction between human-machine and machine-machine can be difficult to pin down. This is mainly due to the fact that the machines would not exist without the humans. Without this initial input by a human, the machine-machine collaboration would be impossible because "machines still need humans, at least for their design and/or the initiation of the

[37]Griffin and Hayler, "Collaboration in Digital".
[38]Griffin and Hayler, "Collaboration in Digital".

processes that they enter into."[39] However, the human input does end at some point in this type of collaboration, and to believe that the initial input "produces 'control' (by humans) is erroneous."[40] When it comes to these many relationships, the boundaries continue to shift and we must constantly work to understand what constitutes human input.[41] In my own example, I contribute by picking the hashtag to search and collect. After that I am no longer a part of the process. I do not get to pick the type of users the machines search for, limit the location of where these tweets are pulled from, or anything specific about the tweets. Everything is done between the TAGS tool and Twitter algorithms.

Democratization

Digital humanities is about not only the production of material but also about reshaping the way that knowledge is shared and discussed. One core characterization of digital humanities is democratization, which often conjures up notions of freedom, fairness, and equal distributions of power. Democratization also brings forth tension between utopian and reality viewpoints concerning digital humanities. There are many who believe that democratization claims linked with technology offer a utopian view that exists outside of reality.[42] The reality viewpoint is based on the idea that access and equity issues persist regardless of the ways that digital approaches expand opportunities.[43] It labels the utopian viewpoint as being naive and impractical, if not impossible.[44] The utopian viewpoint, as outlined in the Digital Humanities

[39] Griffin and Hayler, "Collaboration in Digital".
[40] Griffin and Hayler, "Collaboration in Digital".
[41] Griffin and Hayler, "Collaboration in Digital".
[42] Greenspan, Brian. "Are Digital Humanists Utopian?" In *Debates in the Digital Humanities 2016*, edited by Gold Matthew K. and Klein Lauren F., 395. Minneapolis; London: University of Minnesota Press, 2016. Accessed April 1, 2021. doi:10.5749/j.ctt1cn6thb.36.
[43] Greenspan, "Are Digital Humanists", 394.
[44] Greenspan, "Are Digital Humanists", 394.

Manifesto, works to reimagine the humanities and what is viewed as possible with broad notions of openness, inclusiveness, and collaboration.[45] It works to open up access to humanities material, invites participation by anyone from experts to the general public, and works to collaborate with this public.[46]

Despite the valid concerns about utopian blind spots, it is fair to say that digital humanities are characterized by movements toward democratization, access, and participation.[47] We can see this in aspects of access and participation linked with social engagement, global reach, timeliness, and collaboration.[48] An illustrative example can be found in democratization movements related to open access publishing. This will be explored in this section as a way of highlighting the aspects of democratization, access, and participation that characterize DH. The Budapest Open Access Initiative (2002) defines open access publishing as:

> By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of this articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical buried over than those inseparable from gaining access to the internet itself. The only constant on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.[49]

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[45] Greenspan, "Are Digital Humanists", 401.
[46] Hunter, Andrea. "The digital humanities and democracy." *Canadian Journal of Communication* 40, no. 3 (2015): 411.
[47]Hunter, Andrea. "The digital humanities", 409.
[48] Zriba, Hassen. "The Role of Digital Humanities in the Democratization of Knowledge." *Journal of Humanities and Social Sciences Studies* 1, no. 4 (2019): 84.
[49]"Read the Budapest Open Access Initiative." Budapest Open Access Initiative, February 14, 2002. https://budapestopenaccessinitiative.org/read.

The first characteristic is that it "opens and extends social and cultural relations between academic institutions and their socio-economic and political environments."[50] It brings together academic and professional experts, students, and the general public, which results in the creation and dissemination of new knowledge and engagement within a community centered learning experience.[51] In "The Future of Scholarly Journals Publishing Among Social Science and Humanities Associations," Mary Waltham looks at eight of the most popular academic journals and analyzes the requirements to be published within each of them. She found that the acceptance rate for publication in one of these journals to be roughly eleven percent.[52] This means you have just as much of a chance of being published in an academic journal as you do of being accepted into an Ivy League University. Academics coming from less privileged backgrounds or people simply interested in the topic have very little ability to share their voices through any of these venues. This means that the discussions surrounding issues, ideas, and knowledge can become homogeneous as no new insights or viewpoints are allowed to participate.[53]

The second characteristic is the global/distribution of open access.[54] Open access publishing is web-based and designed to reach anyone around the globe who can get an internet connection.[55] This disrupts earlier models of academic publishing that were in many ways linked to the potential for academics to earn tenure or gain esteem from colleagues. The gatekeeping functions of typical academic publishing create a scarcity model that makes it not only difficult

[50] Zriba, "The Role of Digital", 84.
[51] Zriba, "The Role of Digital", 84.
[52] Howard, Jennifer. "Humanities Journals Cost Much More to Publish Than Science Periodicals." chronicle.com, July 20, 2009. https://www.chronicle.com/article/humanities-journals-cost-much-more-to-publish-than-science-periodicals-47477/.
[53] Zriba, "The Role of Digital", 90.
[54] Zriba, "The Role of Digital", 84.
[55] Zriba, "The Role of Digital", 84.

to get published but also expensive for the public to access the information. With many journals requiring a paid subscription, the traditional model creates barriers to people discovering new ideas. Like digital humanities broadly, open access seeks to break down barriers to all who are interested.

The third characteristic is timeliness.[56] The immediacy of the internet allows academics to publish their work much more quickly than going through a traditional publication method. Unlike the one and half plus years it can take for academic papers to be traditionally published, with a few taps on a phone or computer and the push of a publish button researchers can put work out there for millions of people to see. Digital publishing can also be updated continuously, which allows for new knowledge, critique, and interactions to be shared on the internet in real time.[57]

Open access publishing and democratization also further collaboration. To better understand the nature of this collaboration we can look at an example. The *International Journal of Humanities and Cultural Studies* is an electronic academic journal that is open access and is equipped with different reading tools that boost access and participation.[58] This allows for considerable amounts of collaboration among authors and readers. They can comment on and communicate with other authors and readers in real time with the push of a button. Other examples of open access journals are *Digital Humanities Quarterly* and *Digital Scholarship in the Humanities*. Most of the publishing venues linked with digital humanities and open access are committed to not only expanding the ease with which the public can access information but

[56] Zriba, "The Role of Digital", 84.
[57] Zriba, "The Role of Digital", 84.
[58] Zriba, "The Role of Digital", 88.

also including the voices of those groups in the conversations that develop around new knowledge.

One example of the remarkable nature of democratization and digital humanities is the case of Brian Croxall. Croxall went viral in 2009 for several weeks during and after the 2009 Modern Language Association (MLA) Convention. Due to a lack of funds, instead of attending the convention, Croxall had his paper "The Absent Presence: Today's Faculty" read in his absence. While this was occurring, he simultaneously published the paper on his blog, which resulted in his paper being heavily re-blogged, tweeted about, and receiving coverage in both the *Chronicle of Higher Education* and *Inside Higher Ed*.[59] This made his paper one of the most widely seen and read papers from the 2009 MLA Convention. The discussion surrounding his work continued to spread across Twitter and various blogs for weeks after the convention ended. If he had simply gone to the convention, it is unlikely that his paper would have been seen by anyone outside of the conference room. Instead, Croxall was able to freely distribute his work to all those who were interested. This also allowed others, including the general public, to participate in the discussion.

Interdisciplinarity, collaboration, and democratization inform digital approaches and serve to organize our thinking about what digital humanities is or can be. Definitions may be less important than recognizing these characteristics and ensuring that they shape the work that we do as we bring together the humanities and technology. This approach is especially pressing as humanists begin to work with digital data. In the next sections, I will explore the real world

[59] Kirschenbaum, Matthew. "What Is Digital Humanities and What's It Doing in English Departments?" In *Debates in the Digital Humanities*, edited by Gold Matthew K., 7. Minneapolis; London: University of Minnesota Press, 2012. Accessed April 1, 2021. doi:10.5749/j.ctttv8hq.4.

applications of human-machine relationships, the need for a bridge between human and database narratives, and the ways humans engage with computers both technically and conceptually.

Humans and Machines/Algorithms

The relationship between humans and machines needs to be explored in more depth to better understand how their collaboration can be utilized in research. In this section, I will discuss these collaborations and the ways that boundaries between what we typically think of as humans and machines can break down. I will do so by looking at the ways computers and data have been deployed in world applications

Human Machines

In everyday life, humans are constantly analyzing and interpreting the data around them. We then use this data to create informal models that we use to shape the decisions we make in our daily lives. This might all sound like some broad and confusing concept. Afterall, humans are not computers. However, models are nothing more than abstract representations of some process. Whether running in a computer program or in our head, a model takes the information we receive, and then uses it to predict future responses to various situations to guide our decision-making processes.[60] This is something that Jeanette Wing termed "Human Computation."[61] To illustrate, consider an informal human computation model that I used during my time as a Resident Advisor. As a Resident Advisor (RA), I planned various programs for my student residents. When planning each program, I internally and intuitively model my residents'

[60] O'Neil, Cathy. *Weapons of Math Destruction : How Big Data Increases Inequality and Threatens Democracy*. 18. New York: Crown, 2016. http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1109940&site=ehost-live.
[61] Brown, James J. "Rhetorical Devices: Database, Narrative, and Machinic Thinking." In *Ethical Programs: Hospitality and the Rhetorics of Software*, 155. ANN ARBOR: University of Michigan Press, 2015. Accessed March 29, 2021. http://www.jstor.org/stable/j.ctv65swg4.9.

interests, schedules, previous engagement, etc. Just like any model, my internal RA programming model had inputs and outputs.[62] The input is the information that I have about my residents, the available housing budget, my own schedule, and the amount of energy that I wanted to put into each program. The output is the program itself. This could include any activities I decide to offer or the food I cooked. At the end of each program, I would evaluate the success of each individual program by how many residents attended, how many stayed throughout the program, and the overall satisfaction of my residents. This evaluation gives me new information about my residents that I could use to update my model for the next program I planned.

In the above model, I could miss something or there could be a mistake, because in their very nature models are simplifications.[63] No model can account for all the complexities in the world or the varying nature of humans.[64] In our everyday lives, these blind spots within our models are not that important. If a program I had anticipated going well with a high attendance rate turned out to be a dud, there would be no catastrophic side effects. Within this human model, there is also the possibility of my own desires and priorities clouding the data to create a blind spot. Some people might assume that the only way to get rid of this human error is to make the model computerized. I could input all the information about my residents into a computer program that would then predict the success rate of various events. Without the human making decisions, it would be assumed that the data generated would be fair and free of my own interests. However, this is not always the case.

[62] O'Neil, *Weapons of Math Destruction*, 18
[63] O'Neil, *Weapons of Math Destruction*, 20
[64] O'Neil, *Weapons of Math Destruction*, 20

In the same way that my human model can have blind spots, so can a model that has been generated by computers and data. These blind spots reflect the judgements and priorities of those who created the data or the procedures that work with it.[65] Let us say that the police department wanted to start a new initiative to combat racial prejudice among their officers. To do this they might decide to rely on statistics to better inform what neighborhoods they are policing, who they are stopping, etc. However, many criminal statistics are racially skewed and make it look like a particular race is more likely to commit a crime. In 2016, black Americans made up 27% of arrests in the United States, which is double their share of the population.[66] Black adolescents make up about 15% of the children in the United States but accounted for 35% of juvenile arrests in 2016.[67] At first this might appear to be a linkage between race and crime; however, it fails to acknowledge the racial bias in the justice system that results in racially skewed statistics.

