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Exploring Echo-Systems: How Algorithms Shape Immersive Media Environments

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ABSTRACT

In the lead up to the 2016 election, fake news often "outperformed" actual news in users' social media feeds. This paper attempts to analyze the process in which fake news proliferates social networking sites and presents a method of understanding and articulating ways in which personalized feeds are shaped by algorithm-based user feedback. The algorithm systems are embedded programs that analyze past user data and search history in combination with other users' searches and history to calculate digital outcomes, anticipate possible recommendations, and present consumers with feeds that represent their own unique immersive media environments. Users may tend to believe misinformation or fake news regardless of their information echo-chamber, but rather as a result of algorithms tailoring cultural artifacts customized to the user in social media information and distribution systems. Social media platforms create user categories based on data collected through online behavior as well as data collected offline in "dataveillance" methods. Further complicating an understanding of information network analysis is the general "invisibility" of the algorithm in end-user interaction within social networking sites. When consuming digital media on various digital platforms, users often access media without interrogating how fake news is designed to find its way into user algorithms and social feeds. This paper analyzes how the algorithm itself should be considered an immersive media environment that permits users to consume unique media feeds that may affect civic actions.

Keywords: *algorithms, programming, media environments, quantization*

As a growing majority of U.S. citizens get some of their news from social media feeds, many users may be unaware of the technological methods platforms use to organize and distribute information on these sites (Rader & Gray, 2015; Shearer & Gottfried, 2017). As a result, this shift in media consumption to digital sources is in conflict with the pitfalls of potential misinformation campaigns that exist in social feeds. The revelations of Cambridge Analytica's "harvesting" of Facebook data (Cadwalladr & Graham-Harrison, 2018), as well as controversies with YouTube's recommendation system, provide an opportunity to respond to

media delivery methods in digital media and social networking sites; users are often unaware that news media and informative content consumed on social media news feeds or timelines are uniquely customized to each user's preferences (Flynn, Nyhan, & Reifler, 2017; Qiu, Oliveira, Shirazi, Flammini, & Menczer, 2017; Rader & Gray, 2015). To operate at scale, social networking sites and digital media distribution sites employ various algorithms in their operations. The algorithm systems are embedded programs that analyze past user data and search history in combination with other users' searches and history to calculate digital outcomes, anticipate possible recommendations, and present consumers with feeds that represent their own unique immersive media environments. The algorithmic media environment differs from screen media ecologies by incorporating data collected both online *and* offline to present consumers with unique media feeds, advertisements, and the distribution order of media content. Whereas television, cable, radio, and newspapers provide media abundantly to many consumers, the social media feed provides a singular, unique media presentation (feed) to each user through a feedback loop of choices and actions. This paper analyzes how the algorithm itself should be considered an immersive media environment that permits users to consume unique media feeds that may affect civic actions.

In the lead-up to the 2016 United States general election, misinformation disguised as real news "outperformed" factual news in social media feeds (Silverman, 2016). In early 2018, it was revealed that some of the media reaching millions of users was misinformation provided by bad actors that manipulated the data provided on social media. At that time, users were made aware of Macedonian "fake news factories" accused of creating false websites and social media pages, as well as the indictment of 13 Russian nationals who have been found to have fabricated events and created posts designed to create civic discord among U.S. citizens (Apuzzo & LaFraniere, 2018; Subramanian, 2017). Aside from these indictments, the ultimate revelation comes from whistle-blower Christopher Wylie's account of Cambridge Analytica's alleged "harvesting," or the storing of long-term user activity, of 87 million users' data, used to alter the algorithm of social media feeds, resulting in skewed media diets delivered to affected users (Cadwalladr & Graham-Harrison, 2018). These revelations bring to light the technical apparatus underlying social media and news feeds that provide media to hundreds of millions of users.

While many citizens are aware that algorithms exist in digital media spaces, it is unlikely that users are media literate in the way algorithms operate social media and digital feeds. Since the algorithm is an advanced mathematical computer program, the average user is at a knowledgeable disadvantage of how machine thinking, code, and feeds operate, relying on the trust that platforms act rationally and appropriately. Additionally, the intentional "invisibleness" of the algorithm further complicates how users can gain awareness of how to "read" their feeds and act more intentionally (Eslami et al., 2015). By analyzing and humanizing the process in which algorithms are deployed, media educators, researchers, and especially users can begin to engage intentionally with social media feeds and reconsider news media consumption.

