

**Ljubiša Bojić**

*University of Belgrade, Institute for Philosophy and Social Theory,  
Digital Society Lab, Belgrade, Serbia\**

ljubisa.bojic@instifdt.bg.ac.rs

**Aleksandra Bulatović**

*University of Belgrade, Institute for Philosophy  
and Social Theory, Belgrade, Serbia*

aleksandra.bulatovic@instifdt.bg.ac.rs

**Simona Žikić**

*Faculty for Media and Communication,  
Singidunum University, Belgrade, Serbia*

simona.zikic@fmk.edu.rs

## **The Scary Black Box: AI Driven Recommender Algorithms as The Most Powerful Social Force\***

**Abstract:** Recommender algorithms shape societies by individually exposing online users to everything they see, hear and feel in real time. We examine the development of recommender algorithms from the Page Rank and advertising platforms to social media trending tools to draw conclusions about their social effects. Decisions on how to simplify the complex world around us into dozens of possibilities immensely affect societies and individuals. Similar to our perceptive apparatus, algorithms are eyes and ears in the online world, as they focus our attention towards what they „think” should be important, which is similar to news priming. That is why recommender algorithms are compared to mass media, given their similar roles to sell products and prolong content exposure of online users. This inquiry concludes that AI driven recommender algorithms represent the most powerful social force at present.

**Key words:** recommender systems, mass media, social polarization, echo chambers, negative news

---

\* Corresponding author: Ljubiša Bojić, ljubisa.bojic@instifdt.bg.ac.rs

\*\* This paper was realised with the support of the Ministry of Education, Science and Technological Development of the Republic of Serbia, according to the Agreement on the realisation and financing of scientific research.

## Introduction

The promise of an information highway that connects the world was made by computer evangelists Steve Jobs and Bill Gates in the 80s (Gates 1995; Isaacson 2011). They wanted to change how we perceive the world. The mix of people, ideas and programs appeared as an optimistic picture of the future. The information age was considered a breeding ground for innovation and creativity at the dawn of the 21st century. The idea was to have all the world's information and make it accessible and useful for everyone, as stated in the mission statement of Google (Mission 2022). From an early age technology was envisioned as intelligent, almost as magic, capable of attending to our every need. However, the road was long between the vision of changed humanity and the first technologies that were able to touch everyone's lives. The first online platform that appeared successful in engaging users was the Google search engine, founded in 1998, which was followed by other services provided by the same company (StatCounter 2022; Obrelo 2021; TechRepublic; Pew 2019; Petrov 2022). On the other hand, in terms of social media it was Facebook, founded in 2004 (Phillips 2007).

The event which triggered our inquiry was a statement issued by former Facebook employee Frances Haugen in October 2021 warning that AI based recommender algorithms intensify hate, create polarizations in societies and harm democracy (Perrigo 2021). Based on documents Haugen disclosed in late summer of 2021 it was possible to conclude that Facebook knew about the hazard its algorithms used to pose to teens' mental health and related to misinformation on its platforms. Although aware of these hazards, Facebook appeared to be unwilling or incapable of acting on them. The company denied Haugen's claims with the notion that it spent \$5 billion per year on keeping its platforms safe. Previously, Haugen used to be on Facebook's team aimed at keeping users of that platform safe by tackling misinformation and fact checking both in the US and the rest of the world.

Social media are online apps that empower people to create, share and react to content (Kaplan and Haenlein 2010). As such they have been redefining human communication, especially because of prominent features such as interactivity and immediate access of users to social media sites. They promote user participation, openness/transparency and the „network effect” (Witteaman and Zikmund-Fisher 2012). Prominent roles of social media include interpersonal and intergroup communication, news consumption, PR, crisis management (Graham, Avery and Park 2016) and political communication (Maarek 2014). These networks have made substantial transformations in the economy, advertising and public relations (Doyle and Lee 2016).

Social networking sites are used increasingly for news consumption at present, which is changing patterns of traditional communication in which citizens are just on the receiving end of information, without the capability of affecting topics and directing the public debate (Kalsens and Larsson 2017). However, some scholars claim that traditional media still have dominant influence in the online sphere, as they set the main topics to be discussed (Conway-Silva et al. 2018). This is especially notable because traditional media are first to report about real time events and breaking news that occur around the globe, or because people consider these important (Vargo et al. 2015). Setting the topics that are widely discussed on the nationwide or global level is called priming. On the other hand, new capabilities provided by smartphones and other technologies open two-way communication on a lot of new levels which have not been possible before, such as group level of conversing from anywhere. This provides more choices, target group fragmentation and changes in media use, which threaten the traditional agenda-setting power of the mass media (Feezell 2018). The latest reports show that more than 50 percent of Facebook and Twitter users come across novel information and report on these sites as frequently as every week (Newman et al. 2021).

Changed patterns of communication and news consumption introduce new challenges, such as misinformation. This has been especially prevalent during the Covid-19 pandemic, when social media has been shaping perception, knowledge, and behavior related to health in societies around the world (Ali et al. 2020). For example, a study by Li et al. (2020) showed 25 percent of Youtube videos contained misinformation. These videos were very popular as they often had millions of views, which contributed to the conspiracy mentality. This polarized the world and created two echo chambers for the first time in human history on a global level: one supporting the vaccines and the other one opposing them (Sear et al. 2020). The pandemic brought fake news, conspiracy theories, polarizations in societies and echo chambers, but this would not be possible without social media and smartphones (Schmidt et al. 2018; Zollo 2019; Rieger and Wang 2020).

As Cinelli et al. (2021) states, echo chambers are online environments of connected individuals in which opinions or beliefs on certain topics of importance are reinforced due to repeated interactions and exposure to similar content. These environments would not grow into significant social groups without stimulation by recommender algorithms that actually distribute content and reinforce existing attitudes within the echo chambers.

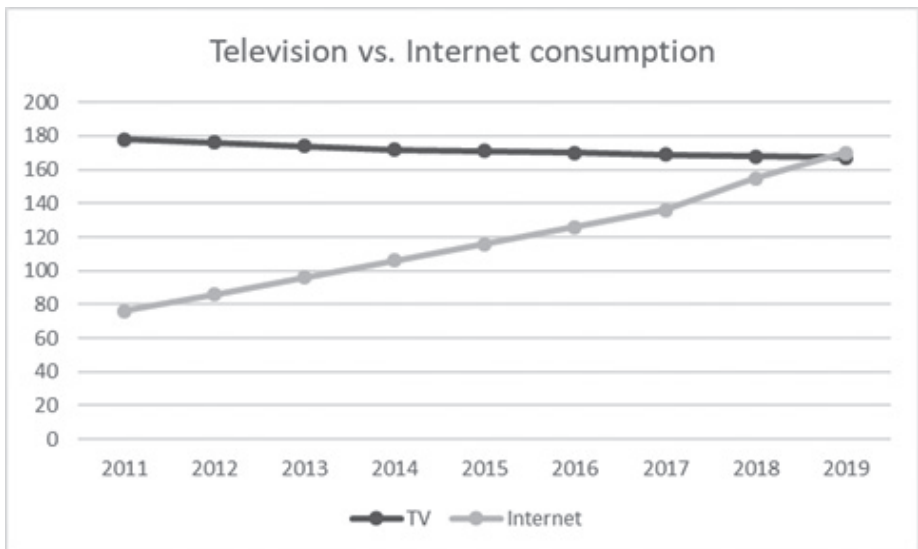
Echo chambers are created because of two important preconditions. The first is the opinion which is expressed by some online entity, which can be a person, website or traditional media. The second precondition is that this opinion is further shared by the community consisting of various online and offline actors.

This is what theorists call echoing opinion (Garimella et al. 2018), which basically creates and sustains an echo chamber. The echo chamber hasn't been defined in terms of how large the online community around some issue must be or how long conversations about the topic of interest must last. What researchers know is that fake news reports stimulate polarization about important issues, which is a precondition for echo chambers to be created (Spohr 2017). It is not known when echo chambers started to occur in the online sphere, but the first important polarization of a society was detected during the 2016 presidential election in the U.S. and the 2016 EU membership referendum in the UK (Spohr 2017).