To understand this on a deeper level, consider the example of marijuana use. The use of marijuana is roughly equal between black and white citizens. In 2010, 14% of blacks and 12% of whites reported that they had used marijuana in the past year.[68] In that same year, 59% of blacks and 54% of whites reported having never used marijuana.[69] By looking at the statistics, it would be reasonable to assume that the number of arrests for marijuana possession would be relatively equal between whites and blacks. That assumption would be wrong. In 2010, the white arrest rate for marijuana was about 192 per 100,000, and the black arrest was 716 per 100,000.[70] Blacks are

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[65] O'Neil, *Weapons of Math Destruction,* 21
[66] Porter, Nicole D. "Report to the United Nations on Racial Disparities in the U.S. Criminal Justice System." The Sentencing Project, May 1, 2018. https://www.sentencingproject.org/publications/un-report-on-racial-disparities/.
[67] Porter, "Report to the United".
[68]Edwards, Ezekiel. "Report: The War on Marijuana in Black and White." American Civil Liberties Union, 2013. 21. https://www.aclu.org/report/report-war-marijuana-black-and-white.
[69] Edwards, *The War on Marijuana,* 21.
[70] Edwards, *The War on Marijuana,* 17.

roughly 3.73 times more likely to be arrested for marijuana possession than whites, even though the use of the drug is relatively equal.

One explanation for why there is such a difference in arrests is the "broken windows theory." The broken windows theory is based on the idea that by addressing minor indicators of neighborhood disorder and cracking down on petty offenses, police will reduce serious crime that often evolves from the disorder and petty offenses.[71] This results in over-policing areas that are stricken with poverty because they are viewed as breeding grounds for crime. Another reason for the over-policing of minority areas is racism and human prejudice that results in people viewing minorities as more likely to commit crimes, etc. Over policing of these areas results in a disproportionate number of black people being arrested for offenses like marijuana possession. This creates a statistic that makes it seem like black Americans are more likely to be in possession of marijuana.

Now if the police department wanted to create a program that would tell them what areas to police or who is more likely to use marijuana, the program and the data would be full of racial biases. However, the police would then continue to police these areas more heavily than predominantly white areas. This increase in policing would result in more arrests which would create more data that would feed into this racially biased data system. This creates a feedback loop that contributes to and maintains this toxic cycle.

To break this cycle, we need to input some kind of fairness. However, according to Cathy O'Neil, these data systems tend to favor efficiency over fairness and "we can't count on automatic systems to address the issue."[72] They are designed to feed on data that can be

[71] Edwards, *The War on Marijuana*, 17.
[72] O'Neil, *Weapons of Math*, 155.

quantifiably measured and counted.[73] Despite their power, "machines cannot yet make adjustments for fairness, at least not by themselves."[74] Fairness requires human input because "only human beings can impose that constraint."[75] It is a concept that can have many different meanings and outcomes. Fairness is not something that can be coded. This results in the production of unfairness from these purely data-based systems.

The question is, how do we solve this problem? Do we simply stop using algorithms and data? Or rather than completely scrapping the use of these systems, perhaps we can leverage some of the characteristics of digital humanities, including aims to democratize, the value that comes from interdisciplinary perspectives, and insights into the relationships between humans and machines. There is a danger in relying on data without any human insights attached to it. This might sound odd considering the problem with the data systems I mentioned above stemmed from the influence of human prejudice. While there are flaws to human models, there is one major virtue. Humans can evolve. As humans learn and adapt, so do our processes.[76] We need to impose human values into these algorithms and create big data models that are balanced by these values.[77]

As digital humanities engage with data, we can combine the efficiency of algorithms and data models with human values of fairness. There is nothing wrong with using algorithms and data models to speed up the process of analyzing data; however, you cannot let machines run everything. There needs to be a human counterbalance with people constantly looking over the data and adjusting it as needed. Digital humanities is poised to respond to these oppressive

[73] O'Neil, *Weapons of Math*, 95.
[74] O'Neil, *Weapons of Math*, 155.
[75] O'Neil, *Weapons of Math*, 95.
[76] O'Neil, *Weapons of Math*, 204.
[77]O'Neil, *Weapons of Math*, 204.

algorithms and human biases. The collaboration and interdisciplinary nature of this field creates a checks and balances system. By having multiple people working on a project, including coders, technology savvy individuals, humanists, ethicists, etc., we can gain a diversity of insights and correctives for the science/human divides that underlie many of the problems with data models.

Rhetorical Devices in Database Narratives

The interpretation of data will always require narratives as a safeguard against potential ethical problems. However, machines are playing more prominent roles as the amount of data increases beyond simple human capacity.[78] The machines cannot be left to do all the work. As discussed in the previous section, a uniquely human understanding is essential for correctly analyzing and interpreting data. On the other hand, humans might lack the ability to handle large datasets in a timely manner. We need a bridge between the world of machine databases and human narratives. In his book *Ethical Programs: Hospitality and the Rhetorics of Software*, James Brown introduces the idea that the tools of rhetoric can provide procedures for moving between these two worlds.[79]

Brown investigated a system called Stats Monkey to see what kinds of procedures are applied to data and what we can learn from this type of system.[80] He found that the algorithms of Stats Monkey are "motivated" and are not "merely machines, but rather rhetorical devices that sit between database and narrative, making decisions."[81] Stats Monkey used rhetorical considerations like audience expectations and genres to computationally make decisions about narratives.[82] Brown calls the procedures used by the algorithms ethical programs.[83]

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[78] Brown, *Ethical Programs*, 139.
[79] Brown, *Ethical Programs*, 138.
[80] Brown, *Ethical Programs*, 138.
[81] Brown, *Ethical Programs*, 138-139.
[82] Brown, *Ethical Programs*, 153.
[83] Brown, *Ethical Programs*, 139.

These ethical programs use mechanical thinking paired with rhetoric as a way of making decisions about data, what data to keep/throw out, and how to generate narratives.[84] Brown calls for humans to develop machinic thinking to better engage with these kinds of questions. Similarly, Cathy Davidson suggests that machine thinking "provides an alternative to fact-based mastery and proposes, instead, iterative, process-oriented, constructive, innovative thinking" about the relationship between data and narratives.[85] It is important to note that machine thinking is not just about algorithms and computers. Jeanette Wing highlights how this type of thinking can exploit the combined processing power of a human and a machine. She calls attention to how "humans are still better than machines at parsing and interpreting images; on the other hand, machines are much better at executing certain kinds of instructions far more quickly than humans and processing datasets far larger than a human can handle."[86]

Collin Brooke is another scholar who suggests that rhetoric needs to be reimagined in terms of machine thinking. Brooke is primarily focused on the five canons of classical rhetoric--invention, arrangement, style, memory, and delivery.[87] One example of this reworking is an update to the concept of arrangement. Typically, arrangement is concerned with how the rhetor orders their ideas; however, Brooke updates this by viewing new media rhetoric in terms of "patterning."[88] Rather than focus on strictly defined space and arrangements, the new media

[84] Brown, *Ethical Programs*, 140.
[85] Brown, *Ethical Programs*, 155.
[86]Wing, Jeannette M. "Computational thinking and thinking about computing." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 366, no. 1881 (2008): 3720.
[87] Brooke, Collin Gifford. "Chapter 4: Pattern." Essay. In *Lingua Fracta: toward a Rhetoric of New Media*, 93. Cresskill, NJ: Hampton Press, 2009.
[88] Brown, *Ethical Programs*, 156.

rhetor should aim to create conditions or "patterns" that expand potential relationships between data and narratives.[89]

With this expansion comes questions about ethics and ethical choice. Interpretations of data and generated narratives, whether from a machine or human, often contain motives and assumptions.[90] The use of rhetoric like "patterning" can be helpful in understanding ways to reverse engineer data-driven narratives, look for the underlying rules and assumptions, or to recraft new narratives from different patterns that emerge.[91] This will hopefully provide a way to keep ethical concerns in the foreground as we engage with data.

For the human-machine relationship to be successful, there needs to be an established link between narratives and databases that recognizes the role of each in producing knowledge. The machine thinking of ethical programs creates that link. Going between narratives and databases can, if done well, generate innovative ideas and analysis.[92] Human narratives that actively work to critically engage with technology can be a step towards this successful relationship.

Critical Engagements with Technology

The human-machine relationship reveals a strength of digital humanities in the ways it allows us to critically engage with technology. However, this raises questions within the field about what is required of a digital humanist when it comes to working with technology and algorithms. Do you need to know how to code? Is the "hack" or the "yack" more important? What role does cultural criticism play? And much more. I would argue that there are two main

[89] Brown, *Ethical Programs*, 157.
[90] Brown, *Ethical Programs*, 164.
[91] Brown, *Ethical Programs*, 165.
[92] Brown, *Ethical Programs*, 162.

ways to engage with technology in digital humanities, technically and conceptually, and both are important to the field.

Technical -- Know How to Code

Within digital humanities, there have been debates about whether or not technical knowledge or, more specifically, knowing how to code, is essential to being a digital humanist. A tweet exchange between Tom Scheinfeldt and Ryan Shaw sums up the debate between the hackers and the yackers (figures 1 and 2).

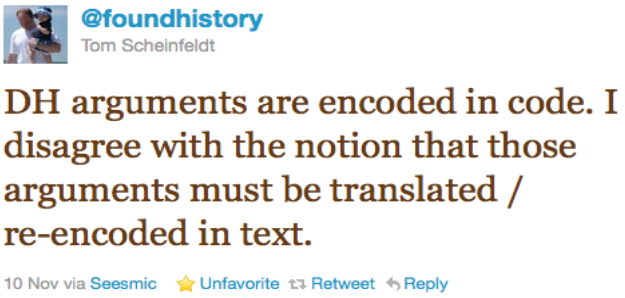

Figure 1: Tweet by Tom Scheinfeldt that reads: DH arguments are encoded in code. I disagree with the notion that those arguments must be translated / re-encoded in text.[93]

Figure 2: Tweet by Ryan Shaw: @foundhistory @ncecire If you can't explain to me in words how your code works, you don't really know how it works.[94]

[93] Scheinfeldt, Tom, and Ryan Shaw. "Words and Code." Wayback Machine, 2011. https://web.archive.org/web/20121110033038/http://journalofdigitalhumanities.org/1-1/words-and-code-by-tom-scheinfeld-and-ryan-shaw/.
[94] Scheinfeldt and Shaw, "Words and Code."

Stephen Ramsay, in his book *Who's In and Who's Out*, stresses the importance of digital humanities scholars knowing how to code. At the 2011 MLA conference in Los Angeles, he blatantly expressed his opinion on the importance of coding: "Do you have to know how to code? I'm a tenured professor of digital humanities and I say yes . . . if you are not making anything, you are not--in my less than three-minute opinion--a digital humanist."[95] This viewpoint has created a divide within digital humanities between those who call for coding knowledge and those who disagree. Coding is certainly important because of its applicability to research and that way it allows or constraints what can be envisioned as possible.[96] Without understanding the technical nature of these tools and processes, it will be difficult for scholars to fully critique their implications. Further, without facility with the technical elements needed to create computer-mediated knowledge, scholars will find it hard to intervene with alternatives and will be left instead with systems that further the very biases digital humanists hope to counter.

Conceptual -- Critique and Draw Conclusions

While the technical aspects of digital humanities are important, they are not the end all be all. In his paper "Where is Cultural Criticism in Digital Humanities?," Alan Liu warns against placing more importance on the technical or hack side in fear of missing out on a crucial opportunity to expand digital humanities. In particular, he calls for an emphasis on the role that cultural criticism can play within the field. Liu argues that digital humanists focus so much on

[95] Quoted in, Smithies, James. "Digital Humanities, Postfoundationalism, Postindustrial Culture." DHQ: Digital Humanities Quarterly, 2014. http://www.digitalhumanities.org/dhq/vol/8/1/000172/000172.html#liu2011b.
[96] Endres, Bill. "A Literacy of Building: Making in the Digital Humanities." In Making Things and Drawing Boundaries: Experiments in the Digital Humanities, edited by Sayers Jentery, 46. Minneapolis; London: University of Minnesota Press, 2017. Accessed April 1, 2021. doi:10.5749/j.ctt1pwt6wq.7.

production and developing tools, data, metadata, etc. that there is rarely reflection on how the data relates to the world.[97] This lack of cultural criticism blocks digital humanities from reaching its full potential and having a seat at the humanities table. Without having a grasp on cultural criticism, digital humanists are merely servants at the table who are perceived to be instrumental to the main aims and work of the humanities.[98] By simply focusing on production and the ability to code, digital humanists are relegated to the position of worker bees because they are viewed as lacking the ability to closely analyze the data that they are manipulating.