The explanation of algorithmic processes is not often prioritized in mainstream media and entertainment. Media narratives about programming and algorithms, as seen in David Fincher and Aaron Sorkin's *The Social Network* (2010), frame algorithms as obtuse equations drawn on windows and whiteboards that only the "techies" can employ. In the film, we see algorithms referred to, but not explained, as a piece of code that is unique to each operation. In *The Social Network*, the algorithm is the intellectual property that frames the plot of the film, though the audience is never informed of the underlying functions of the program. The film perpetuates the persistence of the concept of a "black box" – an opaque, seemingly invisible operation that runs

behind the scenes of Facebook and other social media sites. Nearly a decade after the film's debut, Facebook's stock value declined because the algorithm permit bad actors to manipulate the feed's operation.

If we assume that Facebook, YouTube, and social media sites will continue to provide media feeds using algorithms while also refusing to reveal transparency of operations, several questions should be considered in understanding how feeds can, and were, manipulated. If every user has the same access to Facebook, how did some users alter feeds or create content that they were sure would be displayed more often? Why are some users capable of manipulating algorithmic processes while the majority of users simply consume media on feeds? What can we learn about how the algorithm functions in digital media spaces? Are humans still engaged in developing algorithms that provide unique feeds to millions of users?

As users have learned about Cambridge Analytica's data harvesting operation and YouTube's recommendation system errors in children's media, this paper interrogates the algorithm through several case studies and provides a way for the reader to learn and engage with digital media feeds that are unique to each user. Algorithms collect, convert, and organize user actions into data to create unique media environments through various methods of data collection and data tracking (occasionally referred to as "dataveillance") of digital media activity on apps and browsers, as well as tracking data in physical spaces. Additionally, algorithms are often blamed as the responsible actor in the distribution of misinformation, disinformation and fake news, even though the algorithm operates automatically in nearly complete indifference to human users. This paper also analyzes how users interact with their own unique media environments in which misinformation could make its way to feeds and frame their knowledge and civic realities. This exploration of how algorithms have impacted people's information will encourage educators, practitioners, and scholars to better engage with the phenomenon of digital news and media distribution operating at scale.

THE QUANTIZED YOU: CREATING THE USER DATA FEEDBACK LOOP

To create unique and immersive feeds for every user, an algorithm requires immense amounts of user data and metadata (additional data that makes reference to primary data) to compute and execute its recommendation system. The algorithm on media distribution sites and social networking feeds are structured on numerical data obtained from user activity and converted into large equations. As nearly ten hours of a teenager's typical day is spent on social media accessing visual, audio, and textual media on mobile, web browsers, and digital distribution devices like Apple TV (Tsukayama, 2015), teens participate in the customization of the media they consume. Over the entire length of time a user participates on social media or media sites, the small actions and digital interactions, such as likes, comments, ratings, reads, views, and shares, are accumulated into large mathematical databases. Additionally, the metadata log of this usage captures the time they spend paused on a timeline to watch a video with subtitles, whether they completed the video, the choice to continue scrolling, switch applications, interact and respond (reactions), and if they closed the application. Often unconsidered is the accumulation of data from negative media use, or the time away from the platform. Not surprisingly, this additional data is collected and captured through the mobile device the teen carries, which continues to track this data in the form of GPS data accumulated on the device (found in the Location Services on iOS).

Digital media platforms are interested in how user datasets are mobilized in order to better diversify a user experience, exposing members to content outside their comfort zone or to consider media that would otherwise be unknown to them. Platforms, as defined by Nick Srnicek, are "digital infrastructures that enable two or more groups to interact" acting as intermediaries for customers, advertisers, producers, suppliers, and service providers (Srnicek, 2017, p. 43). Platforms also produce media environments that calculate input data to create feeds or suggestions that are likely to be chosen by the user. For example, the Netflix Recommendation System uses user data and behaviors to encourage users to engage with Netflix content through both views and ratings systems.

