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Algorithms are all around us. In the United States, a person could have hourly interactions with an algorithm and not even realize it. Some people use algorithm-driven devices like smartphones, digital clocks, or personal digital assistants (e.g., Amazon's Alexa or Apple's Siri) to wake them up in the morning. Others navigate to work, school, and other destinations with algorithmic GPS technologies, such as Google Maps, Apple Maps, Waze, or Garmin GPS devices. Many institutions use algorithms to decide whether applicants get jobs, places to live, seats at schools, loans from banks, insurance for medical bills, and public assistance benefits to feed themselves.

In fact, when it comes to mobile or internet activity, almost every component of the digital world employs algorithms. Search engine results on Google, Bing, or Yahoo!, consumer product recommendations on Amazon or Netflix, customer service chatbots, and targeted digital advertisements are driven by algorithms. Using social media sites and mobile apps like Facebook, Twitter, TikTok, or Instagram means interacting with an algorithm. Their algorithms will monitor whether the content posted is appropriate or should be removed. They will determine whether posts will be featured or trending on other users' feeds. At night, an algorithm may put people to sleep by reminding them that it is their bedtime based on their past sleeping behavior. Then algorithms wake us up again the next day, bright and early. It is easy to see why the claim that algorithms are everywhere is not hyperbole.

Regardless of what tasks algorithms are designed to accomplish, virtually all of them operate on two guiding principles: 1) optimize an objective they have been given, and 2) learn how they can best optimize that objective from historical data (i.e., training data).[1] For example, Facebook whistleblower Frances Haugen shared in interviews and congressional testimony that one of the biggest objectives of Facebook's algorithms is to make money from the ads they display on their site. However, Ms. Haugen also testified that Facebook's pursuit of this objective sometimes came at the cost of what was good for the public.[2]

After Haugen's bombshell testimony about the harm Facebook's algorithms enact against everyday people, there has been a groundswell of support for congressional action to reduce algorithmic harms by breaking up Big Tech — the collective of top tech companies that run many aspects of billions of consumers lives. The notion is that breaking up Big Tech companies like Facebook, Google, Apple, and Twitter will free society from the algorithmic echo chambers that endlessly and increasingly circulate harmful content.[3] However, breaking up Big Tech will not eradicate algorithmic harm. Why? Because virtually all algorithms operate on the previously mentioned two guiding principles: 1) optimize an objective, and 2) learn from training data how to best optimize that objective. Hence, the harrowing problems that algorithms perpetuate are not unique to algorithms deployed by Big Tech companies. Algorithms used by small companies, nonprofits, and governments operate the same way. While breaking up Big Tech could temporarily reduce the scale of harmful content, doing so will not stop algorithmic bias and echo chamber facilitation in its tracks. This is because other organizations deploying algorithms will fill the vacuum. As long as algorithms, in their current design, operate in the background of daily life, people will continue to suffer from harmful and biased algorithmic outcomes.

This is how algorithms work. To make money from an online ad, users must see or click on the ad. The ad within a page is surrounded by user-generated content. People are drawn to the page in the first place by the content posted.

If Facebook's algorithm is given the objective to maximize the number of views or clicks of the ad, then it will use information about user content and user viewing and clicking behaviors that led them to click on ads.

Algorithms continually evolve. Just as humans change as they learn new things, algorithms change by updating themselves as they learn from training data. In the case of the Facebook algorithm, to accomplish the objective of getting users to look at an ad and click on it, the algorithm must learn what kind of content users like. The algorithm accomplishes this task by inspecting the content users have typically viewed in the past. The algorithm seeks patterns in terms of content characteristics that increase user engagement (likes, clicks, and reshares of a post). Algorithms can also learn from patterns in content that users have posted themselves. For example, if a user frequently posts about, views, and engages with fashion, beauty, and weight loss content, the algorithm learns over time that the user is interested in those topics.

Algorithms often become even more advanced by learning which users have similar interests across an entire consumer base.[4] This algorithmic capability is often called "look-alike modeling."[5] If the algorithm learns that the aforementioned user who seems to like beauty, fashion, and weight loss topics is a 16-year-old girl from a Columbus, Ohio, suburb, it may look at the behaviors of other teenaged girls who live in mid-western suburbs to discover general patterns that are common among them all.

Then the algorithm exploits these learned similarities across users by sending them content they have not seen before about beauty, fashion, and weight loss. Because similar users are receiving in their content feed more of the same type of content that they may or may not have engaged with before, they stay longer on the site. Consequently, content and advertisement views increase.

Although this kind of content circulation might not seem problematic at first glance, this continual recycling and amplifying the same content categories to the same users is how echo chambers arise (scenarios where beliefs are reinforced and amplified inside a closed communication system).[6] If girls are clicking on harmful content that leads to feeling bad about or even harming their bodies, the algorithm may exploit that knowledge and amplify the volume of similar content directed to those girls through trends, news feeds, and highlights of posts by friends in their networks. If algorithms learn that young men who feel disenfranchised from society like to click on extremist hate content, then algorithms will direct more content to them based on the same topics. Such potentially harmful recommendation patterns serve the algorithm's main objective: to increase average engagement with content and the amount of time users spend on the site so that users view and click more ads (and deliver more profit to the algorithm's developers).