There is a lesson that can be learned from works like Pascale Casanova's *The World Republic of Letters*, Moretti's *Graphs, Maps, Trees,* Google Books's Ngram Viewer, and the Software Studies Initiative at the University of California-San Diego. Casanova and Moretti's books frame their system-scale analyses of literature within cultural criticism. They engage with "a combination of Braudelian historiography, Marxist sociology (in Casanova's case, an Immanuel Wallerstein-like 'core versus periphery' analysis of world literature), and global-scale literary comparatism."[99] Jean-Baptiste Michel and Erez Lieberman Aiden used the study of language and n-gram analysis on Google Books to engage with cultural criticism.[100] They call their qualitative analyses of google books a contribution to "culturomics."[101] By using their n-gram analysis of language within the digital literary system that is Google Books, they were able to analyze the way different cultures and governments use language.

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[97] Liu, Alan. "Where Is Cultural Criticism in the Digital Humanities?" In Debates in the Digital Humanities, edited by Gold Matthew K., 491. Minneapolis; London: University of Minnesota Press, 2012. Accessed April 1, 2021. doi:10.5749/j.ctttv8hq.32.
[98] Liu, "Where is Cultural", 494.
[99] Liu, "Where is Cultural", 495.
[100] Liu, "Where is Cultural", 495.
[101] Liu, "Where is Cultural", 496.

Similarly, the University of California-San Diego is working to develop what it calls "cultural analytics."[102] Cultural analytics can be defined as "using interactive visualization and data analysis for research, teaching, and presentation of cultural dynamics and artifacts."[103] They are not just focused on learning about culture in terms of computation but also work to study it in a more culturally critical sense.[104] They do this by using their literary analysis skills paired with software to analyze United States Presidential campaign ads, tracking conversations in visual social networks and changes in communication strategies within major US magazines.[105]

When it comes to conceptual or technical approaches, we find that bridge building is again called for. Just as the boundaries between humans and machines blur the more we engage them from a digital humanities perspective, so too the need to code and critique come together. Here, the interdisciplinary and collaborative characteristics are of high value. Digital humanities must learn to move between text/code analysis and cultural analysis.[106] Fortunately, the varied skills of digital humanists position the field well to think critically about data and data systems and how they impact governing policies, power struggles, finance institutions, etc.

Case Study: Critically Engaging with Technology

My own project is an example of how the technical and conceptual aspects of digital humanities are equally important. I have no knowledge of how to code; however, I have endeavored to engage with the technical aspects of my Twitter project, and view them as just as

[102] Liu, "Where is Cultural", 495.
[103] Douglass, Jeremy. "Cultural Analytics." Software Studies Initiative, 2008. http://lab.softwarestudies.com/2008/09/projects.html.
[104] Liu, "Where is Cultural", 491.
[105] Douglass, "Cultural Analytics".
[106] Liu, "Where is Cultural", 495.

important as the conceptual. Neither of them can happen without the other. As have other digital humanists, I have also relied on a healthy process of interdisciplinary collaboration.

The internet is a powerful tool that can connect people all over the world to share their knowledge. If you do not know how to code or build programs, there is someone out there who can. In my case, Martin Hawksey created a free program called TAGS that searches Twitter for hashtags and pulls them into Google Spreadsheets. This program allows me to engage with technology without having to know the deeper nuances of computer code. I just need a basic understanding of how to use google spreadsheets and Hawksey's TAGS program, which has a demonstration video for new users. Anything that I do not understand, I am able to either google or find a collaborator to augment my limited knowledge. This allows me to emphasize the conceptual and humanistic aspects of my research. My project does not end with just pulling tweets. To truly engage with the technology and information, I need to analyze the tweets to critically engage with the information that can be technically pulled from Twitter.

Case Study Background:

My project works to analyze trends within online discussions on Twitter about vaccines. Vaccinations that prevent life-threatening diseases are one of the greatest health achievements in history. However, the combination of the internet with skepticism toward vaccines has resulted in a massive spread of misinformation. Some of the biggest misconceptions are that vaccines cause autism and elevated health risks. This spread of misinformation on the internet can have deadly effects. The CDC is reporting an increase of about 100,000 children younger than two

each year not being vaccinated.[107] An analysis published in the *Morbidity and Mortality Weekly Report* saw about 1.3% of children in the 19-month to 35-month age group born in 2015 not being vaccinated, which is up from 0.9% in 2011 and 0.3% in 2001.[108] With this increase of unvaccinated children, previously eradicated diseases like measles are making a comeback in the United States.[109]

The discussions around vaccines spiked with the start of the COVID-19 pandemic, and the importance of research around these discussions has spiked as well. According to the Pew Research Center, 72% of Americans have at least one social media account and roughly two-thirds of Americans get some form of their news from social media platforms.[110] The start of the COVID-19 pandemic resulted in the usage of social media skyrocketing.[111] Previous misconceptions about vaccines, new fears with COVID-19, and the increase in social media usage has created a combination that could have devastating effects on the health and well-being of communities. Studying trends in how misinformation about vaccines spreads and the rhetoric used in vaccine arguments could be instrumental in helping to combat these misconceptions.

Why Twitter?

[107]Zimlich, Rachel. "How Many Kids Are Completely Unvaccinated?" Contemporary Pediatrics, 2018. https://www.contemporarypediatrics.com/view/how-many-kids-are-completely-unvaccinated.
[108]Zimlich, "How Many Kids."
[109]Miller, Kristin. "Diseases Once Thought Eradicated Reappear in the U.S." PBS. Public Broadcasting Service, March 16, 2014. https://www.pbs.org/newshour/health/diseases-thought-eradicated-reappear-u-s.
[110] Blankenship, Mary, and Carol Graham. "How Misinformation Spreads on Twitter." Brookings. Brookings, July 16, 2020. https://www.brookings.edu/blog/up-front/2020/07/06/how-misinformation-spreads-on-twitter/.
[111] Blankenship and Graham, "How Misinformation Spreads."

Social Media platforms are plentiful. Some of the biggest out there are Facebook, Instagram, Linkedin, Pinterest, and Twitter. When it comes to social media research, there are three main reasons for using Twitter: audience reach, engagement factors, and a user-friendly interface. Twitter is unique in the way that tweeters can reach out to their audiences and how the process is democratized. On Twitter, you do not have to follow or friend an account to be able to see their tweets or reach people with your tweets. This means that there is more access and availability for participation on Twitter. There are no restrictions, other than Twitter regulations, that limit who can participate in discussions.

Another feature that makes Twitter different is that there is a 280-character limit to its tweets. This means that tweeters must be able to engage with and capture the attention of their audiences quickly. This makes messages sent out on Twitter easy to digest. The National Center of Biotechnology Information found that the average attention span is only 8.25 seconds.[112] Twitter's limited character count allows people to read and share messages quickly. In many ways, Twitter communication is about not only the rhetoric of messages but also about engagement within the network. And often, the shorter the message the better. A report done by Buddy Media found that tweets shorter than 100 characters get 17% higher engagement rates and adding other twitter features like hashtags only increase engagement rates.[113]

Twitter thrives on several factors that support user engagement: hashtags, photos, links, and videos. Data scientist Douglas Mason analyzed two million Tweets sent by verified users to

[112]Ip, Elaine. "Why Twitter's Character Count Is a Good Thing." Marketo Marketing Blog - Best Practices and Thought Leadership. Marketo, June 3, 2016. https://blog.marketo.com/2016/01/less-is-more-4-reasons-why-twitters-character-limit-is-a-good-thing.html.

[113] Ip, "Why Twitter's Character."

evaluate how specific Twitter factors can influence user engagement.[114] In his research, Mason looked at tweets with photos, hashtags, links, videos, and tweets containing a number or a digit.[115] To measure this, he looked at the number of retweets that the two million tweets with the above mentioned features were getting and compared that to the average numbers of retweets for tweets sent by similar accounts, at similar times, and with similar messages that lacked these features. The results were as follows:

- Photos average a 35% boost in retweets.
- Videos get a 28% boost.
- Quotes get a 19% boost in retweets.
- Including a number receives a 17% bump in retweets.
- Hashtags receive a 16% boost.[116]

Along with these features, Twitter's user-friendly interface primes it for steady engagement. The straightforward and easy to understand nature of Twitter makes it a perfect way for people to communicate.

Process:

In this section, I provide an overview of the processes of my research and how they relate to digital humanities before discussing the results in the next section. The TAGS developed by Martin Hawksey works to pull in tweets from Twitter using a specific hashtag. With an English and history double major, I do not have a lot of knowledge concerning complex digital programs. Fortunately, human-machine and machine-machine collaboration enabled me to engage with

[114]Rogers, Simon. "What Fuels a Tweet's Engagement?" Twitter. Twitter, 2014. https://blog.twitter.com/official/en_us/a/2014/what-fuels-a-tweets-engagement.html.
[115] Rogers, "What Fuels."
[116] Rogers, "What Fuels."

tweets on a scale that would be impossible on my own. The use of the TAGS program created by Hawksey simplified the process. By downloading TAGS, I was able to make use of the complex code required to tap into the algorithms and vast databases of Twitter (figure 3).

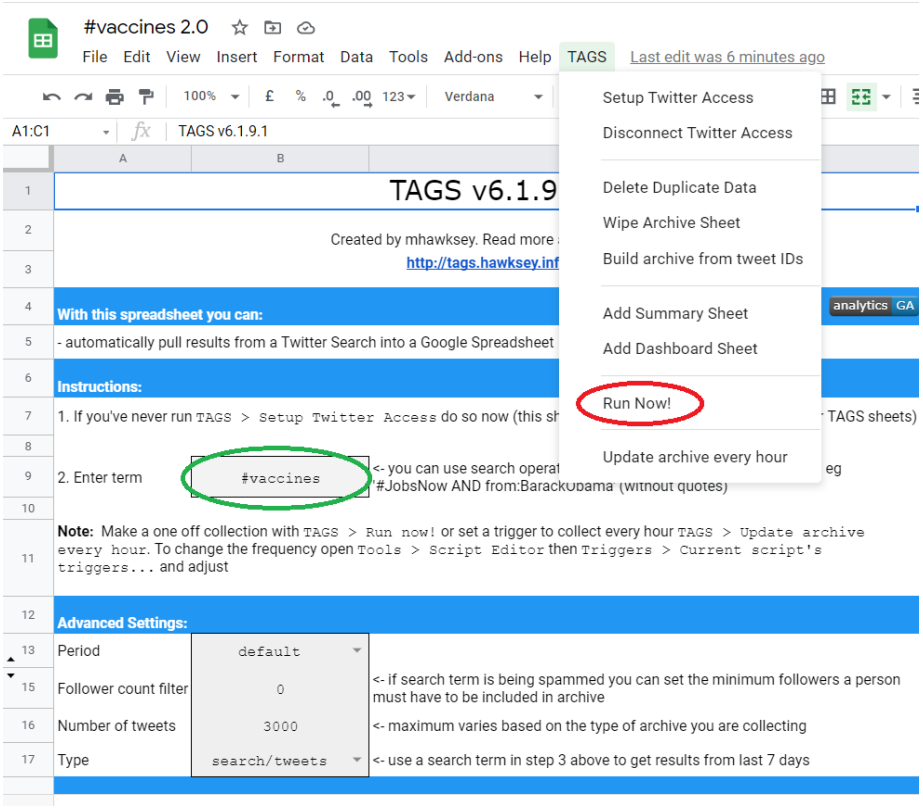

Figure 3: Image of #vaccine TAGS Google SpreadSheet. Hashtag input section is circled in green and RUN NOW! button is circled in red.