By allowing users to rate, not only does Netflix improve its data library, but allows the system to repurpose the data to predict likely choices a viewer may make on the platform. Netflix explained that it wants members to be aware of how it adapts to their tastes: "This not only promotes trust in the system, but encourages members to give feedback that will result in better recommendations" (Amatriain & Basilico, 2012). By combining user data with preferences and content, Netflix was able to create "genres" of media that may be completely disparate, but similar in a specific taste to the member. This algorithm was designed to create a media environment that didn't just offer the most popular (see: most watched or highest rated) to users, but rather, customized the content to a genre that suggested material a Netflix member may *likely* enjoy and "satisfy members with varying tastes" (ibid).

While Netflix creates genres and unique media suggestions, it could also employ data that comes from related behavior like browser history, actual shopping purchases, travel, and connectivity in social networks (friends) and likeliness to receive influence purchases from peers. By comparison, the algorithms that Cambridge Analytica allegedly employed on Facebook combined additional data outside of standard user engagement with the platform. The data collected by Cambridge Analytica was sourced through a seemingly benign online personality quiz called "This is Your Digital Life." By accepting usage of the app, Cambridge Analytica was able to access information on the user, as well as their entire network of friends and allegedly, their private messages (Frenkel, Rosenberg, & Confessore, 2018). Facebook currently uses private message data to create customized advertising, but in this case that collection was harvested by a third party interested in creating even more specific digital campaigns to shift the feed of the affected users. Data is also collected from physical activities, such as shopping purchases made with discount or membership cards as that are connected to your cell phone or email address (Stern, 2018). This collection, occasionally referred to as "dataveillance," is part of modern digital advertising methods that are interested in how to balance and integrate marketing into media. The more cumulative the data acquired, the more accurate the suggestion to users, and the more likely the user stays on the platform and makes informed consumption decisions.

The data collected are combined to create personality profiles, or so-called *psychographs*, a portmanteau of psychology and demographics that organizes user data into behaviors that fit in the "big five" of traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism (also known as OCEAN) (Martínez, 2018). This digital accumulation of data has been well known for years and well discussed after the 2013 Snowden revelations and the 2012 "emotional contagion study" (explained later in this paper). To encourage more intentional and civic use on digital media platforms, users should actively consider how information is collected and quantized to build these psychographs.

If we are to consider the algorithm as media environment, we should also consider how the pathway from the user to the feedback system occurs as filtered through the machine processes. Sociologist Zeynep Tufekci explains that we are entering "the era of judging machines" (Tufekci, 2014). These machines "calculate not just how to quickly sort a database, or perform a mathematical calculation, but to decide what is 'best,' 'relevant,' 'appropriate,' or 'harmful'" to users (ibid). Tufekci's analyses of algorithms over the last decade are invaluable to digital media literacy practitioners, educators, and scholars as users continually interact with media in new ways on different platforms. For a platform to better anticipate our interests and our tastes, it has to better know our personality as created through data.

In her 2017 TED Talk, Tufekci explains that user data is quantized with "every status update you ever typed, every Messenger conversation, every place you logged in from, all your photographs that you uploaded there. If you start typing something and change your mind and delete it, Facebook keeps those and analyzes them, too. Increasingly, it tries to match you with your offline data" (Tufekci, 2017). Users are likely aware of the data they create each day through posts, comments, text messages, and uploads, but likely do not take into consideration the amount of negative media, or the media that is deleted *before* it was posted, is also quantized. This means that both posted and non-posted media on social media and search platforms is logged as user data. Facebook, among several other platforms, will merge the digital data with offline data and sell your profile to advertisers. This is often why users find seemingly coincidental advertising in their feeds that align with purchases or conversations that occur offline.

Overall, the goal of the algorithmic feed or search results is to create a media environment that best suits each user's preferences. In the traditional media environment, television viewers or newspaper readers were subject to advertising likely somewhat unrelated to their specific desires. In a world of big data and algorithms, the feeds and results now streamline the experience for both the advertiser and the user. The advertiser now uses the user profiles to sell specific products and, as an added benefit, the user gains access to material they were previously unaware existed. Digital media consumption, from content to advertising, is thus unique to each user.