The most significant tool that contributes to the creation of echo chambers and polarizations in societies is the technology called recommender systems or recommender algorithms (Garimella et al. 2018; Spohr 2017; Bojic, Zaric and Zikic 2021; Bojic, Nikolic and Tucakovic 2022). This technology is predominantly used online. Social networking sites are the most prominent users of recommender algorithms as they distribute ads and posts in trending sections, do friend recommendations and much more. As recommender algorithms often provide similar recommendations based on content used, they usually conform to the opinion of people, thus increasing polarization around important issues (Bojic, Zaric and Zikic 2021).

Also, online media consumption surpassed TV consumption in 2019 indicating the end of the TV era, which is depicted in Figure 1.0. People consume media for 8 hours on average globally, which is more than ever (Richter 2020).

Figure 1.0  
Estimated daily TV and Internet use per person globally (Richter 2020)



According to the reviewed literature, social media have been redefining human communication and news consumption, which has brought new challenges for societies around the world. Polarizations and echo chambers in societies are created under the influence of misinformation and most importantly recommender algorithms that provide this kind of content to online users. Recommender algorithms make individual decisions on what to recommend based on digital footprints that are collected about every online user. This is connected to the judgements of algorithms about interests, personality traits of online users and so on. We have also learned from the abovementioned statement of a whistleblower and released documentation that fundamentally the described social challenges are tech companies and their use of recommender algorithms.

Based on this, we focus on providing a balanced review to answer the following research question:

RQ1: What is the scope of the impact recommender algorithms have in contemporary society?

To meet the noted aims we: introduce a short history of the digital footprint through the development of web technologies from 1.0 to 3.0, including Page Rank, Ad algorithms and Social Media Trending tools; provide a comprehensive analysis of the consequences of recommender algorithms and the author's personal digital footprint.

As for research methods we employ content analysis (Hsieh & Shannon, 2005), including conceptual and relational content analysis, to note the existence of concepts in previous research inquiries and examine the relationships between concepts in them. This approach will be used to make the most detailed review of scientific papers and the author's personal digital footprint with a final aim to get high quality conclusions and answer the above noted research question.

## The Building Blocks of Digital Footprints

### *Web 1.0: from Page Rank to Online Advertising*

Just a short time after the appearance of Google, the company established domination in the search segment of the Internet (Gray 2021). In 2021, out of all online searches, 92.47 percent went through Google (StatCounter 2022).

In the beginning, a search engine was just an index of all information on the Internet. This was not as big back then in 2004 as the Internet was in the early phases of development. The first philosophy around search engines was to have the best index of information and to get people quickly onto the search engine and off into the open space of the web. Making the best index and a very simple

interface was behind the success of Google in its initial phases (Gray 2021). This contributed to the popularity of the Internet and helped form the idea of the open Internet and aroused enthusiasm about the information age and startups. Google understood itself as a media whose role was to present the most important information to its users. The key was the selection of information. This was the starting point of recommender algorithms in the form that would touch the masses of people, or to be precise, the point at which they would touch Internet users individually.

The first technology used by Google for that purpose was Page Rank (Lamberti, Sanna, and Demartini 2009). The so-called Backrub algorithm put Google ahead of all existing services at that time, such as Yahoo and AltaVista. Page Rank technology surpasses directory service as it goes around the internet to download web pages and analyze them, especially in terms of links making the network around different spots online and therefore determining which ones are more or less relevant. In other words, if online users search for some term, the pages that are linked the most will be shown first. In the next instance, the pages that are highest in relevance are more important than just the mere quantity of pages that link to some website that contains the searched term.

That was the first recommender algorithm that actually made a difference on a large scale as it arguably touched the most people. There were 5.4 billion Google searches per day in 2021 (Georgiev 2022). The Page Rank technology made a revolution in recommender algorithms.

Actually, this was just the beginning. As Google's primary role was to provide a remarkable search engine used by almost everyone, the next challenge was to monetize their product's extreme popularity. The answer to the question how they would do that came in the form of a new recommender algorithm that introduced a new age of online advertising as individual recommendations based on information provided by online users. The trade was simple and it looked like an honest one at that point. Google provided the best search services one could imagine to a user who would give away information on their searches (their interests) in return, which would be used by the search company to get back individual advertisements to its users.

The search history of each and every one of us can tell the algorithm a lot about our personal preferences, such as if one is a republican or a democrat, what one likes to consume, which sports, which products, which desires and wants in real time. The information that would later be called our digital footprint speaks a lot about us both in real time and in the long run, in terms of personality features, sexual preferences and really stable features such as demographics. Long term interests such as sports, music and politics are interwoven with our instant real time wants – what we are focused on at some point in time, where we want to go, what to do etc. This digital footprint data helps tech companies build profiles of their users.

The ads recommender algorithm was designed to individually target online users with ads that would most likely interest them. The next breakthrough in the recommender algorithms race was also won by Google as the company introduced Google Ads, a service for online advertising. In fact, this was the first large-scale mechanism for targeted advertising. The service would basically function by offering ads to those that look for products that are being advertised. For example, if the advertiser is a hotel, Google would send their ads to those individuals looking for accommodation at the place where that hotel is located. So the Google ads would hook up hotels with travelers by knowing their search history in real time. This business model was also successful as Google gets 90 percent of its revenue through Google Ads (Redding 2019).

### *Web 2.0: From Web Browser to Smartphone Operating Systems*

The turning point when Google went from being just a simple search engine to becoming an all-reaching superior power of the Internet was the introduction of the iPhone, or in other words, the proliferation of smartphones in the global markets. About the same time Steve Jobs announced the iPhone, Facebook rose to the leading position as a social media company (Jobs 2010).

In an instant the market changed as new competitors appeared. Time spent on sites, such as Facebook, became significant metrics for advertisers. It was no longer only Google that people used extensively. If people went directly to a website from Google this meant only a short time spent on the platform. Also, the company would not be able to collect the digital footprint that people left on the website or the next platform they went to. Big tech companies understood the game. It would be important to make platforms that people would use as much as possible. That would be only possible if those same users created content, which is essential to the concept of the social Web 2.0 (Murugesan 2007).

As a response to these new trends, almost in an instant, Google spread to other areas of online business that would enable the company to have various platforms that people would spend time on. This became important for serving ads as well and collecting data from online users. Thus, the platforms had multiple roles for the company that runs them. The solution Google saw was in establishing new services such as Email and buying already established or rising websites and social media platforms such as YouTube. Anyway the challenge persisted as Google could not get all the data from its users when they browse other websites. The company's next step was releasing Chrome browser in 2008 (Obrelo 2021). That way it would be possible to collect more data from users even when they are not online and serve ads at the same time. The Chrome browser became the most popular one in a short time after its initial release. It has kept this position to the present day. For example, 64.04 percent of people accessed the internet through Google's Chrome browser in 2021 (Obrelo 2021).

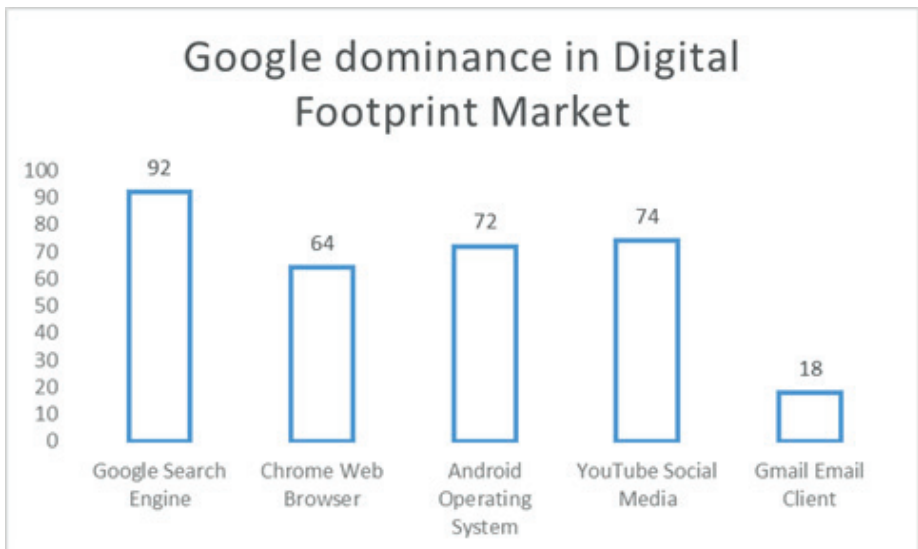


However, the rise of smartphone devices in 2007 opened a new marketplace (Callaham 2021). That was about the time when the shift in use started. Online users increasingly started accessing the internet through their smartphones. The response to that new trend was developing an operating system for smartphones. The new product was called Android and it enabled Google to collect data from people on their activity even while being offline. The popularity of the new smartphone operating system skyrocketed as it offered free services with lots of useful apps. The stats for the usage of mobile phone operating systems places Android firmly in first position with 72.2% percent of users as opposed to Apple's iOS with 26.99 percent (TechRepublic).