After inserting the hashtag and hitting the RUN button, the machine-machine collaboration begins. The TAGS program and Twitter "talk" to each other to pull out tweets with the indicated hashtag. The TAGS program can pull tens of thousands of tweets from Twitter before the system becomes overloaded. Twitter and the TAGS program work to pull tweets going back roughly seven days from the creation of the spreadsheet up until the sheet stops working, which is around 250,000 tweets.

In research about Black Twitter, Lee-Sean Huang found that "the hashtag served as a kind of 'role call' for individuals to publicly self-identify on Twitter and be connected to others" as a way of building communities.[117] In order to do an in-depth analysis of Twitter vaccine communication, I first needed to better understand online communities. According to Huang, there are five attributes that make up a potential online community:

1. Community members share something in common: interests, culture, geography.
2. It is made up of people who care about each other more than they have to.
3. Members communicate and interact with each other through a common language, terminology, or codes particular to that community.
4. Communities require "others" and "outsiders", people who are not part of the community.
5. The boundaries (who's in, who's out) may be fixed or fluid, self-defined, or defined by others.[118]

Each of the above attributes can be used to consider vaccine communities on Twitter. Community members share a common interest, vaccines. However, this interest can be broken down into two sub-groups, pro- and anti-vaxxers. These two sub-groups commonly engage with each other and are a part of the vaccine community as a whole. However, differences emerge when it comes to defining the goals and interests of these two groups. The pro-vaccinators would like to see the vaccine community promoting the immunization of more people. The anti-vaxxers, on the other hand, want the vaccine community to be focused on spreading information against vaccines.

[117]Huang, Lee Sean. "Is a Hashtag a Community?" Medium. Foossa Files, April 14, 2015. https://medium.com/foossa-files/is-a-hashtag-a-community-6a8447c16c3f.
[118] Huang, "Is a Hashtag."

The use of hashtags provides a channel for members of the community to engage with one another.[119] Originally, I only looked at tweets that included the hashtag #vaccines. I did this in hopes of engaging with viewpoints from both the anti-vaxx and pro-vaccine tweeters. However, the recent COVID-19 pandemic paired with the 2020 election has caused the hashtag #vaccines to become more politically centered than focused on vaccines. "Outsiders" and "others," who are not a part of the vaccine community, have co-opted the hashtag that used to be a unique channel of communication about vaccines. While boundaries of this community are fluid when it comes to who can join, the use of the hashtag #vaccines for discussion of elections, lockdowns, etc. shows the way the topic is shaped by political perspectives, but also creates challenges for studying conversations as part of a vaccine community. While communications surrounding vaccines are still happening within this hashtag, the tweets need to be filtered for relevancy. In some cases, members of this community have turned to alternate hashtags to continue to pursue their channels of communication.

To further explore these community dynamics, I decided to look at two more hashtags: #antivaxx and #vaccineswork. In total, I analyzed about 251 tweets split between these three hashtags. The breakdown of tweets is as follows:

- #vaccines: 129 tweets.
- #vaccines work: 49 tweets.
- #antivaxx (2019): 49 tweets.
- #antivaxx (2020): 24 tweets.

To analyze or "code" these tweets, I followed a grounded theory approach. Grounded theory methodology is focused on collecting and analyzing qualitative data to then construct

[119] Huang, "Is a Hashtag."

theories that are "grounded" in the data.[120] Rather than beginning with a theory, the focus is on generating data to see what relevant theories emerge. My goal was to learn about the views, actions, and interactions of participants in vaccine discussions by "letting the data speak." To do this, I created iteratively thirteen different categories, which include: specific diseases, whether the account/tweet was suspended, type of communication, second type of communication, media in tweet, rich media (yes/no), stance on vaccines (pro/con/indeterminate), reasoning behind stance, mode of appeal, rhetorical devices, gender of poster as presented on Twitter, generation of poster, and right/left political inclination of poster. The goal of these categories was to codify tweets to see if patterns could be found. The creation of these categories is based on what Anselm Strauss and Juliet Corbin call open coding. Open coding, as defined by Strauss and Corbin, is "the part of the analysis that pertains specifically to the naming and categorizing of phenomena through close examination of the data."[121] This process of coding the individual tweets within the thirteen categories is what made the rest of the research possible, because it allows patterns to emerge that can reveal or broaden potential relationships between tweets and users.

In a project like this, where I regularly must make judgements on tweets to identify their intentions, their reasoning, and the political inclination of the poster, it is important to recognize and work to prevent my own biases. To this end, I leaned on one of digital humanities characteristics: collaboration. With the help of my thesis advisor, I was able to connect with a

[120]Wolff, William I. "Baby, We Were Born to Tweet Springsteen Fans, the Writing Practices of In Situ Tweeting, and the Research Possibilities for Twitter." Kairos 19.3: Wolff, Baby, We Were Born to Tweet - Results. Kairos: A Journal of Rhetoric, Technology, and Pedagogy, May 15, 2015. http://springsteen.williamwolff.org/kairos-final/results.html.
[121] Wolff, "Baby, We Were Born to Tweet."

group of undergraduate researchers who not only helped eliminate biases but also increased efficiency in coding the #vaccines google coding sheet.

The tweets were split amongst four people, including myself, with each person working on about 32 tweets each. After the first reader went through their assigned tweets and coded them, a different reader was assigned to read the same tweet to check for biases. When someone identified biases or had a different opinion about a code, the tweet would be highlighted and discussed at a meeting. Everyone would look over the highlighted tweets and the group would work together to codify the ambiguous tweets, develop consensus on our approach, and calibrate the interpretation process. Similar iterative calibration was used on the additional data associated with other hashtags. Once the tweets were all coded, it was time to look through the results to see what could be learned about Twitter conversations on vaccines.

Results:

In this section, I provide a brief overview of my results before moving on to analysis of tweet images, specific tweets, and specific Twitter accounts. Two of the hashtags, #vaccineswork and #antivaxx, were similar in their overall vaccine stance results. In the #vaccineswork tweets 97.1% of the tweets were pro and 2.9% were con (figure 4). There was a similar trend in the #antivaxx tweets with 83.1% being pro, 12.3% being con, and 4.6% being indeterminate (figure 4). However, the hashtag, #vaccines revealed a different trend with 50% of the tweets being con, 39.7% being pro, and 10.3% being indeterminate (figure 5). This could be in part because of COVID-19 and the politicization of vaccines by the media. When the political tweets are compared between the three hashtags, we find an increase within the hashtag #vaccines at 27.3% (figure 6) versus #vaccineswork and #antivaxx at 11.4% and 8.1% respectively (figure 7).

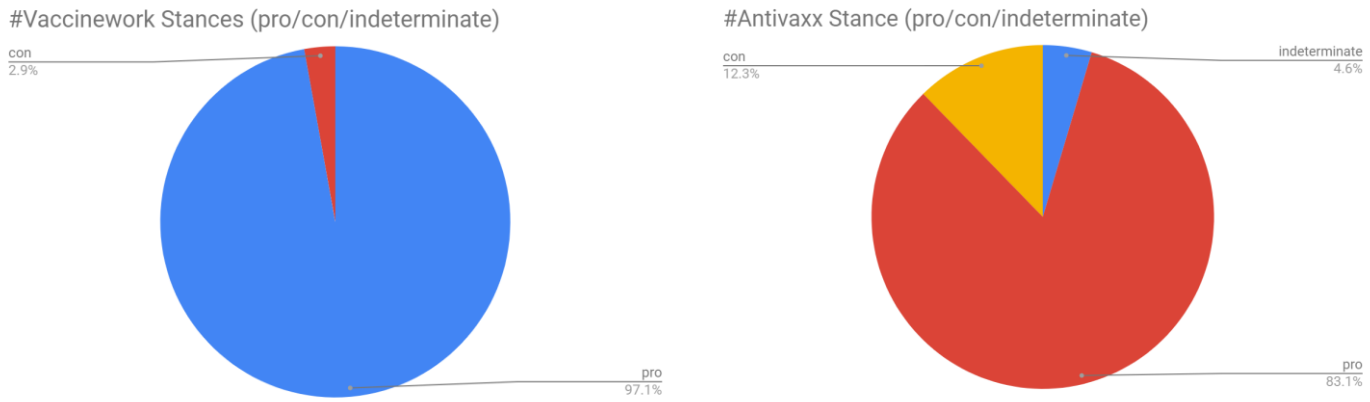

Figure 4: Stance on vaccines for #vaccinework and #antivaxx hashtag conversations (Pro/Con/Indeterminate).

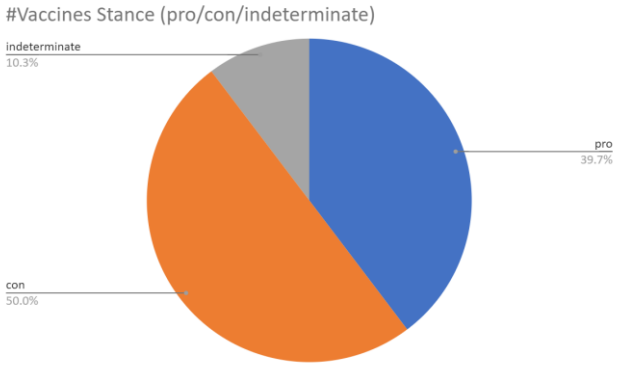

Figure 5: Stance on vaccines for #Vaccines hashtag conversation (Pro/Con/Indeterminate).

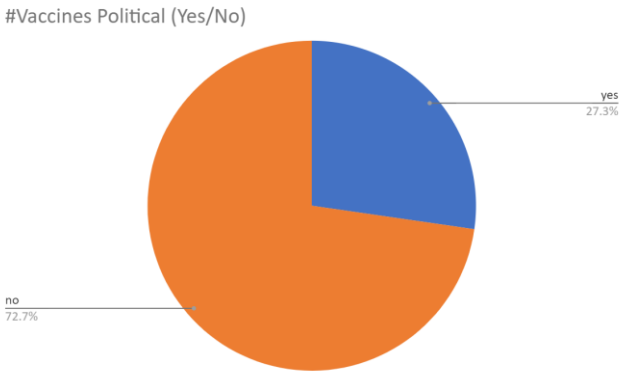

Figure 6: Politically oriented tweets for #Vaccine hashtag conversation.

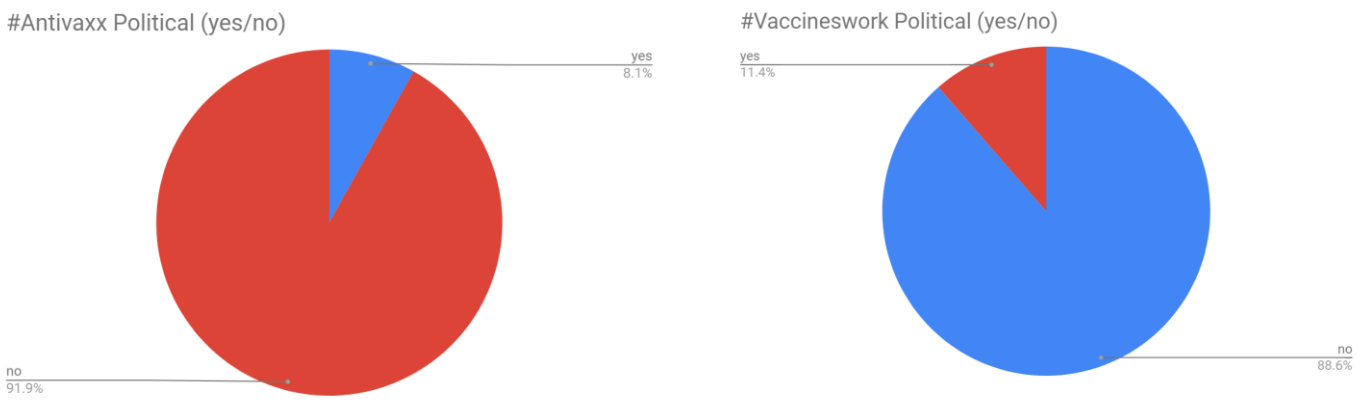

Figure 7: Politically oriented tweets for #Antivaxx and #Vaccineswork hashtag conversations.