THE AMBIVALENT MACHINE

To operate at the scale of over a billion simultaneous users, YouTube operates its feed with the algorithm-based recommendation system. As the algorithm is operating so vastly and globally, it cannot always account for exploits in the hundreds of hours of content uploaded every minute. This technological oversight can lead to feed manipulation, dangerous content bypassing the filters, and potentially the weaponization of media content. In June 2017, a moderator of a subreddit forum expressed concern over a possible algorithmic exploit involving YouTube children's content. The forum known as r/ElsaGate had been investigating a strange shift in how children's content was being prioritized in the YouTube algorithm. Disturbing videos disguised as children's videos were being recommended after clips like "Peppa Pig" or "Surprise Egg" or nursery rhyme videos were played. In the nursery rhymes category, several recommended videos played pleasant and catchy music behind cartoon clips of Spiderman and Elsa (from Disney's 2013 *Frozen*) drinking beer or aggressively arguing with one another. This material received hundreds of thousands of views, likely by children using one of their parent's devices. In his extensive 2017 article "Something is Wrong with the Internet," James Bridle

describes a situation where videos are being used to "systematically frighten, and abuse children, automatically and at scale" (Bridle, 2017).

The algorithm behind YouTube recommendations is based on deep learning and scalability embedded in its algorithms. YouTube employs Google Brain, the deep neural network systems that operate the massive amounts of video on YouTube, filter fresh content, and organize media based on signal-to-noise ratios (Covington, Adams, & Sargin, 2016). Neural networks are machine-learning technologies that act similar to the way a human brain thinks, creating new pathways to create better machine efficiency. While YouTube originally operated its feed with human curators, its current massive iteration requires large-scale algorithmic functions. Unfortunately, this leads to the aforementioned exploits during the "#ElsaGate" controversy. YouTube's goal is similar to that of Facebook's and other algorithmically operated social media platforms: increase time spent on the platform. For users with a healthy skepticism and keen approach to media content, the algorithm works well enough, but user intervention continues to drive media choices. The same framework does not extend to children.

Over the last several years, YouTube had shifted its monetization rules to prioritize content for children. Though the company consistently explains that YouTube is not a platform for children and produced a separate children's app, it's been found to have exploited user data of children in a recent FTC filing (Maheshwari, 2018). The "#ElsaGate" controversy led to hundreds of advertisers leaving YouTube and outcry from concerned parents. YouTube CEO Susan Wojcicki explained in a formal YouTube blog post that "bad actors are exploiting our openness to mislead, manipulate, harass or even harm" (Wojcicki, 2017). Wojcicki stated that YouTube would be adding 10,000 human moderators to assist in monitoring this activity.

Another example of the algorithm being exploited occurred in the early Monday morning hours after the horrific mass shooting in Las Vegas in October 2017. When users sought information on the suspect, Google's search results posted several 4Chan threads in the search results. 4Chan, specifically its "random" board, /b/, had created several wild and incorrect speculations as to who the shooter was the previous night. The search results were exploited when the algorithm mistook the threads as authoritative information due to the collection of links embedded in its thread (Turton, 2017). How an inaccurate forum thread, especially from a site well known for its internet trolls and bad actors, appeared in the top results explains how algorithms prioritize information outcomes, but also offers insight into the operations of the code. If algorithms operate fairly autonomously, then it is important to consider how the machine operates.

In his October 2017 article "The Algorithm is Innocent," William Turton explains that Google, YouTube, and Facebook consistently deflect blame onto the algorithm "as if they don't control their own code" (Turton, 2017). The algorithm is a code-based program that merely executes its commands. As companies deflect blame from the human actors to the machine, the algorithm is further scapegoated. This allows the concept of the algorithm to be separate from the actions of the coders, executives, and platform personnel who can continue to operate the system without much human intervention. The "#ElsaGate" controversy and the 4Chan misinformation campaign are examples of many recent events that seek to blame the algorithm because in many ways, even the computer programmers are unaware of the vulnerabilities of a system until someone (or something) attempts to test the operations. As algorithms capture us implicitly (to borrow a computational term), the blame on the machine is suspect.