When users are connected to the Internet, Android uploads their complete activity while they are offline, including data on locations and use of different apps (Callaham 2021). The new platforms are actually built for dual reasons, both to get another source of information from users and expose users to ads distributed through the Google Ads platform. As noted before, these new platforms and apps such as Docs and Maps are free services in terms of monetary compensation, but instead they are billed through data gathered from users. The business idea is to generate revenue through interaction with machines or, in other words, through surveillance business models (Harrington 2019). The biggest tech companies which run on that business model actually sell their users in a symbolic way.

According to previously presented information, Figure 2.0 summarizes areas in which Google (now Alphabet) is one of the global leaders.

Figure 2.0. Percent of global market in various domains. Stats of Google's dominance in the world of Digital Footprint for 2021 (StatCounter 2022; Obrelo 2021; TechRepublic; Pew 2019; Petrov 2022)





## The Power of Recommender Algorithms

### *General Insight*

The flow of data from users to the tech companies is legal because it is regulated by terms and agreements accepted by online users (Steinfeld 2016). In fact, everybody is more or less aware that every online search is used by advertising platforms. A similar situation is when online users accept cookie notifications when accessing websites. They do it in a routine manner, as reading all these notifications would take a lot of time. Accepting cookie notifications would also give lots of information to ads platforms as 3<sup>rd</sup> parties that buy them from websites.

Recommender algorithms are used in the process of collecting, processing data and getting back outputs to online users on an individual level. The bottom point may not be only about selling information to advertisers or using it on advertising platforms. The algorithms decide what people are exposed to and therefore they have an immense power over our lives. The thing is not only about advertising but more importantly other content that is being recommended. Thanks to this, people, communities, groups and even individuals can be nudged, controlled and steered towards the direction in which tech companies want them to go. A common example may be providing similar content that confirms the worldview of online users, which results in polarizations, echo chambers, decrease in democratic capacity and populism, all instances that are being seen across the world in the last decade (Bojic, Zanic, and Zikic 2021).

A common person would not think about various types of content that are being recommended except advertising. Exactly these types of content could affect our lives both in individual and group terms. The decision which information should be presented to online users depends on algorithmic calculation in each individual case. For example if one gives some input, such as a search query, then the algorithm will make a decision on what results should be presented. This is just one-way algorithms are used. There are many cases in which recommender algorithms make decisions about the ranking of content that is being presented.

Social media trending pages constitute one of the prominent examples, as this is similar to mass media choosing the topics and content we consume. Previously in the case of mass media the content was the same for everyone. People were exposed to similar news on all media, the ones chosen by editors and basically media owners. Now we have individual content for each and every one of us served by algorithms. They shape the thoughts and feelings of billions of people.

Almost everyone on earth is somehow exposed to the influence of recommender algorithms. This shows the magnitude of their impact. Even if some people don't use mobile phones and gadgets, they are exposed, because the majority of the world's citizens are exposed to recommender algorithm content through some device connected to the internet. There were 4.66 billion active

internet users worldwide last year, which was 59.5 percent of the global population (Johnson, 2021).

The ethical presuppositions and flaws of developers are built into the algorithms that sift data to confront billions of people with different choices and expose them to different content. It is astonishing to think that a small number of people who work in leading tech companies actually steer the whole world through their algorithms without anyone knowing about this.

Thoughts, temptations, choices, information, emotions and many other segments of human lives are actually decided and sorted by these algorithms. The choice is made among enormous quantities of data to compress these into dozens of lines offered as an answer to someone's online search. Basically from one complex environment the result narrows down to one or few pages of results.

Simplifying the world for online users may be one of the important roles of the recommender algorithm. Of course, this is a normal and desired outcome for every individual using search engines or social media, to get all possibilities sifted, to make decisions based on this and possibly take action. This is similar to what the human cognitive apparatus does, just that instead of direct reality a person is faced with a mediated one. In other words, algorithms are our eyes and ears while using online devices.

The challenge is the criteria under which algorithms, as giant perceptual machines, operate between people and the complex world around them. Do we get the best answers to the questions directed towards social media or search engines? The algorithms do filtering, which means selecting a certain number of units as a relevant answer to one's question. Also, algorithms do ranking of units, so that some of them are put first ahead of others. This means the algorithm is biased, which is exactly how it must be and what users want. Nevertheless, having the power to curate which links and content people see is a groundbreaking influence on the world. The online systems are denying or approving access to information before online users see anything or have a chance to think about what is behind the algorithms.

A parallel can be drawn between recommender algorithms and all reaching unconscious from which people get thoughts and ideas (Possati 2020). It is just that this unconscious mind directs the whole world towards the interests of tech companies that own and operate it, to the interests of its creators. Based on what is known so far, recommender algorithms create bubbles around their users based on their interests or categories, which are then used as a base for content that is served to them individually. That is how algorithms give everyone similar content that a person likes to consume (Bojic, Zaric, and Zikic 2021).

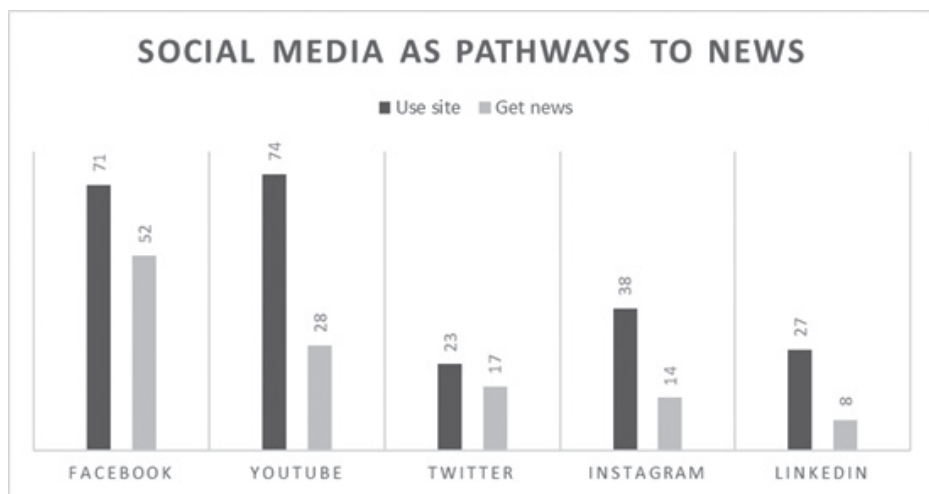
If that is the basic principle that the recommender algorithms operate on, then it means they narrow our worlds making them unrealistically the same. The whole reality is created around online users, to reality which is subjective and does not provide space for new things and ideas. This makes online users extend

their use which would ultimately generate most revenue for the tech company whose platform is being used. If a person repeatedly gets what they want to see or hear, then this can possibly lead to an addiction (Bojic 2022). Online users see what they know, while new ideas and knowledge are hidden from them.

### *News Consumption and Recommender Algorithms*

Information presented by media companies either directly or through social media is not fact checked in most cases. One study finds that 90 percent of Americans don't fact check on their own news they consume on social media (Brown 2017). That means citizens tend to believe what they see online, but they accept it only if it fits into their worldview because of confirmation bias (Nickerson 1998). Knowing that social media have become the primary source of news and information for citizens in many countries may be crucial to stimulating discussion about the importance of recommender algorithms. According to Pew Research Center, in 2019 52% of all U.S. adults got their news through Facebook (Pew 2019). Other social media have been used as well for the same purpose as a pathway to news content, which is presented in Figure 3.0. The consequences of such an impact could depend on how algorithms are set, but also if what comes out from the algorithms is manually altered. The tech companies could virtually bias everything that is presented to their users, so that a certain political candidate or issue would get promoted without anyone noticing this.

