Countering algorithmic bias and disinformation and effectively harnessing the power of AI in media

Shin, D.; Hameleers, M.; Park, Y.J.; Kim, J.N.; Trielli, D.; Diakopoulos, N.; Helberger, N.; Lewis, S.; Westlund, O.; Baumann, S.

DOI
10.1177/10776990221129245

Publication date
2022

Document Version
Final published version

Published in
Journalism & Mass Communication Quarterly

Invited Forum

Countering Algorithmic Bias and Disinformation and Effectively Harnessing the Power of AI in Media

Journalism & Mass Communication Quarterly
2022, Vol. 99(4) 887–907

DOI: 10.1177/10776990221129245
http://journals.sagepub.com/home/jmq
SAGE

Artificial intelligence (AI) is affecting the daily lives of billions of media users (Wölker & Powell, 2021). Algorithms are popular and effective tools utilized by companies online, but their popularity comes at the expense of systematic discrimination, limited transparency, and vague accountability (Möller et al., 2018). Algorithmic filtering procedures may lead to more impartial, and thus possibly fairer processes than those processed by humans. However, algorithmic recommendation processes have been criticized for their tendency to intensify/reproduce bias, distortion of facts, information asymmetry, and process opacity (Ananny & Crawford, 2018). Algorithmic bias may deteriorate algorithmic injustice that machine learning automates and perpetuates unjust and discriminatory patterns (Shin et al., 2022).

Recent algorithmic platforms have faced similar dilemmas (Shin, 2022). Although algorithmic platforms offer personalized and relevant content in innovative interactive ways, the ethical and privacy issues are complicated and intertwined with algorithmic personalization (Helberger et al., 2018). Questions regarding how to safeguard the goals, values, and personalizing processes of algorithms, to what extent users need to share personal information with algorithms, and how to balance privacy and algorithmic personalization remain controversial. Underlying these questions are concerns about how to mitigate bias and discrimination in data and the need to design algorithmic platforms that are transparent and fair (Shin, 2023). As ethical concerns have peaked with the rise of algorithmic media, the opacity of black-box algorithm processes had led to calls for studies on fairness and transparency (Dörr & Hollnbuchner, 2017).

Recent research (e.g., Shin & Park, 2019; Sandvig et al., 2016) has highlighted normative implications and problems associated with these algorithms when it comes to *fairness*, *accountability*, and *transparency*, key attributes of trustworthy algorithmic systems processing user-sensitive data (Helberger et al., 2018). This topic will be even more critical when media platforms utilize more and more sophisticated algorithms and people rely more on algorithms than social influence when making judgments. AI is becoming pervasive across all media industries and service functions. This transformation brings to the fore several key questions: How to govern these algorithms effectively and legitimately while ensuring that they are user-centered and socially responsible? How can users make sense of algorithmic fairness and how do they

construe algorithmic transparency? How do users perceive algorithm-based processes in general? As these normative concerns have given rise to calls for a better explanatory framework (Thurman et al., 2019), a number of studies have examined these concerns from various perspectives, such as a user consumption perspective (how people make sense of it in their everyday lives), journalism ethics (how journalism practices face and deal with the ethical issues), and regulatory and managerial perspective (how to govern and manage algorithmic bias effectively).

The purpose of this Invited Forum is to continue this discussion by inviting leading scholars in the area to share their views on algorithmic biases. Our forum is set to contribute to theorizing and operationalizing algorithmic media platforms that are fairer, more transparent, and more responsible. To this end, this forum aims to contribute to the understanding of algorithmic bias, leading to operational, user-centric definitions for different areas of media platforms with implications for both design/developments and sociological/ethical models. The invited essays in this forum offer theoretical insights into user information processing through clarification of algorithmic sense-making processing. The forum highlights the role of transparent fairness as part of broader considerations of ethics by design in algorithmic media.

Michael Hameleers, assistant professor at the University of Amsterdam, starts off our forum discussion and responds to the call to research algorithmic amplification. He exemplifies algorithmic amplifications with COVID-19 vaccines that skeptical citizens search for and demonstrates how their search behavior and prior exposure patterns can cultivate a restricted media environment where a disproportionate amount of conspiracies, deceptive content, and clickbait reinforce their doubt, leading to the selection of increasingly less diverse, attitude-reinforcing content. He proposes three directions for future research of algorithmic biases: (a) move beyond voluntary selective exposure and confirmation bias; (b) take a holistic approach to media effects studies; and (c) look at the longer-term and spiraling impact of algorithmic amplification. He concludes with urgent calls to design algorithmic media that are transparent and fair, which should be supplemented with educational packages and tools that offer users more control in the fight against disinformation.

Yong Jin Park, professor at Howard University, and Jeong Nam Kim, professor at the University of Oklahoma, rightly point out the dual aspect of algorithmic personalization. Personalization through AI inherently involves the consideration of privacy and amplification of built-in bias in recommended content. They argue that algorithmic personalization is a construct of deliberate choices as algorithmic platforms set up the conditions with finite choices that proximate user preferences. A profound myth to debunk is that it is possible to detect *what users want* and deliver *what they need*, as if there was the intrinsic relationship between the accuracy of the personalization and the extent of data collection—a false premise of the validity of algorithmic personalization. Park and Kim conclude that the algorithmic bias debate should start with the realistic acknowledgment that purely mathematical solutions will never reach the optimal point of fairness, highlighting algorithmic incapability to resolve complex ethical issues by having more data or statistical model choices. This algorithmic incapability is a nice segway into discussing algorithms from a socio-technical perspective.