Blaming the algorithm further obfuscates the potential ways in which we can respond to the media environments that are created by the algorithmic outcomes. Algorithms are pieces of

code that are written by coders – human operators who ingrain their intellect and talent into the program. Code is assumed to be structurally cold, but is actually imbued with the agenda, biases, and vulnerabilities of the programmer. In a concrete example, Facebook employed a "Year in Review" highlight video algorithm at the end of 2014. The site automatically generated a video post that aggregated the images and videos with the most likes of that year. To many, a refreshing recap, but to web designer Eric Meyer, it was an act of "inadvertent algorithmic cruelty" (E. Meyer, 2014). Meyer had lost his daughter earlier that year and Facebook had generated his "Year in Review," which included posts regarding her death – surrounded by animated balloons and confetti.

As a web designer, Meyer was aware that algorithms are thoughtless, but had been affected by its actions nonetheless. Meyer's auto-generated result was not an isolated incident and many users were presented with "Year in Review" reminders of family tragedies, mishaps, or lost pets. Jonathan Gheller, Facebook's product manager of the "Year in Review" app, responded to Meyer's blog post about his daughter and apologized and shed some light on the process. Facebook programmers often lead lives of privilege in a Silicon Valley cultural bubble. The coders and programmers of the "Year in Review" app may not encounter events of the common user during their year and lose sight of how many people may utilize the platform. This technological privilege is often hidden or disregarded as the algorithm bears the brunt of the blame.

The algorithm merely executes code. It is an ambivalent machine that has humans on either end: the programmer and the end-user. The platform acts as the interactive mediator and media host, but as few program the code to be used by many, it is likely difficult to anticipate potentially tragic or inappropriate outcomes. Interrogating the algorithm and considering how it operates allows users to potentially understand the intentions of the system. As platforms continue to scale, they have to simultaneously appeal to general users and the varied niche audience groups, while also producing unique feeds for every user. While platforms like Facebook, YouTube, and Google may act as sources of user-generated content, they actually reproduce the politics and culture of the system or programmer. In his book *What Algorithms Want: Imagination in the Age of Computing*, Ed Finn argues that the algorithm acts as a "culture machine" as the complexity of the machine interacts with humans (Finn, 2017). Finn explains that we "imagine these algorithms as elegant, simple, and efficient, but they are sprawling assemblages involving many forms of human labor, material resources, and ideological choices" (Finn, 2017, p. 28).

THE IMMERSIVE MEDIA ENVIRONMENTS

In comparison to media ecology, the algorithm exceeds the screen interaction of the user. Algorithms create feeds based on combinations of thousands of inputs from the larger audience and the specific user actions both on and off the platform. Considering the algorithm as a media environment means to come to an understanding that future platform interactions will disregard legacy consumption methods of collective, meaning mass, media ecologies and move beyond traditional media literacy approaches to deconstruction and analysis. The algorithmic media environment is a custom, unique environment that changes as the user changes, but also with the culture surrounding the user. This is a massive shift in how media is experienced by the many as media is distributed both massively and uniquely.

While reading a newspaper or consuming television, the viewer is unable to shift the content from the platform level. The reader could turn the page or change the channel, but the content is pre-determined by the publisher or the channel. By reacting to an article or a television show, the next page or the following program does not automatically change – it is static and predetermined. While the choices may shift over a period of months or years, the content shift would require subscribers to make conscious consumption choices of unsubscribing or changing providers. In the digital platform space, a choice made on a piece of content changes the material almost immediately following the action. If a user is on the news app on their mobile device, they may notice the short load time as they scroll. Within those few milliseconds, the feed has shifted, albeit slightly, to accommodate the user's likely desires. Within just a few hours of using an app like Twitter, Netflix, Facebook, or the news app, the feed is customized to the user, based on the choices of what was read, ignored, or reacted to, and combined with the aforementioned collected data in physical spaces. The user is reproduced in their own media environment.