Despite the difference in stance and politically oriented tweets, the three conversations were coded with similar levels for types of communication and modes of appeal. The majority of tweets (whether pro or con) used pathos (emotions) as their primary mode of appeal, with logos (logic) coming in second (figure 8). Along with pathos as their primary mode of appeal, most of the pro tweets were focused on informing as their type of communication (figure 9). To consider aspects of communication in terms of vaccine stances broadly, I aggregated all three conversations and cross-referenced the stance with modes of appeal (figure 8) and communication types (figure 9).

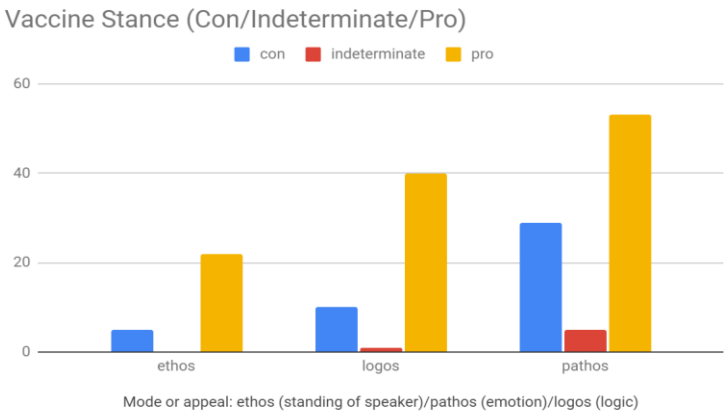

Figure 8: Vaccine stance & mode of appeal across conversations.

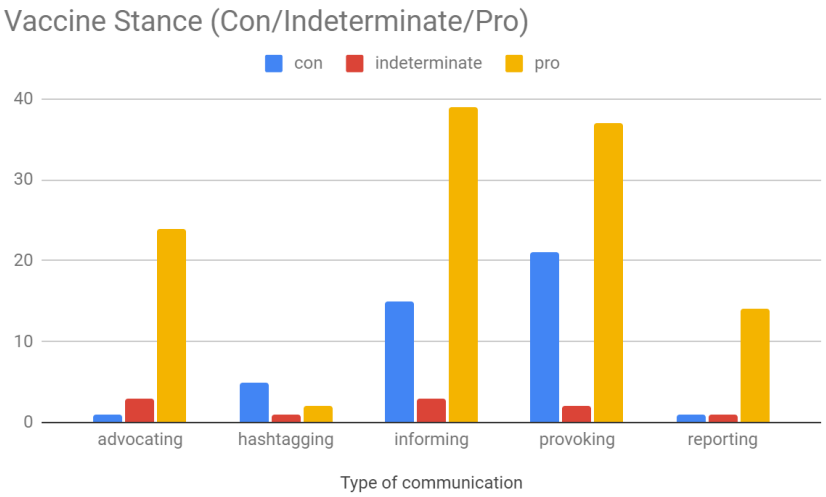

Figure 9: Vaccine stance and type of communication across conversations.

The above charts discussing the conversation analysis represent a quantifying of data. However, the generation of this data and the analysis of the tweets involve qualitative decisions. In some cases, the nuances of these qualitative decisions can be lost as the information is translated into quantitative visuals. For instance, tweets that were labeled as con are generally more focused on provoking as their form of communication (figure 9). At the same time, tweets may well have secondary aspects of communication (like sharing information) that are difficult to account for when applying the code needed to quantify the conversation. Nevertheless, careful reading can be used to identify the varied rhetorical focuses that play out in the conversation. Anti-vaccine tweets that were focused on provoking people would use eye catching words/hashtags or images to gain the attention of the viewers. In a tweet by @LotusOak2 (figure 10), the use of the heavily charged word tyranny to describe mandated vaccines is meant to catch the attention of the viewer. The user then appeals to the viewer's emotions by suggesting that the viewer and their children will be subjected to what they term medical tyranny. The tweet is coded as provoking for the way it essentially tells the viewer that people who are pro-vaccine are trying to take away their freedom and give control over their lives to the government.

from_user	text
LotusOak2	The #vaccine debate is not that complex. You either believe that the Govt. should have FULL CONTROL of what is injected into you & your kids or you don't. There are plenty of other things we can talk about, but the core is medical TYRANNY vs medical #FREEDOM. https://t.co/JRdjpDABP4

Figure 10: Tweet by @LotusOak2, "The #vaccine debate is not that complex. You either believe that the Govt. should have FULL CONTROL of what is injected into you & your kids or you don't. There are plenty of other things we can talk about, but the core is medical TYRANNY vs medical #FREEDOM

The provoking nature of this tweet paired with the emotional appeal towards the viewer's own life and family makes this tweet dangerous. While it does not explicitly call the viewer to arms, it offers a message suggesting that to protect their freedom from governmental control the viewer must resist vaccines. We can see how these visual quantifications rely on determinations that can be arrived at by applying careful, qualitative reading to the tweets.

Unlike the more provoking anti-vaxx tweets, pro-vaccine tweets generally appear to be focused on communicating information about vaccines and their benefits. It seems that these tweeters want information to be the focus and do not want to potentially distract or detract from their messages with heavily emotional images. The pro-vaccine tweet below is an example of how these users share information about vaccines with pathos as a form of appeal. The tweet (figure 11) is informing the reader about the measles epidemic in the Democratic Republic of the Congo (DRC) and the protests in Germany against the measles vaccine. The user is combining these two events with the mention of children to create an argument that is both logical and based on emotions.

The argument reads as follows: There are many children dying in the DRC because of measles, and the only way to stop it is with the measles vaccine. Yet, in a country like Germany, that is privileged because of their access to this life saving vaccine, there are people protesting vaccines. The user is essentially calling out the privilege of those protesting the vaccine and warning them. Their privilege allows them the lack of firsthand knowledge of just how horrendous measles is, especially for children. If they did not have ready access to the vaccine, they would run the risk of losing their children to the disease like so many families in the DRC. It ends with a hashtag warning and reminder that #MeaslesKill so #VaccinateYourKids.

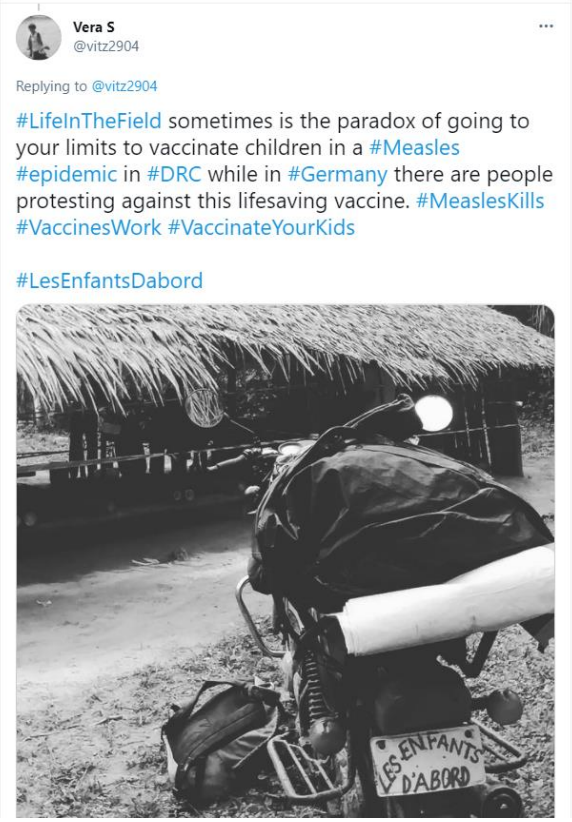

Figure 11: Tweet by @vitz2904, "#LifeinTheField sometimes is the paradox of going to your limits to vaccinate children in a #Measles #epidemic in #DCR while in #Germany there are people protesting against this lifesaving vaccine #MeaslesKills #Vaccineswork #VaccinateYourKids.

This tweet introduces an image along with its message. While at first it only appears to be evidence of travels in the DRC, the inclusion of the image further complicates the reading. The black and white picture paired with the license plate that reads "Les Enfants DaBord" paints a solemn image of life in the DRC. Images can be used to present new arguments and enhance the tweet's text. In the next sections, I will explore instances in which zooming in with the human eye to make additional judgements becomes important when conversations in communities include images.

Image Analysis:

Tweets can include images just as easily as they can text, and postings with visuals are twice as likely to be shared than tweets without images.[122] In a study conducted by Tao Chen and Mark Dredze on vaccine images on Twitter, it was found that images used in vaccine debates online can be just as, if not more, powerful than text.[123] A single glance at an image can evoke emotions of anger, sadness, or joy. The use of scale, color, arrangement, lighting, shapes, lines, and other factors can influence the message that an image is trying to convey.[124] Images offer not only effective ways of eliciting emotions but also a means for presenting statistics and data in easy to understand formats.[125] In Chen's and Dredze's study, three key functions of vaccine

[122]Chen, Tao, and Mark Dredze. "Vaccine Images on Twitter: Analysis of What Images Are Shared." *Journal of Medical Internet Research* 20, no. 4 (2018): 2. https://doi.org/10.2196/jmir.8221.
[123] Chen and Dredze, "Vaccine Images", 4.
[124] Jenkner, Ingrid, and Verna Gatane. "Visual Rhetoric Strategies." Essay. In *Beyond Words*, 3rd ed., 470. Halifax: Mount Saint Vincent University Art Gallery = Galerie d'art de l'Universit Mount Saint Vincent, 2004.
[125] Chen and Dredze, "Vaccine Images", 7.

images were identified: (1) expressing the topic visually, (2) supplementing information in the text, and (3) eliciting emotional responses.[126]

The use of images to convey a message calls for understanding of visual rhetoric. Kostelnick and Roberts, authors of Designing Visual Language: Strategies for Professional Communicators, believe that there are three important components of visual rhetoric: audience, purpose, and context.[127] The audience is the viewer who the visual message is directed at. Identifying the target audience is key in communicating a message effectively. In trying to figure out who the audience is, some things to think about might be gender, age, political leanings, ethnicity, etc.[128] Purpose, similarly, provides a familiar rubric for producing and analyzing visual communication. But these broad concerns are only one aspect of visual rhetoric. Images also call for us to make judgments using strategies that go beyond words. When producing images, authors can use things like scale, color, arrangements, etc. to help express the purpose. Color can be used to set a desired mood or feeling.[129] The use of shapes or the arrangements of objects in the image can be used to draw the viewer's attention to a specific point in the image.[130]

Ensuring that the target audience is understanding and interested in the message depends on the context in which the message is viewed. Context, as described by Kostelnick and Roberts, is the situation or "place" in which a viewer is digesting the image being presented.[131] This is where hashtags on Twitter can be useful. An image that evokes one meaning under the hashtag #vaccineswork may elicit another when tweeted with #vaccineinjury. To link images with

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[126] Chen and Dredze, "Vaccine Images", 9.
[127]Kostelnick, Charles, and David D. Roberts. *Designing Visual Language: Strategies for Professional Communicators*. 4. London: Longman, 2011.
[128] Kostelnick and Roberts, *Designing Visual Language*, 5.
[129]Kostelnick and Roberts, *Designing Visual Language*, 4.
[130]Kostelnick and Roberts, *Designing Visual Language*, 5.
[131]Kostelnick and Roberts, *Designing Visual Language*, 5.

communal contexts, hashtags like #vaccines, #antivaxx, or #vaccineswork become key adjacent pieces of information. The audience will be focused on the message of the image because they are already anticipating images/messages related to (one stance or another on) vaccines.

Below I will analyze three images that appeared within my Twitter data to explore the influence that images can have on vaccine communication (figures 12, 14, and 15).