Figure 3.0. Percentage of U.S. adults who use social media to get news in 2019 (Pew 2019)



The polarizing echo chamber algorithm fits well with manipulations in politics, populist leaders and conspiracy theorists. There have been multiple reports that populist leaders and movements, such as Trump in the U.S. and the Brexit campaign in the U.K. have been successfully using social media to their benefit, because algorithms have been favoring emotional content (Cadwalladr 2017). Also, negative emotions are spread easily in the online sphere, which has potentially led to much public unrest across the world labeled as colored revolutions (Haring and Cecire 2013). The algorithms also fit well with bot and fake news attacks from foreign countries. One such attempt has been registered during the U.S. elections (Paul 2020). Fake commenting attacks by live or algorithmic bots have been registered in many countries with populist leaders in power (Pavlovic and Bojic 2020). Finally, different socially important issues, such as elections or pandemics have been polarizing agents in societies across the world (Cinelli et al. 2021).

The problematic issue comes to the surface not only because of how the algorithms are set, but also because tech companies sometimes artificially intervene to change the „organic” results that show up in trending sections. In one of the examples for this Michael Nunez writes for the tech magazine Gizmodo, „Facebook workers routinely suppressed news stories of interest to conservative readers from the social network’s influential „trending” news section” and adds, „In other words, Facebook’s news section operates like a traditional newsroom, reflecting the biases of its workers and the institutional imperatives of the corporation.” (Nunez 2016). The trending section is the outcome of the algorithm, which means its segments appear organically, while curators have the role to write descriptions for them. The trending section dictates what news stories are seen by Facebook users at any given moment.

### *Why Fake News Are Not as Important*

Fake news can be seen. They are not hidden. Actually, misinformation has existed since the beginnings of journalism, much earlier than the invention of the internet (Frenda, Nichols and Loftus 2011). It is nothing new. People are misled by the war on misinformation as they often neglect the fact that social media choose what online users see. Campaigns against fake news appear to be deceptive, to turn away public focus from algorithms and the social media that control them.

Mass media speak all the time about how dangerous fake news is, and also how companies like Cambridge Analytica take online users’ data to manipulate them. What remains in the shadows is what appears to be a really important issue for societies across the globe – how social media that control recommender

algorithms manipulate online citizens. Fake news and Cambridge Analytica are not really issues, or at least not nearly as important as potential algorithmic manipulation that opens up the following questions: how algorithms are set, who controls them and how they affect online citizens.

Confirmation bias is the tendency of people to believe information that confirms their existing opinions and that fits into their worldview (Nickerson 1998). This is a powerful social rule that explains why polarizations of societies are created through the influence of recommender algorithms that pair posts, ads, information and news with social media users. In other words, this means that stories that don't fit into the existing worldview of online citizens will be dismissed, which is exactly the reason why fake news couldn't be effective on those individuals with different opinions.

Fake news doesn't change people's opinion. It just supports opinions and beliefs that people already have. If recommender algorithms stop spreading fake news or if a percentage of alternative content is introduced to people's feeds that would make a difference. Stopping the spread of fake news would be easy, as it all uses similar sensationalistic and emotional language that is easily recognized by recommender algorithms. On the other hand, a percentage of alternative content would introduce a realistic note to the content that is being served online, as people in direct reality are faced with different kinds of experiences that don't necessarily interest them. This could be beneficial for tech companies that run the noted algorithms as some research has shown that key to successful mediated communication in the tech sphere is actually in making it as realistic as possible (Bojic 2022).

### *Analysis of the Personal Digital Footprint*

Recommender algorithms base their work on data, often referred to as digital footprints left on social media and while using any online apps and websites (Hinds and Joinson 2019). Digital footprints are a pretty much novel source of user generated data, which is automatically collected (Settanni, Azucar and Marengo 2018, 217). Based on the digital footprint, computers are able to create the digital identity of any person (Deeva 2019 185). One of the outputs of the digital footprint may be personality judgment (Settanni, Azucar and Marengo 2018, 217), based on multiple pieces of data combined (Risso 2018, 77). Demographics, likes, activity stats, expressed language and multimedia published by a user all help algorithms make strong judgements on many points of interest, including personality traits (Farnadi et al. 2016, 113). It is suggested that algorithms are better at predicting personality than humans (Azucar, Marengo and Settanni 2018, 150), as the tests show using digital footprints is in line

with traditional methods, such as surveys conducted in studies of individual differences. For example, as regards determination of the Big Five personality traits, correlations between digital footprints and personality traits are .29 for Agreeableness and .40 for Extraversion (Azucar, Marengo, and Settanni 2018, 150). Accuracy improves when multiple types of digital footprints from various sources are used (Skowron et al. 2016, 108). Digital footprints even reveal many things unrelated to personality traits, such as political opinions, addictions and health issues (Youyou, Kosinski and Stillwell 2015, 1039). There are various ways in which algorithms can make accurate judgments on the personality of online citizens. Some of them include analyzing comments and links that people share (Yamada, Sasano and Takeda 2019, 177–182).

Potentially, one of the reactions from tech companies to Frances Haugen's statement (Perrigo 2021) came in the form of a possibility for users of social media platforms to customize their privacy settings. For example, the new approach exercised by Google enables its users to set whether to personalize ads or not. One can change the settings and even delete all conclusions about personal interests that the algorithm made previously. This possibility was made public on Privacy Day, 28th January in 2022 when Google offered each user a review of their privacy settings and individual choices (AdSettings 2022).

The selected conclusions about the demographics of this article's author are listed as follows: Age: 35–44 years old; Gender: Male; Language: English and 3 more; Marital Status: Married; Parental Status: Not A Parent; Education Status: Advanced Degree; Company Size: Large Employer (250–10k Employees); Homeownership Status: Homeowners; Serbia; Job Industry: 2 factors (health-care industry and technology industry).

Although accurate, it appeared interesting to see such conclusions, as some of these have not been provided by the author, for example: language, marital status, parental status, education status, company size, homeownership status and job industry.

When each of these conclusions are clicked on by the author, a pop up window appears with a similar statement: Google estimates this demographic because your signed in activity on Google services, and on other websites and apps, is similar to people who've told Google they're in these categories.

Other conclusions include more than 150 interests out of which some are general, such as Autos & Vehicles, specific, such as Auto Interior, Auto Exterior, Auto Insurance, Vehicle Wheels & Tires, Vans & SUVs and Crossovers and more detailed ones including concrete brands: Citroën, Kia, Hyundai, Mitsubishi Land Rover, Land Rover and Peugeot.

Just one line of interests is provided here for illustration, although there are many lines of interests presented in the Ad Personalization report with the op-

tion to turn it off. It may be interesting that one tourist destination was listed in the report, Kerala in southern India, although the author does not remember searching for it online. However, the same explanation was provided for this list in the Ad Personalization report, namely, that it was an estimate based on interest, expressed through activity on Google services (such as Search or YouTube) while the author was signed in. Of course, it is reasonable to conclude that all listed interests change, as ads are personalized in real time based on search and other parts of the digital footprint left by online users.

On the other hand, Webchoices: Digital Advertising Alliance's Consumer Choice Tool For Web lists which tech companies use data about the online activity of any browser to deliver personalized ads. To cite from their website:

„The Digital Advertising Alliance (DAA) is an independent not-for-profit organization which establishes and enforces responsible privacy practices for relevant digital advertising, while giving consumers information and control over the types of digital advertising they receive” (AdChoices 2022).

In the case of this article's author there are numerous companies listed with the same explanation: cookies are being used to customize ads for this browser. There were 84 companies using cookies of the author's browser, 36 companies not using cookies of the author's browser and 5 companies whose status could not be confirmed in relation to the author's browser at the time of checking on 28th January 2022. This makes the total of 125 companies participating in the Digital Advertising Alliance at that time. It is unknown however how many companies do the same thing while not participating in the Digital Advertising Alliance.