Nick Diakopoulos and Daniel Trielli at Northwestern University approach algorithmic media as a complex socio-technical system that includes different actors whose motivations, pressures, and values influence the curation of content. They offer two lenses to analyze the interaction between actors in algorithmic media systems: power and values. These lenses enable us to look at a meaningful interpretation of curation in algorithmic media by examining not only the algorithm or the users in isolation but also the intersections in curation processes between algorithmic mediators, the actions of the users, and the availability of content provided by publishers or creators. Simply describing the actors in algorithmic media curation makes it hard to disentangle one from the other: The algorithm is shaped by the values imbued in it by designers but also by the needs of the user and the opportunities of the source media; the user shapes and responds to the algorithm in search for the available content; the available content is shaped by the needs of the user as refracted through the pressures of the algorithm as understood by the creators. Their key arguments resonate with Helberger, Lewis, and Westlund's views.

Natali Helberger, professor at the University of Amsterdam, Seth Lewis, Professor at the University of Oregon, and Oscar Westlund, professor at Oslo Metropolitan University discuss the responsibility of AI as a broader socio-technical system by conceptualizing responsibility as connected to moral and legal requirements associated with any agent in the system. Building on the four A's socio-technical framework, they approach AI as a socio-technical system that, as a key technological *actant*, intersects with social *actors* that are central to the shaping of media production as well as diverse *audiences*. These actors, actants, and audiences are interconnected through the *activities* of media work, and it's in the interactions that occur among them where a socio-technical system is made.

Sabine Baumann, professor at Jade University of Applied Sciences in Germany, challenges the existing pop-culture notions of AI technologies and investigates the human element of supposed AI failures. She notes the black box phenomenon of AI and calls for research on explainable AI so that AI enables users to appropriately understand and effectively manage the AI systems as a prerequisite of a trustworthy AI. Although Baumann proposes numerous remedial strategies for AI to be responsible and fair, she predicts that super-intelligent general AI systems will not happen any time soon. This resonates with Trielli and Diakopoulos's argument that AI cannot fully replace humans because AI judgment relies purely on trained logic while humans use empathy, imagination, and valuation. This view is also in line with Hameleers who emphasized the importance of educating news users how they can control algorithms, and how their own choices can provide more control over the techniques concerning their choices. This can be a realm of algorithmic literacy (Shin et al., 2021). All authors seem to unanimously agree that human moral responsibility and proactive user control are key factors in minimizing bias in AI technologies.

Donghee Shin
Invited Forum Editor, Zayed University

The Algorithmic Amplification of Dishonesty and Biased Realities: Challenges, Implications, and a Future Research Agenda

Disinformation has been regarded as a key threat to democracies throughout the globe (e.g., Bennett & Livingston, 2018; Dan et al., 2021; Marwick & Lewis, 2017). The phenomenal spread of deceptive information cannot be understood without taking the context of digital affordances into account (e.g., Starbird, 2019; Zhang et al., 2021). Online, citizens can easily find a version of reality that best fits their identities and beliefs. This process, however, may not fully operate in a transparent, controlled, and voluntary way: Disinformation may find susceptible recipients and augment their beliefs through algorithmic amplification. This means that existing doubts and selection patterns limit people's selection options and create an illusionary worldview of like-mindedness—legitimizing deceptive narratives, conspiracies, and untruths. In that sense, the algorithmic recommendation of deceptive content may impede learning from the other side, create an illusion of social support, and herewith reproduce (dis)information biases.

Why would this be a challenge to democracy, since algorithms and recommendation systems should offer tailor-made recommendations on journalistic products that best fit people's interests and beliefs? The problem is that algorithms create an uneven playing field without informing news users on its workings, biases, and implications (Helberger et al., 2018; Möller et al., 2018). To offer an example, when citizens search for information on COVID-19 vaccines motivated by doubts on its effectiveness, their search behavior and prior exposure patterns can cultivate a restricted media environment where a disproportionate amount of conspiracies, deceptive content, and clickbait reinforcing their doubt is offered—amplifying people's existing doubts and motivating the selection of increasingly less diverse, attitude-reinforcing content.

As argued by Waisbord (2018), eroding levels of trust and the politicization of science may have contributed to an "epistemic democracy" where multiple contesting truth claims compete for attention and legitimacy. In this setting, existing (moderate) levels of uncertainty and distrust may motivate the selection of attitude-reinforcing disinformation. The processing of such information further strengthens uncertainty and distrust. This feedback loop is amplified by algorithms in the digital media environment, which promote attitude-consistent information selection and limit cross-cutting news options. Although algorithms on their own may not be as dangerous and autonomous as assumed in some dystopian views, they may amplify existing fears, distrust, and confirmation biases.