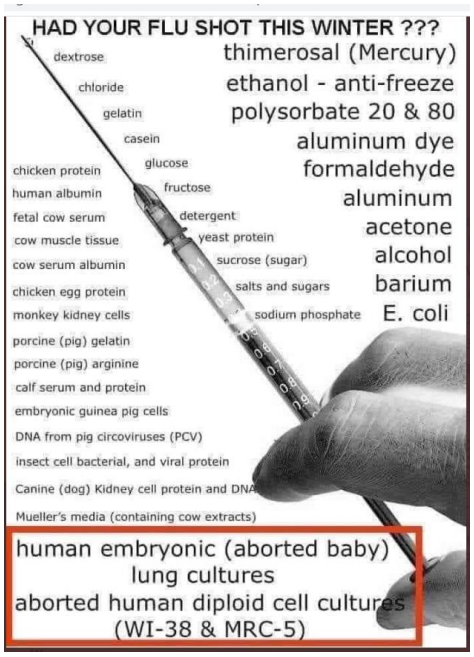

Figure 12: Image of a large needle that presumably lists ingredients in a flu shot. Tweet by @discangirl.

The above image is attached to a Tweet by user @discangirl in opposition to vaccines and in response to a tweet sent out by Alex Azar, Secretary of Health and Human Services, about getting the flu vaccine. In her tweet, she includes three other images but the one above offers several aspects for analysis. The first thing that the viewer's eyes are drawn to is the needle, due to its size and placement. The next place that catches the eye is the text surrounded by the red box. The use of the red box outline and the increase in text size in the box convey a sense of urgency and importance. Why, out of all the text, are these two things being highlighted? These

characteristics all can be identified with aspects of visual rhetoric and allow us to consider further the context, the audience, and the purpose of the image.

Let us first look at the context. This image was posted with a tweet using the #vaccines hashtag. Along with the initial hashtag, there were other hashtags included like #COVID_19 and #shots (figure 13). These hashtags paired with the tweet sent out by Alex Azar help the viewer understand that this tweet is meant to be digested in a context focused on promoting negative messages about vaccines.

Figure 13: Tweet by @discangirl, "#Vaccine ingredients are not safe! @HPVEffects @VaccineAlterFYY @InsideVaccines @VACTRUTH @VAware1986 @kronin8 NO #COVID_19 vax NO #CoronavirusVaccine @POTUS @NYGovCuomo @JoeBiden NO #mandatory #shots #DoctorsSpeakUp @delbigtree @NYTHealth @exposebillgates @WSJ.

The target audience is people looking to get the flu shot, which leads to the purpose of the image, which is to convince people not to get the flu vaccine. Again, these broad rhetorical concerns inform analysis of the visual strategies. The primary color scheme of the image is black and white, which conveys a sense of seriousness and allows the reader to focus on the text of the

image.[132] This also means that any color in the image is going to immediately draw the eye, which is what happens with the red box outline. The use of red suggests warning.[133] This associates the words in the red text box with danger. In this case, the poster wants to draw attention to supposed use of aborted fetal cells in the flu vaccine. Following Chen's and Dredze's identification of image functions, the placement of the text about aborted fetal cells next to the needle is meant to elicit an emotional response. This function fits with the previous data discussed about anti-vaccine posts that found the majority of con tweets relied on pathos (emotions) as a form of appeal. The placement, repetition, and size of the other text in the image is also meant to convey that these are all ingredients in the flu vaccine, which is being depicted as a giant needle in the center of the image.

When you ignore the use of color, scale, and placement of the texts and needle you might notice that nowhere in the image does it claim that these are actual ingredients in the flu vaccine. The placement of these ingredients next to the needle with the question about the flu vaccine at the top of the image conveys the idea that these are all significant components of the shot. However, a quick google search will reveal that these are not ingredients being used in the flu vaccine, despite the image leaving that impression.[134]

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[132]"The Power of Emotions in Black-and-White Photography." Image Converter Plus, March 13, 2021. https://www.imageconverterplus.com/news/power_of_emotions_in_black_and_white_photography_989/.

[133] Gremillion, Allison S. "How Color Impacts Emotions and Behaviors." 99designs. 99designs, June 30, 2020. https://99designs.com/blog/tips/how-color-impacts-emotions-and-behaviors/#:~:text=Red%20is%20the%20warmest%20and,a%20design%20element%2C%20use%20red.

[134] "Fact Check: The Flu Vaccine Does Not Include Many of These Supposed Ingredients." Reuters. Thomson Reuters, October 30, 2020. https://www.reuters.com/article/uk-factcheck-vaccine/fact-check-the-flu-vaccine-does-not-include-many-of-these-supposed-ingredients-idUSKBN27F2YI.

Figure 14: Tweet by @qooldad1978 with an image of a gun being compared to a pill bottle.

The second image (figure 14) is attached to a tweet by @qooldad1978 posted in opposition to vaccines. To better understand this image and the tweet, let us start with the context, the audience, and the purpose. Similar to figure 12, this image was found in the #vaccine conversation and was classified as being against vaccines. What is different about this tweet is that it only presents the image and a few hashtags with no text in the actual tweet. This places great importance on the hashtags being used and therefore the context being created. The user, in addition to #vaccines, includes the hashtags: #BigPharma, #Scientism, #Vaccinators, and #CashCow. This tweet is intended to be consumed within conversations surrounding vaccines and the role that #BigPharma plays.

The target audience for this tweet is a little more difficult to pick out. They do not mention a specific vaccine in their tweet, and the hashtags being used are broad enough to reach both sides of the vaccine arguments. This leads to the possible conclusion that this tweeter could

be hoping to reach a broad audience of people who agree with their viewpoint on vaccines or big pharma and people who do not in hopes of persuading them.

The purpose of the image is perhaps clearer. This is due to the placement and scale of the objects in the image. The image is split between two smaller pictures. The left side is an image of someone pointing a gun at the viewer with the background blurred. This places importance on the gun because it is a clear focal point of that image, which immediately draws your attention to it. The right side is an image of a man presenting a pill bottle. Both images have the statement "Your money or your life" above them. Placing these images right next to each other suggests a sense of equivalence. Medication or vaccines are just as dangerous as an armed robber. What is interesting about this image is the fact that there is no mention or depiction of vaccines within the actual image; instead, the poster is using the tweet to express the message, vaccines are dangerous, visually.[135] The linkage of the image with the hashtag #vaccines is enough to associate the dangers of an armed robber with those of vaccines.

The last image (figure 15) was posted with a tweet by user @AboutPediatrics and was found in the #vaccineswork conversation. This tweet is different from the two discussed above for several reasons. Again, let us start with context. While all these images can be read in the context of vaccine discussions, this one is meant to be viewed a bit more specifically. This is established through the inclusion of a new hashtag: #DoctorsSpeakUp. This hashtag places the tweet within the context of advocacy and not just discussions about vaccines. The placement of

[135] Chen and Dredze, "Vaccine Images", 9.

the hashtags offers further insights into the context. @AboutPediatrics uses #DoctorsSpeakUp within the text of their tweet to seamlessly blend their textual message and the use of the hashtag.

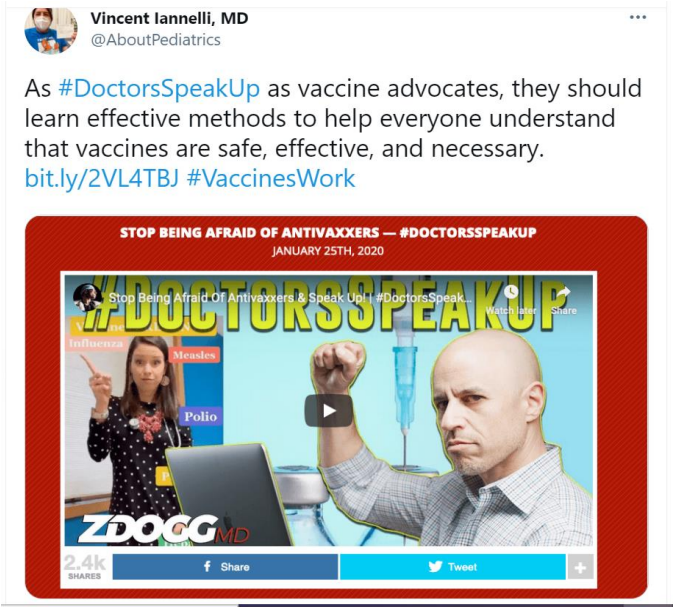

Figure 15: Tweet by @AboutPediatrics. Image with the text #DoctorsSpeakUp at the top with a white man raising his fist and a woman pointing to the names of deadly diseases.

This hashtag also speaks to the target audience for the image, doctors who might be interested in vaccine advocacy. This is shown through the two hashtags that were chosen to accompany the image as well as the educational focus of the tweet. The use of #DoctorsSpeakUp and #vaccineswork conveys the message: Doctors should speak up about the fact that vaccines work. This is boosted with the inclusion of the picture of the woman on the left side of the image. In this section, the woman appears to be standing in front of a white board while pointing to the names of deadly diseases. The environment suggests education, and the stethoscope around her neck shows her identity as a doctor. These two items paired together reveal the intended audience as being doctors who can educate the public about vaccines. Interestingly, there may be a secondary audience as well: patients or the general public who might be swayed by the authority of the doctors conveyed in the image.

Further analysis reveals the primary focus of the image remains engaging with doctors, as shown by the purposes and functions associated with this image. The first purpose is a call for doctors to speak up about vaccine importance with a focus on a specific day. This is shown with the use of the hashtag #DoctorsSpeakUp spread across the image and the inclusion of a date at the very top. The inclusion of the date serves to supplement the text and provide additional information. (Something that is often needed due to Twitter's character limit.)[136] The second purpose is to elicit an emotional response by encouraging and boosting the confidence of doctors. This is where the visual rhetoric really comes into play. The man with the raised fist is slightly larger in scale compared to everything else in the image; he is placed in the foreground, and there is a yellow outline around him that is the same color as the hashtag #DoctorsSpeakUp. The first two items combine to create a sense of power and confidence.[137] Outlining the man in the same color of yellow as the bold text of #DoctorsSpeakUp, which is spread across the image, connects this figure's sense of power and confidence to the hashtag.

These image analyses speak to the need to take a deeper look at specific tweets with the human eye. Machine reading of tweets can easily miss many of these subtleties, although computer scientists are working on refining processes to read images with machines. The judgment required to connect broad rhetorical concerns with identifiable rhetorical strategies, however, is something (at this point in time) that only humans are capable of. Because most computational approaches work at massive scales, the algorithms are not able to detect all the nuance. This is something we will see below as we look at suspended accounts.

Suspended Accounts

[136] Chen and Dredze, "Vaccine Images", 4.
[137] Chen and Dredze, "Vaccine Images", 6.

While coding, I would revisit tweets multiple times; tweets I was coding as con (anti-vaccine) were often suspended or deleted a few days after viewing them the first time. However, there were some tweets that were coded as con that were not being suspended. Twitter must balance its desire for open discussion and opinion sharing with protocols meant to keep users safe from harm and disinformation. To keep this balance, the suspension of accounts is for the most part driven by algorithms, but also includes humans. Twitter has algorithms that work to identify behavior and hashtag-based signals.[138] The algorithms look for tweets and accounts in large volumes for potential blocking, reporting, or muting. The human Twitter team is then notified, and they run an independent investigation into whether that account is violating regulations, such as abusive behavior, spamming, etc.[139] The same is done for hashtags. The algorithm looks at how users are engaging with specific hashtags and then sends items to the human team for closer analysis if needed.[140]

In this section, I will analyze three tweets that were suspended and three tweets that were not suspended in hopes of finding a pattern. The first three tweets are from users @LotusOak2 (figure 16), @ThePlandemic (figure 17), and @TruthsRising (figure 18). The first two were posted with the #vaccine hashtag and the third one with #antivaxx.