Just to illustrate, companies using cookies of the author's browser that were listed through a check on <https://optout.aboutads.info/> were Google Inc., LinkedIn, Microsoft, Twitter, Yahoo, Amazon Ad System, 33Across, AcuityAds, Adbrain, AddThis, Adelphic, Adform, Adobe Marketing Cloud – Advertising Services, Amobee, AppNexus, Audiencerate, Beeswax, Branch, Bombora, Cadent, Carbon RMP (formerly Clicksco), Choozle, Connexity, Cognitiv, Conversant, Criteo, Demandbase, eBay, Experian, Eyeota, Flashtalking, FreeWheel, GumGum, IHS Markit Digital, Index Exchange, Innovid, Inuvo, Kargo Global, Knorex, LiveRamp, LKQD Technologies, Lotame, Magnite, MediaMath, Merkle, MiQ, mPlatform, Nativo, Neustar/Aggregate Knowledge, OpenX, Oracle Advertising, Outbrain, OwnerIQ, PubMatic, Quantcast, Rakuten Marketing, Responsys, Retargetly, Roku's Advertising Services, Salesforce Audience Studio, Samba.TV, Semasio, ShareThis, Simplifi, Sizmek, Sonobi, Sovrn, Taboola, Tapad, The Nielsen Marketing Cloud, The Trade Desk, Throttle, TI Health, Triplelift, Undertone, Unruly Group LLC., UNTU, V12 Group, Valassis, VDX.tv, Veeva Crossix, Vibrant Media, Xaxis, Yieldmo and Zeta Global.



## Conclusions

To sum up, all the issues related to the social context of recommender algorithms are presented in brief, followed up with a recapitulation of broad concerns and questions that arise from the previous analysis. Finally, our major conclusions are presented, as well as ideas for further research and the limitations of this inquiry.

The issue of recommender algorithms transcends fake news as the main question for social and individual wellbeing may be in stories, posts and information that people don't see. Actually, there is a whole universe of new thoughts, ideas and concepts that remains outside the sight of online citizens just because that content is not promoted by the recommender algorithm. This is different to direct reality because one must notice at least with a blink of an eye what happens around. These things are not always desired to be seen but they constitute what we call reality. The current situation is as follows: the majority of citizens whose opinions, beliefs, attitudes, political and economic decisions are directed by invisible recommender algorithms, which are set by tech companies without either the knowledge of or control by societies. The real issue is the fact that societies don't know anything about these algorithms, as if they are secret. Even if we presume that tech companies don't suppress stories, which would be hard to believe, online citizens don't have an idea how and why they are steered by algorithms towards some topics. That is the essential deception that is going on. Fake news may be a concept that tech companies want the public to focus on and to examine as an issue, while neglecting the real one.

Our digital profiles, otherwise called digital footprints, are detailed patterns of our online and offline behavior. They are granular segments of long- and short-term inputs that form our complex online identities.

Although regulated by different laws and regulations, tech companies easily get their users' consent to various Terms, Conditions and similar documents. In this process online citizens, who constitute most of the world population, have become „goods of tech companies”. People accept to be analyzed by clicking „Accept”, not only to Terms and Conditions of major platforms such as Google, but also to privacy notices on almost every website they visit. It looks as if the regulations are made for the interests of tech companies and not the interests of citizens. This kind of game has been forced on the tech companies as nobody would use their basic services if they cost something. The only solution was to get their user's data in exchange, so that tech companies would survive in the world of business. This makes the situation clear and absolves tech companies of blame, as the profit motive forces them to do what they do.

People use online services extensively to get information, search terms and express themselves in various ways. It would be impossible to expect online

citizens to really notice or be aware how what is presented to them would impact their lives. Online users also tend to accept cookie notifications when accessing some websites without thinking about this at all (Steinfeld 2016). Survey results have shown that almost 32 percent of respondents in the U.S. agree to all cookie notifications when accessing a website (Statista 2021). Also, younger individuals from 25 to 34 years of age tend to accept cookie notifications more than older groups from 45 to 54 (Statista 2021).

Some anecdotal evidence even warns that social media companies may listen to people while they are online through the microphones on mobile devices that they use. This claim has been denied by reps of tech companies.

„The truth is, Facebook tracks us in ways many of us don't even realize and is so good at it, we think it's monitoring our conversations. Instead, it uses sophisticated demographic and location data to serve up ads. It's like they're stalking you. They put all sorts of circumstantial evidence together, and you're marketed to as if they're listening to your conversations”, says Jamie Court, the president of the Los Angeles-based Consumer Watchdog nonprofit (Graham 2022). This however points towards another potentially much more problematic issue: potential advancements of AI that people are not aware of.

The issue is that our societies don't know much about the algorithms, as they are controlled by tech companies. The question is what tech companies know about them, except the input data that are private by definition and too big at the same time so they cannot be perceived by any human being. However, the companies might know how they direct the algorithms or how they are set to operate, or at least their goals. We may just imagine that the primary goal of advertising algorithms may be to sell products, while the primary goal of social algorithms may be to keep people using their services as much as possible in the long term, so they would be exposed to ads.

The power of tech companies is evident. For example, they can cancel our online identities, like they did with the Twitter profile of Donald Trump. They can control the whole media industry, a power that they demonstrated in their clash with Australia, when Google and Facebook came out as winners to decide how to finance media in that country (Bojic, Zejnulahovic and Jankovic 2021). Thus, the tendency of the contemporary world towards techno feudalism is clear if one looks at it just from the perspective of tech companies and their growing power in a globalized tech driven society. However, the power of algorithms may be surpassing the power of tech companies at some point, and it should be looked at independently because we do not know to what extent tech companies can control algorithms based on artificial intelligence, as they have their „Black Boxes”, so we cannot know exactly why they make decisions.

According to the analyzed literature, as an answer to the first research question (RQ1), we conclude that recommender algorithms constitute an unprece-

mented social force in human history as they impact virtually all Internet users in a direct way by exposing them to ads and other content on an individual level, but also at the same time affecting those who don't use the Internet in an indirect way. More precisely, the stories and topics that are spread through recommender algorithms also impact individuals who don't use the Internet through conversations and other forms of contact between people.

The most impactful recommender algorithms are social media algorithms that choose content that is being presented individually to users on social media, both in feeds on homepages that showcase posts and updates from friends and connections and on other pages as well, such as: trending content that includes news and ads; search engine algorithms such as Page Rank that determine which links to showcase first as a response to search queries, which is also done on an individual level; and, finally, Ads Algorithms which decide which ads should be shown to which users, based on their digital footprints.

When fragmenting the power of recommender algorithms there are two aspects: how they are set by tech companies that control them, and machine learning algorithms themselves which are left with the power to make independent decisions on how to achieve previously set goals. Although algorithms are made by software developers and are thus significantly influenced by their creators, these pieces of code work on their own based on a high number of small correlations which means no human being can understand why exactly they make some decisions. They are in some way unpredictable, since they are based on artificial intelligence. Thus, we may conclude that the most powerful global force is actually controlled by both tech companies and AI, as such. The existence of the „black box”, which is an essential part of AI-based recommender algorithms, leads us to conclude that AI already has extensive influence in all societies around the globe.

The important question may be how much algorithms shape our lives and predict the future of our needs and wants. This goes beyond just acting on the information of our searches and offering ads and content. What if algorithms know what we would like to purchase or consume next? This is the scary thing about algorithms, their potential capability to predict our future needs and wants, individually and as a group.

This inquiry has explained why recommender algorithms are in fact essentially important for societies as they constitute „an unprecedented social force” that is greater than mass media ever used to be, as they expose online users to individualized content, assisting them in all aspects of their lives, not just in news and entertainment.

The limitation of this inquiry is a lack of quantitative data analysis. Although there are many facts and data presented and reviewed in a detailed manner, only broad questions are covered as a pathway to more specific scientific approaches.

Based on the above noted premises, future research should focus on: (1) establishing and validating empirical methods based on which online echo chambers can be discovered, qualified and monitored (their appearance, lifespan and disappearance); (2) experimenting on how much algorithms can predict our needs and wants and how much they can affect our future as individuals and groups; (3) analyzing digital footprints from a number of respondents to make quantitative based conclusions about them and conduct various correlations related to the matter.