Algorithms can also be problematic if they inherit a biased understanding of societal concepts. If user behavior or content is imbued with inherent biases, then the algorithm will also learn and amplify those biases. For example, imagine that a website creates a social media post with a list of the smartest people in the world. Say the post features the 2021 Nobel Prize winners, and the post generates a lot of engagement (likes, reshares, reposts). An algorithm would learn that this type of content is engaging and would update its understanding of the content characteristics associated with "smart." Though most would agree that Nobel Prize winners are indeed some of the smartest people in the world, 77% of the 13 Nobel Prize winners in 2021 are white and male.[7] The algorithm could learn from the website's post and other widespread, highly engaging content that "smart" is associated with white and male. It will serve and boost similar content, and in doing so, produce mass-scale biased output that amplifies the idea that people who are not white and not male are not associated with "smart."

Thoroughly solving the issues brought to light by Haugen first requires acknowledgement that algorithmic harm is not solely created by Big Tech. The algorithm problem spans across all sectors and organizations, large and small. An effective and feasible solution requires a tactical approach more closely aligned with the design and inner workings of algorithms. An effective solution must also consider the incentives at play for organizations like Facebook. For-profit firms will seek to maximize profit. They will consequently build profit maximization into the objectives of the algorithms they use.

Therefore, one solution is to require that constraints be built into algorithmic objective functions to ensure that algorithms serve not only the firm's goals, but also the public good. Research has shown that designing algorithms to maximize profits while minimizing social harm can be done.[8]

While free market and commercial rights advocates might decry this proposal, opponents should note that similar restrictions are commonplace in other sectors of business activity. For example, mainstream TV entertainment companies have had to follow the Federal Communication Commission's (FCC) rules for decades that limit the types of content they can expose the public to.[9] It is plausible that TV entertainment companies could increase ratings and revenue if they included more hardcore pornographic or ultra-violent content in their entertainment products. But should they? Despite society's regrettable predilections and companies' constant pursuit of maximal profits, regulations successfully prevent viewers from seeing pornographic and ultra-violent content on mainstream TV in order to protect viewers from the social harm such content can cause. Importantly, there has been no need to break up big entertainment companies to achieve the objective of reducing social harm. Instead, regulators provide guidelines detailing what type of content was acceptable for viewers to be exposed to prevent public harm while also allowing companies to grow and flourish.

Regulators today can take a similar approach to reducing algorithmic harm. Algorithms can be reprogrammed to optimize their objective while fulfilling constraints designed to protect the public.

For example, a Facebook algorithm could still identify and disseminate popular beauty content among teenage suburban girls, as long as the content does not contain glorification of anorexia, bulimia, or other body dysmorphic behaviors. Furthermore, Facebook could mitigate algorithmic bias in the beauty content served by incorporating characteristics that ensure content features a variety of beauty standards into their algorithm's design.

To rebuild and reprogram algorithms with constraints requires substantial investment, resources, and research into algorithmic approaches that achieve company objectives while reliably minimizing societal harm. Modifying existing algorithms also requires firms to actively audit, monitor, and update their work because the algorithms learn from data and change constantly. To catalyze the process of algorithm redesign, a credible and capable third-party entity must be empowered to spur action. Fortunately, many of the large companies perpetuating algorithmic harm on a massive scale have the very resources required to successfully accomplish this task. The Big Tech companies in particular are best positioned to lead the way because they possess the knowledge, talent, and financial resources. In contrast, smaller companies with fewer resources may struggle to update their algorithms with the required restrictions, even if they possess the requisite knowledge.

CONCLUSION

Current bills proposed in Congress and the Senate are not well-equipped to protect consumers from algorithmic harm because the underlying policies do not take algorithmic design principles and the ubiquitous nature of algorithmic activity into account. Presently, the proposed legislation aims to ameliorate algorithmic harm by restricting the power that Big Tech platforms currently have over smaller home-grown competitive offerings. However, this paper argues that forcing Big Tech companies to sell parts of their businesses will not prevent algorithms at large from circulating extremist, incendiary, and other harmful content. Algorithms are used by large companies and small, and by for-profits and nonprofits. Algorithms are everywhere, and they all operate on the same two guiding principles. To attack the algorithm problem at its roots, society must implement policy that applies to all algorithms. Breaking up Big Tech will not accomplish that objective.

ABOUT THE AUTHOR

Dr. Kalinda Ukanwa is an Assistant Professor of Marketing at the University of Southern California's Marshall School of Business. A quantitative modeler, Professor Ukanwa researches how algorithmic bias, algorithmic decision-making, and consumer reputations impact firms. She is the winner of the 2018 Eli Jones Promising Young Scholar Award and a finalist for the 2018 INFORMS Service Science Best Student Paper Award, 2019 Howard/AMA Doctoral Dissertation Award, and the 2020 AMS Mary Kay Doctoral Dissertation Award. In a prior life, Professor Ukanwa was an industrial engineer, financial analyst, and finance executive at Walt Disney, Citigroup, Viacom, and Kaplan.

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