[138] "About Specific Instances When a Tweet's Reach May Be Limited." Twitter. Twitter. Accessed April 1, 2021. https://help.twitter.com/en/rules-and-policies/twitter-reach-limited.
[139] Twitter, "About Specific Instances".
[140]Twitter, "About Specific Instances".

from_user	text
LotusOak2	Does the current CDC #vaccine schedule cause #Autism? The #CDC has NO data to answer this question! #TheAutismStudies #ICANvsCDC #InformedConsent Press release @ICANdecide: https://t.co/OSkAHLhky5 Video: https://t.co/iQCanfD76B

Figure 16: Tweet by @LotusOak2, "Does the current CDC #vaccine schedule cause #Autism? The #CDC has NO data to answer this question. #TheAutsimStudies #ICANvsCDC #InformedConsent".

from_user	text
ThePlandemic	EVEN 'WHO' CAN't STAND LOCKDOWNS NOW >>> Coronavirus: WHO joins the Great Barrington Declaration by condemning lockdowns https://t.co/2PifEWm32d #Plandemic #PlandemicHOAX #Scamdemic #Covid19 #CovidHoax #COVIDIOT #Coronavirus #Freedom #Awake #WeDoNotConsent #NoMasks #Vaccine https://t.co/zE7MK83ugQ

Figure 17: Tweet by ThePlademic "Even Who can't stand lockdowns now. Coronavirus: WHO joins the Great Barrington Declaration by condemning lockdowns. #Plandemic #PlandemicHOAX #Scamdemic #Covid19 #CovidHoax #COVIDIOT…"

from_user	text
TruthsRising	PROOF #COVID19 #Death stats have been #Fudged! Why believe #COVID−19 #LIES!? #CrimesAgainstHumanity #Covid19UK #covid19WA #COVID19BC #COVID19Aus #COVID #COVID19Vaccine #CovidMask #COVIDIOTS #COVID19SA #MaskUp #Agenda21 #NWO #antivaxx #Covid #CovidVaccine #maskhole #coronavirus https://t.co/2VShEMZAVl

Figure 18: Tweet by TruthsRising, "PROOF #COVID19 #death stats have been #Fudged! Why believe #COVID-19 LIES!? #CrimesAgainstHumanity…."

At first glance, these three tweets do not appear to have a lot in common. The first is about whether vaccines cause autism, the second is about Covid-19 lockdowns, and the third is about Covid-19 death statistics. However, all three of these tweets were deleted by Twitter. What about these three very different tweets caused Twitter to delete them? When you start to analyze the tweets, look at the different hashtags, and the individual messages, the reasonings become a little clearer.

These three tweets are spreading misinformation about vaccines and the covid situation. The first tweet spreads misinformation about vaccines causing autism. Various health organizations, including the WHO and the CDC, have presented research to disprove the link between vaccines and autism.[141] However, this poster is still spreading this misinformation. This can be dangerous, because there might be people who do not know there has been extensive research on vaccine side effects and that autism is not one of them. This blatant spread of misinformation is probably the reason why this tweet was flagged by Twitter.

The second tweet does not appear to be spreading misinformation until you look at the hashtags used. At the end of the tweet, the user includes the hashtags #Plandemic, #PlandemicHOAX, and #Scamdemic. Just these three hashtags alone allow the reader to infer that the poster believes the COVID-19 situation and vaccine are a planned hoax. Several social media sites have taken a stance against the hashtag Plandemic, which offers conspiracy theories about the origin and extent of the pandemic. The third tweet at first seems less concerning, and it is possible to wonder what may have led to its deletion. The hashtags used for this tweet include #lies, #COVIDIOTS, and #CrimesAgainstHumanity. Here, we have to wonder whether the

[141] "Autism and Vaccines." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, August 25, 2020. https://www.cdc.gov/vaccinesafety/concerns/autism.html.

human team at Twitter was able to parse the purpose of the tweet and place it in the same context as the tweet with the explicit reference to the conspiracy theory.

The next three tweets are con tweets (anti-vaccine) that were not removed by Twitter. The tweets I will be looking at are by Twitter users @joejoe80495073 (figure 19), @CleanFoodHeals (figure 20), and @filomenalala (figure 21).

Figure 19: Tweet by @joejoe80495073, "That's why they need to get their aluminum filled #flushot so they can come down with dementia and alzheimers later in life, in this case in their 30s. Wow, #vaccineswork in such detrimental ways.

The first tweet is spreading misinformation like the previous three tweets, but it is doing so in a way that allows it to slip through the Twitter algorithms undetected. When a human reads this tweet, it is easy to see that it is an anti-vaccine tweet meant to spread misinformation. This tweeter uses out of context information, aluminum in vaccines, to spread the idea that the flu shot causes early onset dementia, despite CDC research that proves this information wrong.[142] While this information is blatantly false, the tweeter does not use hashtags like #lies or #plandemic.

[142] "What's in Vaccines? Ingredients and Vaccine Safety." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, August 5, 2019. https://www.cdc.gov/vaccines/vac-gen/additives.htm.

Instead, the only hashtags used in this tweet are #flushot and #vaccineswork. This allows the tweet to slip through the algorithms because there are no "trigger" words that the algorithm can use to identify the tweet as spreading misinformation. In fact, the #vaccineswork tag may offer its own "inoculation" against deletion; an algorithm/machine might read this tweet as being pro-vaccine because of this positive hashtag and the lack of trigger words or anti-vaccine rhetoric.

The next two tweets are similar with their strategic use (or disuse) of hashtags, as well as unique in that they are focused on attacking people who are pro-vaccine rather than vaccines themselves. In figure 20, user @CleanFoodHeals focuses on attacking the pro-vaccine argument of another tweeter rather than promoting their own anti-vaccine message. This makes it harder to filter the tweets, because they require a human lens to understand the context of the tweet. This allows them to slip by while other, more blatant anti-vaccine tweets, are caught in the web sent out by the algorithms.

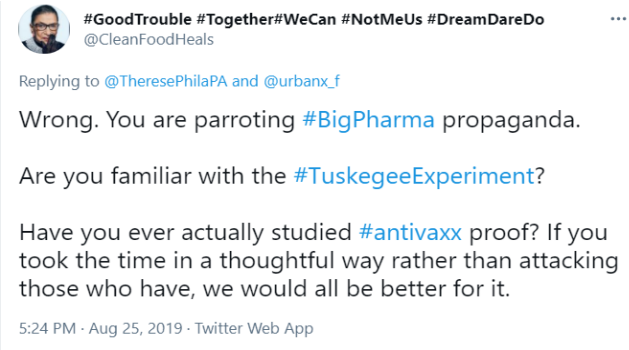

Figure 20: Tweet by @CleanFoodHeals. "Wrong. You are parroting #BigPharma propaganda. Are you familiar with #TuskegeeExperiment? Have you ever actually studied #antivaxx proof? If you took the time in a thoughtful way rather than attacking those who have, we would all be better for it."

Figure 21: Tweet by @filomenalala, "Fixed it for you. Dr. Richard Pan promotes disinformation that can injure or kill. @DrPanMD must be held accountable for platforming dangerous disinformation. #science #vaccineswork #ivax2protect #resist #alternativefacts @WHO @Facebook @vaccinateCal @vaxyourfam.

At first glance, the tweet by @filomenalala (figure 21) appears to be a pro-vaccine tweet calling out another tweeter for spreading anti-vaccine misinformation. The hashtags used all line up with a pro-vaccine message. However, once you look at the tweet they are replying to (figure 22) it appears that the hashtags are being used in an ironic manner as a way to mock Dr. Pan, a pro-vaccine physician. When you compare the two tweets further, @filomenalala repeats Dr. Pan's pro-vaccine message almost exactly except for who is being accused of spreading misinformation. Camouflaging the anti-vaccine tweet through mimicking a pro-vaccine message makes it harder for an algorithm to pick up on the anti-vaccine message.

Figure 22: Tweet by @DrPanMD, Anti-vaxxers promotes disinformation that can injure or kill. #SoMe companies must be held accountable for platforming dangerous disinformation. #science #vaccineswork #ivax2protect #resist #alternativefacts @WHO @Facebook @vaccinateCal @vaxyourfam.

The above three tweets needed a human reading to pick up on their anti-vaccine message, because the algorithms were not equipped to identify the way they framed their arguments. The unique use of hashtags, attacking pro-vaccine people versus vaccines, and reframing pro-vaccine tweets to be anti-vaccine allows the tweets to slip under the radar of machine detection.

Twitter Account Analysis:

To further explore the dynamics of deletion and the rhetoric of tweets, we can also turn to analysis of entire accounts, which can help reveal more information about the vaccine community. I will be analyzing two accounts: @VaxxHappenedBot and @TeagenHelen.

VaxxHappenedBot:

The account @VaxxHappenedBot stands out because of the number of tweets being sent out and the type of tweets sent. From August 17, 2019 to August 25, 2019 out of 466 tweets with the #antivaxx hashtag, this account was responsible for about 35.6% of them (figure 23).

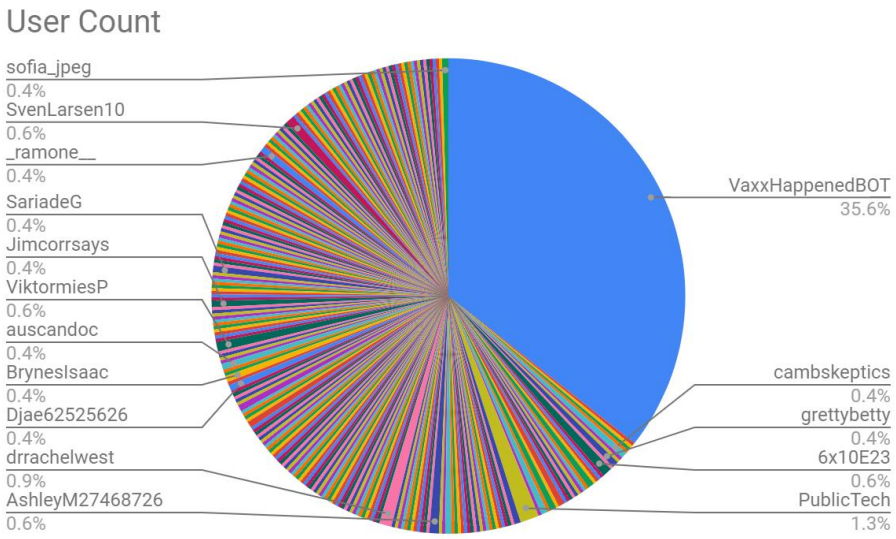

Figure 23: User Count chart from August 17-25, 2019 of #antivaxx tweets.

This account appears to be a bot run using a program called IFTTT that creates tweets by pulling posts from the reddit page r/vaxxhappened. Redditors post on the r/vaxxhappened page with images and captions that other redditors can interact with in the form of comments, awards, and up/down voting. There does not appear to be a common characteristic among the posts that become tweets. I originally thought that the reddit posts that received the most interaction or the most recent posts could be the ones being pulled; however, this does not seem to be the case. It seems the only way to truly understand how this bot runs would be to reverse engineer it or discuss it with the person who created the bot. At the time of this thesis, the account has not responded to my attempts at making contact. This leads me to assume that the bot might be running on its own in a machine-machine relationship, without the input of the creator anymore.

This account appears to be posting roughly eight to twelve tweets a day using the #antivaxx hashtag. Most of them fall under the category of pro-vaccine. This leads me to assume that the account is intended to drown out real anti-vaxx rhetoric by pulling pro-vaccine rhetoric from reddit to post on Twitter. The account does not post a lot of informing or reporting tweets; instead, most of them are provoking using the rhetorical device, ad-hominem (figure 24). By drowning out real anti-vaxx tweets, the account could be hoping to slow down or even help stop the spread of misinformation that is normally attached to anti-vaxx tweets.