The algorithm works best when platforms prioritize time spent on their site as well as traffic to and from the site. This allows cookies, small pieces of tracking software, to be installed from the browser to the user's computer. The traffic helps determine what is considered a "popular post" or should be prioritized in each unique feed and also contributes to post visibility on other feeds, which in turn could contribute to a post's possible "virality," or likelihood to be shared (Oremus, 2016). For example, the style of "clickbait" headlines has shifted over the years as a direct result of user interactions, clicks, shares, and algorithm tweaks. Sites like HuffPost or Upworthy shifted their headline text to lure visitors to their site and, in turn, share the link again (R. Meyer, 2013). As a result, the algorithm shifts to prioritize links that are clickable and possibly malicious, rather than factual data-based headlines.

In an extreme, though concrete example, Dylann Roof's murderous act was predicated by his radicalization into white nationalism through his internet habits (Hatewatch Staff, 2015). In the Southern Poverty Law Center's (SPLC) investigation into Roof's heinous hate crime of murdering nine African-American citizens in a historic black church in Charleston, South Carolina in 2015, the SPLC discovered traces of his radicalization through Google search results. In his online manifesto, Roof explained that he was affected by the Trayvon Martin case in 2012. Martin was fatally shot by George Zimmerman, a neighborhood watch volunteer, in Sanford, Florida. The highly controversial case resulted in an acquittal for Zimmerman on self-defense grounds. In his manifesto, Roof writes that he was prompted "to type in the words 'black on White crime' into Google, and I have never been the same since that day" (ibid). The Google results prioritized the Council of Conservative Citizens (CCC) as the first link, due the nature of data included in the site. While the CCC site is extremely biased and omits important data, this algorithmic technique is known most commonly as search engine optimization, or SEO, where the title, content, and links allow sites to move up and down the search ranks.

Roof's life may have changed due to the nature of the content on the CCC site, but more importantly, simply clicking on the link permanently altered his media environment. As soon as the CCC site loaded, the malicious site's cookies were downloaded on Roof's hard drive. The next time Dylann Roof made a Google search in a similar category, it used his previous search history to inform his results. As Roof sought out information to confirm his biases, the search results customized, displaying a unique media feed for Roof that persisted across various digital platforms. As he made new conscious purchasing decisions, communicated in new forums, the search algorithm did not react to his behavior by neutralization, but rather more specific and

narrower results. Rather than being exposed to the likely multi-dimensional points of view available on traditional spaces, Roof became further radicalized by his search results.

In theory, Google should have provided a more factual site as the first result, perhaps from the FBI crime statistics page. If this had happened, Roof may have had a chance to debunk his confirmation bias rather than immediately consider the truth to be certified by his predisposed thoughts. This personalization of media is consequential and results in unique feeds for every user. Even if two users have identical friends and connections, the search results will be unique based on their previous interaction with the system and the actions in their personal life (Bozdag, 2013). This media environment extends beyond the monocultural filter bubble or echo chamber, to entire media eco-systems. This "echo-system" is all-encompassing and persists into the feeds of the network of friends or users in the connective environment. For example, the Facebook News Feed curation algorithm employs 100,000 factors to customize the feed of any given user, doing more to omit content rather than include it (Eslami et al., 2015). This feed personalization is a selective environment that results in the display of content deemed worthwhile to the user, in order to increase the time spent online.

The personalization algorithm that creates these unique platform media environments are multi-nodal sourcing from the user history, user preferences, location data, level of novelty, personal networks and the advertisers (Bozdag, 2013). In the consumption of the feeds, users are presented with the illusion of a qualitative experience of information flows, thereby lacking the desire to critically examine or respond to the methods in which the media environment was produced.