## References

- AdChoices. 2022. "Frequently Asked Questions about the Digital Advertising Alliance and Its Consumer Choice Tools: WebChoices, AppChoices and YourAdChoices." *YourAdChoices*. Accessed January 19, 2022. <https://youradchoices.com/choices-faq>.
- AdSettings. 2022. "Ad personalization." *Google*. Accessed January 1, 2022. <https://adsettings.google.com/>.
- Ali, Khawla F, Simon Whitebridge, Mohammad H Jamal, Mohammad Alsafy, and Stephen L Atkin. 2020. "Perceptions, knowledge, and behaviors related to COVID-19 among social media users: Cross-sectional study." *Journal of medical Internet research* 22 (9): e19913. <https://dx.doi.org/10.2196%2F19913>.
- Azucar, Danny, Davide Marengo, and Michele Settanni. 2018. "Predicting the Big 5 personality traits from digital footprints on social media: A meta-analysis." *Personality and Individual Differences* 124: 150–159. <https://doi.org/10.1037/a0030383>.
- Baumeister, Roy F., Ellen Bratslavsky, Catrin Finkenauer, and Kathleen D. Vohs. 2001. "Bad Is Stronger than Good." *Review of General Psychology* 5 (4): 323–70. <https://doi.org/10.1037/1089-2680.5.4.323>.
- Bojic, Ljubisa. 2021. "How Media Directly Impact Society: A Psychometric Analysis of Leading Twitter News Profiles and their Followers in Serbia." In *Romina Surugiu, Adriana Stefanel, Nicoleta Apostol (eds.), 30 de ani de învățământ jurnalistic și de comunicare în Estul Europei/30 Years of Higher Education in Journalism and Communication in Eastern Europe*, 483–504. Bucharest: Tritonic. <https://rifdt.institfdt.bg.ac.rs/handle/123456789/2365>.
- Bojic, Ljubisa, Damir Zejnulahovic, and Milos Jankovic. 2021. „Tehno-feudalizam na primerima Trampove suspenzije sa Tvitera i spora Australije sa Guglom i Fejsbukom.” *Sociološki pregled* 55 (2): 538–561. <https://doi.org/10.5937/socpreg55-32105>
- Bojic, Ljubisa, Maja Zaric, and Simona Zikic. 2021. "Worrying impact of artificial intelligence and big data through the prism of recommender systems." *Issues in Ethnology and Anthropology* 16 (3): 935–957. <https://doi.org/10.21301/eap.v16i3.13>.
- Bojic, Ljubisa. 2022. *Culture Organism or Techno-Feudalism: How Growing Addictions and Artificial Intelligence Shape Contemporary Society*. Belgrade: Institute for Philosophy and Social Theory.
- Bojic, Ljubisa, Nemanja Nikolic, and Lana Tucakovic. 2022. "Wars of Echo Chambers: Analysis of Covid-19 Echo Chambers in Serbia." *Communications* 48 (2).

- Brown, Eileen. 2017. "9 out of 10 Americans don't fact-check information they read on social media." *ZdNet*. Accessed December 1, 2021. <https://www.zdnet.com/article/nine-out-of-ten-americans-dont-fact-check-information-they-read-on-social-media/>.
- Cadwalladr, Carole. 2017. "The great British Brexit robbery: How our democracy was hijacked." *The Guardian*. Accessed January 18, 2022. <https://www.theguardian.com/technology/2017/may/07/the-great-british-brexite-robbery-hijacked-democracy>.
- Callahan, John. 2021. "The history of Android: The evolution of the biggest mobile OS in the world." *Android Authority*. Accessed January 18, 2022. <https://www.androidauthority.com/history-android-os-name-789433/>.
- Cinelli, Matteo, Gianmarco De Francisci Morales, Alessandro Galeazzi, Walter Quattrociocchi, and Michele Starnini. 2021. "The echo chamber effect on social media." *Proceedings of the National Academy of Sciences* 118 (9). <https://doi.org/10.1073/pnas.2023301118>.
- Conway-Silva, Bethany A., Christine R. Filer, Kate Kenski, and Eric Tsetsi. 2018. "Reassessing Twitter's Agenda-Building Power: An Analysis of Intermedia Agenda-Setting Effects During the 2016 Presidential Primary Season." *Social Science Computer Review* 36 (4): 469–83. <https://doi.org/10.1177/0894439317715430>.
- Coviello, Lorenzo, James H. Fowler, and Massimo Franceschetti. 2014. "Words on the web: Noninvasive detection of emotional contagion in online social networks." *Proceedings of the IEEE* 102 (12): 1911–1921. <https://doi.org/10.1109/jproc.2014.2366052>.
- Dang-Xuan, Linh, and Stefan Stieglitz. 2021. "Impact and Diffusion of Sentiment in Political Communication – An Empirical Analysis of Political Weblogs." *Proceedings of the International AAAI Conference on Web and Social Media* 6 (1): 427–30. <https://ojs.aaai.org/index.php/ICWSM/article/view/14326>.
- Deeva, Irina. 2019. "Computational Personality Prediction Based on Digital Footprint of A Social Media User." *Procedia Computer Science* 156: 185–193. <https://doi.org/10.1016/j.procs.2019.08.194>.
- Derks, Daantje, Agneta H. Fischer, and Arjan E. R. Bosc. 2008. "The role of emotion in computer-mediated communication: A review." *Computers in Human Behavior* 24 (3): 766–785. <https://doi.org/10.1016/j.chb.2007.04.004>.
- Doyle, Evan, and Young Lee. 2016. "Context, context, context: Priming theory and attitudes towards corporations in social media." *Public Relations Review* 42 (5): 913–919. <http://dx.doi.org/10.1016%2Fj.pubrev.2016.09.005>.
- Farnadi, Golnoosh, Geetha Sitaraman, Shanu Sushmita, Fabio Celli, Michal Kosinski, David Stillwell, Sergio Davalos, Marie-Francine Moens, and Martine De Cock. 2016. "Computational personality recognition in social media." *User Modeling and User-Adapted Interaction* 26 (2): 109–142. <https://doi.org/10.1007/s11257-016-9171-0>.
- Feezell, Jessica T. 2018. "Agenda Setting through Social Media: The Importance of Incidental News Exposure and Social Filtering in the Digital Era." *Political Research Quarterly* 71 (2): 482–94. <https://doi.org/10.1177/1065912917744895>.
- Ferrara, Emilio, and Zeyao Yang. 2015. "Measuring emotional contagion in social media." *Plos One* 10 (11): e0142390. <https://doi.org/10.1371/journal.pone.0142390>.

- Frenda, Steven J., Rebecca M. Nichols, and Elizabeth F. Loftus. 2011. "Current Issues and Advances in Misinformation Research." *Current Directions in Psychological Science* 20 (1): 20–23. <https://doi.org/10.1177/0963721410396620>.
- Garimella, Kiran, Gianmarco De Francisci Morales, Aristides Gionis, and Michael Mathioudakis. 2018. "Political discourse on social media: Echo chambers, gatekeepers, and the price of bipartisanship." In *Proceedings of the 2018 World Wide Web Conference*, Geneva, Switzerland: International World Wide Web Conferences Steering Committee. <https://arxiv.org/abs/1801.01665>.
- Gates, Bill. 1995. *The Road Ahead*. New York: Viking Press. <https://www.amazon.com/Road-Ahead-Bill-Gates/dp/0670859133>.
- Georgiev, Deyan. 2022. "111+ Google Statistics and Facts That Reveal Everything About the Tech Giant." *Review42*. Accessed January 18, 2022. <https://review42.com/resources/google-statistics-and-facts/>.
- Google. 2022. *Google*. <https://www.google.com/>.
- Gray, Catherine. 2021. "How Google became the world's most popular search engine." *Technology Magazine*. Accessed December 11, 2021. <https://technologymagazine.com/digital-transformation/how-google-became-worlds-most-popular-search-engine>.
- Greving, Hannah, Aileen Oeberst, Joachim Kimmerle, and Ulrike Cress. 2018. "Emotional Content in Wikipedia Articles on Negative Man-Made and Nature-Made Events." *Journal of Language and Social Psychology* 37 (3): 267–87. <https://doi.org/10.1177/0261927X17717568>.
- Graham, Jefferson. 2022. "Is Facebook listening to me? Why those ads appear after you talk about things." *USA Today*. Accessed January 18, 2022. <https://www.usatoday.com/story/tech/talkingtech/2019/06/27/does-facebook-listen-to-your-conversations/1478468001/>.
- Haring, Melinda, and Michael Cecire. 2013. "Why the Color Revolutions Failed." *Foreign Policy*. Accessed January 18, 2022. <https://foreignpolicy.com/2013/03/18/why-the-color-revolutions-failed/>.
- Harrington, Kent M. 2019. "Surveillance Is the Business Model of the Internet. What's Coming Next?" *MediaVillage*. Accessed January 18, 2022. <https://www.media-village.com/article/surveillance-is-the-business-model-of-the-internet-whats-coming-next/>.
- Hatfield, Elaine, John T. Cacioppo, and Richard L. Rapson. 1993. *Emotional Contagion. (Studies in Emotion and Social Interaction)*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9781139174138>.
- Hinds, Joanne, and Adam Joinson. 2019. "Human and computer personality prediction from digital footprints." *Current Directions in Psychological Science* 28 (2): 204–211. <https://doi.org/10.1177/0963721419827849>.
- Hsieh, Hsiu-Fang, and Sarah E Shannon. 2005. "Three approaches to qualitative content analysis." *Qualitative Health Research* 15 (9): 1277–1288. <https://doi.org/10.1177/1049732305276687>.
- Isaacson, Walter. 2011. *Steve Jobs: The Exclusive Biography*. New York: Simon & Schuster. [https://www.goodreads.com/book/show/1081637.The\\_Road\\_Ahead](https://www.goodreads.com/book/show/1081637.The_Road_Ahead).
- Jobs, Steve. 2010. "Steve Jobs Introducing The iPhone At MacWorld 2007." Accessed December 1, 2021. YouTube. <https://www.youtube.com/watch?v=x7qPAY9JqE4>