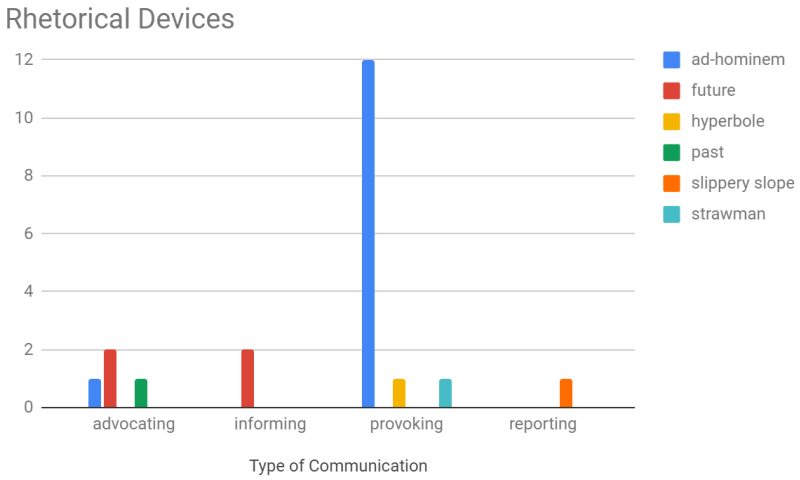

Figure 24: VaxxHappenedBot chart with rhetorical devices and type of communication.

However, the machine-machine relationship that defines this account can lead to problems, as machines are not able to distinguish between messages with sarcasm or irony the same way that humans can. While most of the tweets fulfill the purpose of drowning out anti-vaxx rhetoric with pro-vaccine messages, occasionally one will slip through with an ambiguous message. If the purpose of the account is to drown out anti-vaxx messages, the creator would not want tweets posted that can be interpreted as being anti-vaccine (figure 25). The reddit page that the account is pulling from is intended to be a platform for pro-vaccine individuals to interact with one another and make fun of anti-vaxxers. This can lead to posts that appear to be anti-vaccine until you start reading the comments and realize that the post is making fun of the picture/message it has attached to it. The bot, however, does not pull the comments of the original posts, and this can result in the wrong message being sent.

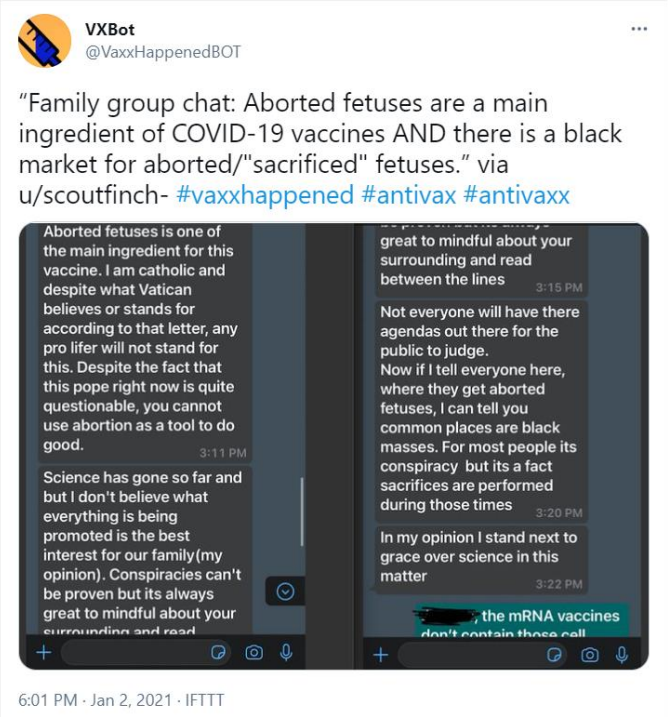

Figure 25: VaxxHappenedBot Tweet: "Family group chat: Aborted Fetuses are a main ingredient of COVID-19 vaccines AND there is a black market for aborted/"sacrificed" fetuses." Image attached of text messages.

The above tweet (figure 25) reveals how the bot, machine-machine collaboration can be lacking in some ways. Without the additional information and comments attached to this original post, the pro-vaccine message gets lost. Having a human checking and analyzing the messages that the bot is posting could help prevent the wrong message from muddling the intentions of the account.

Fake Community

The next account is part of a community of what appears to be fake accounts pretending to be anti-vaxxers. Like @VaxxHappenedBot, the account owners have not responded to my messages at this time; so, I had to do some inferring in analyzing their tweets. The specific account from this fake community that I will be analyzing is @TeaganHelen.

When I first came across the tweets from this account, I had them labeled as coming from an anti-vaccine poster. From the individual tweets (figure 26) there was nothing that indicated that the account was fake. The name, profile image, and profile bio all appeared to be normal. When I coded this tweet for the first time, I noted the anti-vax tweet stance and the reference to children.

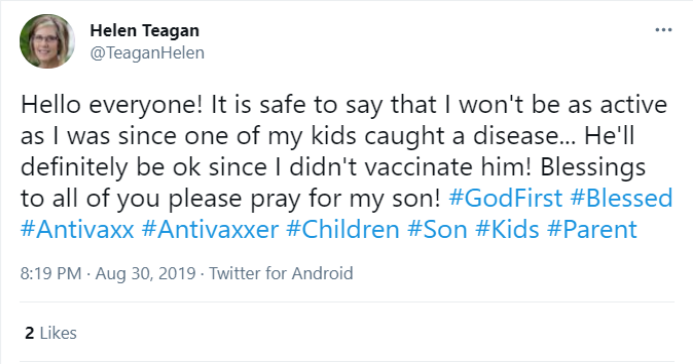

Figure 26: @HelenTeagan tweet "Hello everyone! It is safe to say that I won't be as active as I was since one of my kids caught a disease… He'll definitely be ok since I didn't vaccinate him! Blessings to all of you please pray for my son!"

However, after scrolling through other tweets sent by this account, I came across a tweet that made me question the intentions of the poster (figure 27).

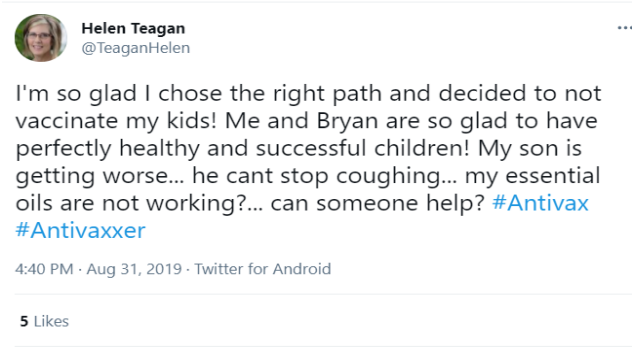

Figure 27: @TeaganHelen tweet: "I'm so glad I chose the right path and decided to not vaccinate my kids! Me and Bryan are so glad to have perfectly healthy and successful children! My son is getting worse...he cant stop coughing...my essential oils are not working?..can someone help?"

The first two sentences of this tweet do not reveal anything new from what I originally assumed about the account; however, the second half paired with the comments revealed more complexities. When reading "...my essential oils are not working? can someone help?", the mocking tone led me to look closer at the comments and other tweets. Most comments were from people telling the account to vaccinate their child or calling them a killer. However, I noticed that the account had only responded to one comment from someone who said they were hoping it was a joke (figure 28). This exchange revealed that the account, @TeaganHelen, was a fake account that someone created.

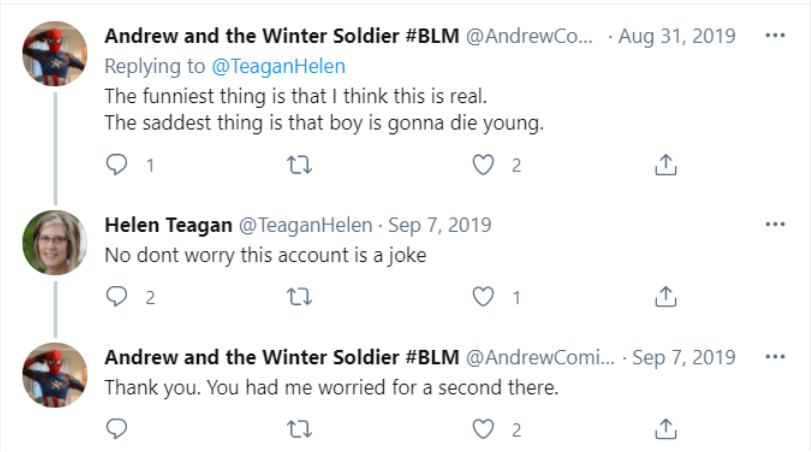

Figure 28: Tweet exchange by @TeaganHelen and @AndrewComiffb.

After this exchange, I decided to look at the three accounts that @TeaganHelen was following. This revealed an elaborate system of other fake accounts (figure 29). These other accounts all post similar anti-vaccine messages, which leads to a lot of questions. Are these all the same person? If they are different people, do they all know each other? Why create fake accounts?

Figure 29: @TeaganHelen Followers.

While this network of fake accounts is interesting, it is also dangerous. If I had passed these tweets through a machine to code them, the fake account could have been taken for a real anti-vaccine account. This highlights the risk associated with relying on machines to do all the work without any human input when it comes to these ambiguous situations. If an anti-vaxxer sees these tweets, they might feel like they affirm their stance on vaccines. Rather than disrupting the anti-vaccine rhetoric, the fake accounts might amplify it.

What Can We Learn From This?

In 2019, the World Health Organization named vaccine hesitancy as one of the top ten threats to global health.[143] The emergence of COVID-19 and the increase in skepticism around

[143] Robeznieks, Andis. "Stopping the Scourge of Social Media Misinformation on Vaccines." American Medical Association, March 15, 2019. https://www.ama-assn.org/delivering-care/public-health/stopping-scourge-social-media-misinformation-vaccines.

vaccines makes it even more important to understand anti-vaccine rhetoric and the best ways to combat this misinformation. Social media platforms make it easy for misinformation to spread, as there is little regulation on discussions happening online. These platforms are stuck between trying to address the problem and not censoring different beliefs. However, as anti-vaccine rhetoric starts to become a world health problem, something needs to be done to address it.

Understanding how anti-vaccine rhetoric is represented on social media can help create strategies on how to combat it. Once we understand the techniques that are being used in the anti-vaxx community, we can create responses to better correct the misinformation. It is also important to note that the general public is the target audience, not the vocal anti-vaxxer. In a way, pro-vaccine and anti-vaccine groups are working not to convince each other but to convince the general public that might be swayed either way.

Twitter has begun to try and filter anti-vaccination misinformation; however, algorithms are currently not as effective as we would hope. Algorithms cannot identify sarcasm or irony, and this can lead to certain anti-vaccine messages slipping through the cracks. They are only capable of catching the most obvious cases of misinformation. These machines lack the human context that is needed in addressing this problem. This makes it hard to rely on algorithms to weed out this misinformation. Until algorithms are able to understand these nuances, we need to take a different approach.

Instead of relying on censoring the misinformation, there needs to be a focus on drowning it out with the truth in specifically designed messages. For example, most anti-vaxx tweets relied on the use of pathos (emotions) rather than logos or ethos. To combat these messages, simply linking a scientific article about the effectiveness of vaccines is not going to be sufficient. Instead, messages need to be tailored to address or correct the misinformation. If the

anti-vaxx tweets utilize pathos and children in their rhetoric, then we need tweets that are focused on addressing how vaccines are beneficial for children. Tailoring messages to specific claims in the anti-vaccine community and then complementing evidence-based, scientific research with rhetorically effective appeals can help make the general public more resilient against anti-vaccine misinformation and perhaps sway some members of the anti-vaccine community.

Conclusion

Digital humanities is an interdisciplinary, collaborative field that works to democratize knowledge while engaging concerns both technically and conceptually. This thesis offers one-way digital humanities can be used to provide real world approaches to problems facing society. The increase in vaccine hesitancy is a dangerous problem, especially as diseases like COVID-19 appear. Analyzing vaccine-centered conversations on Twitter is a great first step in finding solutions to the spread of misinformation.

This analysis revealed challenges related to Twitter's deletion and suspension policies, images used in tweets, and specific accounts involved in vaccine conversations. The inability of Twitter's suspension policy to keep up with and weed out the spread of dangerous, false information shows that simply censoring the information is not the solution. Instead, there needs to be a focus on rhetorically informed messages meant to counter specific anti-vaccine rhetoric. Finding ways to combat the spread is imperative to solving the problem. It is the hope of this project that bringing together humanistic concerns like rhetoric and technical approaches can help.

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