HUMANIZING THE ALGORITHM: IMPLICATIONS FOR MEDIA LITERACY PRACTICE

Just two days after Donald Trump's 2016 electoral win of the U.S. presidency, Alexander Nix of Cambridge Analytica praised his company's "revolutionary approach to data-driven communication" and how it "played such an integral part in President-elect Trump's extraordinary win" (Grassengger & Krogerus, 2017). At the time, users were unaware that much of their data had been allegedly harvested and kept by Cambridge Analytica for extended periods of time, in order to evaluate the likelihood of civic actions. In the month before the 2016 election, Brad Parscale, Donald Trump's digital media director, had used the harvested data to create "dark posts" – posts that exist solely in unique media environments, seen only by specific users, and do not archive (Green & Issenberg, 2016). Parscale's goal was to affect civic action, and in the case of the posts created in 2016, to discourage communities from voting by using Facebook's News Feed to promote distrust in Hillary Clinton. The awareness of this type of media manipulation dates back to the 2012 "[e]xperimental evidence of massive-scale emotional contagion through social networks" study where 689,003[1] feeds were altered to find that "emotional states can be transferred to others" without their direct awareness (Kramer, Guillory, & Hancock, 2014, p. 8788).

The emotional contagion experiment analyzed how users express emotion on Facebook feeds. The researchers had access to the Facebook ranking algorithm and over the course of one week in January 2012, the researchers found that when positive material was omitted from their

[1] Participants were randomly selected based on their User ID, resulting in a total of about 155,000 participants per condition who posted at least one status update during the experimental period (Kramer, Guillory, & Hancock, 2014).

News Feeds, users reacted by posting more negative content, and more surprisingly, caused negative responses from their network of friends. In the words of the researchers, "The results show emotional contagion" (Kramer et al., 2014, p. 8789). The harvesting of data by Cambridge Analytica was likely informed by this study, as well as the ability to understand how users interact, share, and express themselves on social media. By comparison, the Cambridge Analytica data collection likely affected 87 million users.

As Ed Finn states near the conclusion of *What Algorithms Want*, "Canons, literary fields, even individual books are no longer the stable intellectual entities they once were, as the institutions involved in their preservation and study undergo the same rapid technological changes affecting the rest of the algorithmic ocean" (Finn, 2017, p. 193). Mathematician Cathy O'Neil explains that ignorance of algorithms is a "crucial piece of the puzzle" for advertisers and the opaque nature of the system is by design (O'Neil, 2016, p. 72). Media literacy focuses on deconstruction, interpretation, and analysis of media consumption choices, but in the age of unique media environments, a more humanizing approach to media literacy education might consider the implications of new challenges encountered by algorithmic media distribution.

As platforms continue to scale and media is almost entirely digitally distributed, new lessons will be learned only *after* each exploitation of the algorithm. Digital media literacy needs to wrestle with methods of exploring and interrogating the algorithm because actors interested creating widespread "information cascades" are aware of how users receive and interact with unique media environments (Del Vicario et al., 2016). Media literacy educators, practitioners, and scholars have the responsibility to promote important concepts and methods of interrogating the algorithm, platform capitalism, and misinformation campaigns, while simultaneously encouraging increased attention to user habits and knowledge of data collection and dataveillance.

Contemporary media literacy education could incorporate new methods of reading and interpreting feeds by understanding the multiple ways user actions are converted into algorithmic tools. While intentional use is covered in media literacy education, students should also be made aware of how social media platforms and digital distribution outlets use the algorithm to increase time spent online by incorporating the collection, quantization, and repurposing of user data, including most importantly, the "negative" media data activity, or the time calculated off the platform. Activity away from digital media no longer equates to non-use, but is part of the user-media feedback echo-system. In addition to this, students should be considerate of how personality traits are derived and converted into so-called psychographs and deployed in the algorithm as the feed uses these traits to shape our media diets.

Just as media literacy recognizes the point of view of the author and creator, contemporary media literacy education needs to be more intentionally situated in humanizing digital media, so as to interrogate the programmers' intention and possible shortsighted deployments. While the algorithm may be ambivalently executing its operations, the intentions (biases, perspectives, goals) of the programmer should be analyzed. Digital misinformation is insidious in online social media and threatens civic action and democracy as the unique media environments often result in polarization rather than cohesion. Operationalizing media literacy to consider the algorithm as media environment prepares for citizens a way to imagine digital media platforms distinctly from collective media distribution.

Using this framework set forth in this paper, users are empowered to consider how unique media environments are presented to them intentionally but consumed unconsciously. In interrogating, analyzing, and humanizing the many aspects of our digital echo-systems, we can

respond to our growing oversaturated data feedback environment and prepare for an even more digital future.

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