- Johnson, Joseph. 2021. "Worldwide digital population as of January 2021." *Statista*. Accessed December 1, 2021. <https://www.statista.com/statistics/617136/digital-population-worldwide/>.
- Kalsnes, Bente, and Anders Olof Larsson. 2017. "Understanding news sharing across social media." *Journalism Studies* 19 (11): 1669–1688. <https://doi.org/10.1080/1461670x.2017.1297686>.
- Kaplan, Andreas, and Michael Haenlein. 2010. "Users of the world, unite! The challenges and opportunities of social media." *Business Horizons* 53 (1): 59–68. <https://doi.org/10.1016/j.bushor.2009.09.003>
- Lamberti, Fabrizio, Andrea Sanna, and Claudio Demartini. 2009. "A Relation-Based Page Rank Algorithm for Semantic Web Search Engines." *IEEE Transactions on Knowledge and Data Engineering* 21 (1): 123–136. <https://doi.org/10.1109/TKDE.2008.113>.
- Li, Heidi Oi-Yee Li, Adrian Bailey, David Huynh, James Chan. 2020. "YouTube as a source of information on COVID-19: a pandemic of misinformation?" *BMJ Global Health* 5 (5): e002604. <https://doi.org/10.1136/bmjgh-2020-002604>.
- Liebrecht, Christine, Letticia Hustinx, and Margot van Mulken. (2019). "The Relative Power of Negativity: The Influence of Language Intensity on Perceived Strength." *Journal of Language and Social Psychology* 38 (2): 170–93. <https://doi.org/10.1177/0261927X18808562>.
- Mission. 2022. "Our Approach to Search." *Google*. Accessed January 1, 2022. <https://www.google.com/search/howsearchworks/mission/>.
- Murugesan, San. (2007). "Understanding Web 2.0." *IT Professional* 9 (4): 34–41. <https://doi.org/10.1109/MITP.2007.78>.
- Newman, Nic, Richard Fletcher, Anne Schulz, Simge Andi, Craig T. Robertson, and Rasmus Kleis Nielsen. 2021. "Reuters Institute Digital News Report 2021." *Reuters Institute for the Study of Journalism*. Accessed December 1, 2021. [https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2021-06/Digital\\_News\\_Report\\_2021\\_FINAL.pdf](https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2021-06/Digital_News_Report_2021_FINAL.pdf).
- Nickerson, Raymond S. 1998. "Confirmation Bias: A Ubiquitous Phenomenon in Many Guises." *Review of General Psychology* 2 (2): 175–220. <https://doi.org/10.1037/1089-2680.2.2.175>.
- Nunez, Michael. 2016. "Former Facebook Workers: We Routinely Suppressed Conservative News." *Gizmodo*. Accessed December 1, 2021. <https://gizmodo.com/former-facebook-workers-we-routinely-suppressed-conser-1775461006>.
- Obrelo. 2021. "Most Popular Web Browsers in 2021." *Obrelo*. Accessed December 1, 2021. <https://www.oberlo.com/statistics/browser-market-share>.
- Park, Sup Park. 2015. "Applying "negativity bias" to Twitter: Negative news on Twitter, emotions, and political learning." *Journal of Information Technology & Politics* 12 (4): 342–359. <https://doi.org/10.1080/19331681.2015.1100225>.
- Paul, Kari. 2020. "Russian hackers targeting US political campaigns ahead of elections, Microsoft warns." *The Guardian*. Accessed December 1, 2021. <https://www.theguardian.com/technology/2020/sep/10/microsoft-russia-us-election-2020-hackers>.
- Pavlovic, Maja, and Ljubisa Bojic. 2020. "Political marketing and strategies of digital illusions – examples from Venezuela and Brazil." *Sociološki pregled* 54 (4): 1391–1414. <https://doi.org/10.5937/socpreg54-27846>.



- Perrigo, Billy. 2021. "Inside Frances Haugen's Decision to Take on Facebook." *Time*. Accessed November 22, 2021. <https://time.com/6121931/frances-haugen-facebook-whistleblower-profile/>.
- Petrov, Christo. 2022. "52 Gmail Statistics To Show How Big It Is In 2021." *TechJury*. Accessed January 5, 2022. <https://techjury.net/blog/gmail-statistics/#gref>
- Pew. 2019. "Americans Are Wary of the Role Social Media Sites Play in Delivering the News." *Pew Research Center*. Accessed December 1, 2021. [https://www.journalism.org/wp-content/uploads/sites/8/2019/09/PJ\\_2019.09.25\\_Social-Media-and-News\\_FINAL.pdf](https://www.journalism.org/wp-content/uploads/sites/8/2019/09/PJ_2019.09.25_Social-Media-and-News_FINAL.pdf).
- Philippe Maarek. 2014. "Politics 2.0: New forms of digital political marketing and political communication." *Tripodos* 34: 13–22. [http://www.tripodos.com/index.php/Facultat\\_Comicunicacio\\_Blanquerna/article/view/163](http://www.tripodos.com/index.php/Facultat_Comicunicacio_Blanquerna/article/view/163).
- Phillips, Sara. 2007. "A brief history of Facebook." *The Guardian*. Accessed December 1, 2021. <https://www.theguardian.com/technology/2007/jul/25/media.newmedia>.
- Possati, Luca M. 2020. "Algorithmic unconscious: why psychoanalysis helps in understanding AI." *Palgrave Communications* 6 (70). <https://doi.org/10.1057/s41599-020-0445-0>.
- Redding, Ryan. 2019. A Brief History of Google Ad Strategy (and why you should care). *DP Marketing Services*. Accessed December 1, 2021. <https://www.dpmarketing.services/a-brief-history-of-google-ad-strategy-and-why-you-should-care>.
- Richter, Felix. 2020. "The End of the TV Era?" Accessed December 1, 2021. *Statista*. <https://www.statista.com/chart/9761/daily-tv-and-internet-consumption-worldwide/>.
- Rieger, Marc Oliver, and Mei Wang. 2020. "Trust in Government Actions during the COVID-19 Crisis." *Universitat Trier*. Accessed December 1, 2021. [https://www.uni-trier.de/fileadmin/fb4/prof/BWL/FIN/Files/Trust\\_in\\_Government\\_Actions\\_during\\_the\\_COVID-19\\_Crisis.pdf](https://www.uni-trier.de/fileadmin/fb4/prof/BWL/FIN/Files/Trust_in_Government_Actions_during_the_COVID-19_Crisis.pdf).
- Risso, Linda. 2018. "Harvesting your soul? Cambridge analytica and brexit." In *Brexit Means Brexit? The Selected Proceedings of the Symposium, Akademie der Wissenschaften und der Literatur*, 75–90, Mainz, Germany: Akademie der Wissenschaften und der Literatur. [https://www.adwmainz.de/fileadmin/user\\_upload/Brexit-Symposium\\_Online-Version.pdf](https://www.adwmainz.de/fileadmin/user_upload/Brexit-Symposium_Online-Version.pdf).
- Rozin, Paul, and Edward B. Royzman. 2001. "Negativity Bias, Negativity Dominance, and Contagion." *Personality and Social Psychology Review* 5 (4): 296–320. [https://doi.org/10.1207/S15327957PSPR0504\\_2](https://doi.org/10.1207/S15327957PSPR0504_2).
- Schmidt, Ana Lucía, Zollo, Fabiana, Scala, Antonio, Betsch, Cornelia, and Quattrociochi, Walter. 2018. "Polarization of the vaccination debate on Facebook." *Vaccine* 36 (25): 3606–3612. <https://doi.org/10.1016/j.vaccine.2018.05.040>.
- Sear, Richard F., Nicolás Velásquez, Rhys Leahy, Nicholas Johnson Restrepo, Sara El Oud, Nicholas Gabriel, Yonatan Lupu, and Neil F. Johnson. 2020. "Quantifying COVID-19 content in the online health opinion war using machine learning." *IEEE Access* 8: 91886–91893. <https://doi.org/10.1109/ACCESS.2020.2993967>.
- Settanni, Michele, Danny Azucar, and Davide Marengo. 2018. "Predicting individual characteristics from digital traces on social media: A meta-analysis." *Cyberpsychology, Behavior, and Social Networking* 21 (4): 217–228. <https://doi.org/10.1089/cyber.2017.0384>.

- Skowron, Marcin, Marko Tkalčić, Bruce Ferwerda, and Markus Schedl. 2016. "Fusing social media cues: personality prediction from twitter and instagram." In *Proceedings of the 25th International Conference Companion on World Wide Web*, 107–108, Geneva, Switzerland: International World Wide Web Conferences Steering Committee. <https://doi.org/10.1145/2872518.2889368>.
- Spohr, Dominic. 2017. "Fake news and ideological polarization: Filter bubbles and selective exposure on social media." *Business Information Review* 34 (3): 150–160. <https://doi.org/10.1177/0266382117722446>.
- Steinfeld, Nili. 2016. "I agree to the terms and conditions": (How) do users read privacy policies online? An eye-tracking experiment." *Computers in Human Behavior* 55(B): 992–1000. <https://doi.org/10.1016/j.chb.2015.09.038>.
- StatCounter. 2022. "Search Engine Market Share Worldwide." *StatCounter*. Accessed December 1, 2021. <https://gs.statcounter.com/search-engine-market-share>.
- Statista. 2021. "Level of consent to cookies usage in the U.S. 2021, by age." *Statista*. Accessed December 1, 2021. <https://www.statista.com/statistics/989896/users-consent-in-advertising-tracking/>.
- Stieglitz, Stefan, and Linh Dang-Xuan. 2013. "Emotions and information diffusion in social media —Sentiment of microblogs and sharing behavior." *Journal of Management Information Systems* 29 (4): 217–248. <https://doi.org/10.2753/mis0742-1222290408>.
- TechRepublic. "Why is Android More Popular Globally While IOS Rules the US." *TechRepublic*. Accessed December 1, 2021. <https://www.techrepublic.com/article/why-is-android-more-popular-globally-while-ios-rules-the-us/>.
- Vargo, Chris J., Ekaterina Basilaia, & Donald Lewis Shaw. 2015. "Event versus issue: Twitter reflections of major news, a case study." *Communication and Information Technologies Annual*, 215–239. <https://doi.org/10.1108/s2050-20602015000009009>.
- Witteman, Holly O, Brian J Zikmund-Fisher. 2012. "The defining characteristics of Web 2.0 and their potential influence in the online vaccination debate." *Vaccine* 30 (25): 3734–3740. <https://doi.org/10.1016/j.vaccine.2011.12.039>.
- Yamada, Kosuke, Ryohei Sasano, and Koichi Takeda. 2019. "Incorporating Textual Information on User Behavior for Personality Prediction". In *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics: Student Research Workshop*, 177–182, Florence, Italy: Association for Computational Linguistics. <https://doi.org/10.18653/v1/P19-2024>.
- Youyou, Wu, Michal Kosinski, and David Stillwell. 2015. "Computer-based personality judgments are more accurate than those made by humans." *Proceedings of the National Academy of Sciences* 112 (4): 1036–1040. <https://doi.org/10.1073/pnas.1418680112>.
- Zollo, Fabiana. 2019. "Dealing with digital misinformation: A polarised context of narratives and tribes." *EFSA Journal* 17, no. S1: e170720. <http://dx.doi.org/10.2903/j.efsa.2019.e170720>.

Ljubiša Bojić

Institut za filozofiju i društvenu teoriju,  
Digitalna socijalna laboratorija, Univerzitet u Beogradu,  
ljubisa.bojic@instifdt.bg.ac.rs

Aleksandra Bulatović

Institut za filozofiju i društvenu teoriju, Univerzitet u Beogradu  
aleksandra.bulatovic@instifdt.bg.ac.rs

Simona Žikić

Fakultet za medije i komunikaciju, Singidunum Univerzitet, Beograd  
simona.zikic@fmk.edu.rs

*Strašna crna kutija: algoritmi za preporuke  
zasnovani na veštačkoj inteligenciji kao najveća društvena sila*

Algoritmi koji preporučuju sadržaj oblikuju društva tako što individualno izlažu korisnike onlajn platformi svemu što oni na njima vide, čuju i osećaju, u realnom vremenu. U radu ispituje razvoj algoritama za preporučivanje od sistema za rangiranje stranica i reklamnih platformi do alata za društvene medije, kako bismo izvukli zaključke o njihovim društvenim efektima. Odluke o tome kako da se pojednostavi kompleksan svet u kome živimo, tako što se kao odgovor na upite kreira samo mali broj preporuka za korisnika, utiču na individue ali i društva u celini. Slično kognitivnom aparatu, algoritmi su naše oči i uši u onlajn svetu, s obzirom da fokusiraju našu pažnju prema onome šta oni „misle” da je bitno, što je slično selekciji najvažnijih tema za emisiju vesti u klasičnim medijima. Zbog toga su algoritmi upoređeni sa mas medijima, jer imaju slične uloge da prodaju proizvode i produže izloženost sadržajima. Zaključak jeste da algoritmi za preporuke zasnovani na veštačkoj inteligenciji predstavljaju naj-snažniju društvenu silu u ovom momentu kojom je izložen ceo svet.

*Ključne reči:* sistemi za preporučivanje, mas mediji, društvena polarizacija, eho komore, negativne vesti

*L'effroyable boîte noire: les algorithmes de recommandation  
basés sur l'intelligence artificielle comme  
la force sociale la plus puissante*

Les algorithmes de recommandation modèlent les sociétés en exposant individuellement les utilisateurs en ligne à tout ce qu'ils voient, entendent et ressentent en temps réel. Nous examinons le développement des algorithmes de recommandation depuis des systèmes de classement des sites et des plateformes publicitaires jusqu'aux outils de tendance des réseaux sociaux pour tirer des

conclusions sur leurs effets sociaux. Les décisions concernant la simplification du monde complexe autour de nous consistant à ramener à un petit nombre les réponses aux requêtes des utilisateurs affectent immensément les sociétés et les individus. Semblablement à notre appareil cognitif, les algorithmes sont les yeux et les oreilles dans le monde en ligne, comme ils concentrent leur attention sur ce qu'ils „pensent” devoir être important, ce qui est semblable à la sélection des informations dans les médias classiques. C'est pourquoi les algorithmes de recommandation sont comparés aux médias de masse du fait de leur rôle similaire dans la vente des produits et la prolongation de l'exposition des utilisateurs à des contenus divers. Cette recherche aboutit à la conclusion que les algorithmes de recommandation basés sur l'intelligence artificielle représentent la force sociale la plus puissante de notre temps.

*Mots clés:* systèmes de recommandation, médias de masse, polarisation sociale, chambres d'écho, nouvelles négatives

Primljeno / Received: 9.02.2022

Prihvaćeno / Accepted for publication: 30.03.2022