These shifts in the digital ecology of factual relativism create a breeding ground for the rejection of the scientific paradigm, conspiracy theories, and attacks on scientific consensus (Waisbord, 2018). This is highly problematic as the epistemic foundations of deliberative democracy are at stake (Arendt, 1967). Hence, reasoned from people's own biased news ecologies, the illusion of truth and social support is amplified because algorithmic amplification has created—without acknowledging its

biases—a worldview governed by false consensus, social support, and evidence, herewith transgressing the model of a well-functioning deliberative democracy where citizens can learn from the other side and engage in argumentative debates. What's left to debate if everyone seems to agree with you?

What Should (We/They) Do About It?

Although notions of omnipresent "filter bubbles" and "echo chambers" have been debated for quite some time (see e.g., Zuiderveen Borgesius et al., 2016), we cannot ignore the fact that algorithms do, at least for vulnerable segments of the news audience, reinforce spirals of deceptive content and niches of disinformed audiences clinging on to alternative worldviews. The specific problem with false information is that lying and deceiving is a fundamental right that different actors may exercise. Legal boundaries are only crossed when deception takes on the shape of hate speech or discriminatory language. A simple ban on disinformation is thus neither feasible, nor desirable. In my view, a more viable and sustainable solution is to reveal the mechanisms behind algorithms, offering people insights into the workings of the "black box" and educating them on their implications. In addition, user control should be built into the dynamics of recommendation systems—allowing news users the choice if, and if so, to what extent, they would like their exposure options to be tailored by recommender systems.

Regulators, policymakers, and platforms should all make important steps in the direction of transparency, accountability, and education. Urgent calls to design algorithmic systems that are transparent and fair (Shin, 2023) are, thus, crucial in the fight against disinformation but should be supplemented with educational packages and tools that offer users more control (Dan et al., 2021). It is not enough to simply reveal what's hidden in the black box without educating news users on how they can act on this, and how their own choices may afford them more control over the techniques concerning their choices.

A Research Agenda Integrating Algorithmic Amplification in Media Effects Studies

To arrive at these solutions, we need recommendations that are founded on empirical evidence on the workings (and potentially discriminatory) implications of algorithms. Therefore, I propose three directions for future research integrating algorithmic biases in media effects studies:

1. Move beyond "voluntary" selective exposure and confirmation biases. Most research looking at selective exposure and avoidance assumes that biased information environments are more or less driven by individuals' own choices and automatic processing biases. Yet, algorithms create an uneven playing field by limiting the number of options people can select or avoid, and these biasing and discriminatory practices should be taken into account to fully comprehend how people select content in fragmented online information settings.

2. Take a holistic approach to effects studies. We should not blame it all on the algorithm (Möller et al., 2018). People's biased news diets may start with their own

doubts, uncertainty, and fear—and the neglect of their sentiments by the established press. Hence, disinformation's effectiveness is in large part driven by distrust in mainstream media and the feeling of being unrepresented. Although such feelings may be amplified by algorithms, they have a socio-political origin that should not be neglected.

3. Look at the longer-term and spiraling impact of algorithmic amplification. The real democratic and societal impact of algorithms and their amplifying nature does not materialize after one exposure moment. It rather consists of a reinforcing spiral that—over time—places people in niches or traps of deceptive content that will increasingly resonate with their own beliefs. For this reason, future research should map the impact of algorithmic amplification over time, assessing how people's information ecology gradually becomes less diverse, more consistent, and more extreme.

Conclusion

Although algorithms may be conducive to a media ecology that is more personalized and tailored to individual needs and preferences, they may also threaten democratic communication by reinforcing disinformed worldviews and congruent information. Here, I argue that algorithms are not the cause of disinformation or polarization, but rather a catalyst or amplifying factor: Existing doubts and distrust may be strengthened when algorithms recommend like-minded content while filtering out discrepant or nuanced views that could help them to relativize their distrust and counter misperceptions. Importantly, future research needs to map how algorithms play a role in limiting people's media choices, and how that might contribute to increasing polarization. At the same time, policy and media literacy interventions should offer more transparency in how algorithmic biases operate while giving citizens the tools they need to resist such biases, or at least make a well-informed choice on the extent to which their mediated reality is governed by algorithmic biases.

Michael Hameleers
University of Amsterdam

OTT-Media Selectivity, Algorithmic Personalization, and Audience-User Data: Tailored, Pushed, or Fair?

In the domain of OTT media, we find conflicting viewpoints between doomsayers and enthusiasts of algorithmic personalization. Skeptics quickly predict recurring problems of media business with built-in bias in their recommended contents. But Silicon-Valley enthusiasts easily find reasons to celebrate their algorithms for finding "the right" content that match tastes; thus, sacrificing the privacy of personal data is a justifiable cost of delivering diverse content to unique individuals.

Algorithmic personalization invites debates on more than two sides of pros and cons, however, defying the understanding of media audience based on "one-to-many" broadcasting model (Guzman & Lewis, 2020). We argue in this forum that taking a

side too quickly with either skeptics or enthusiasts is a dangerous enterprise that flames moral panic or simply ignores complex challenges posed by OTT (over-the-top) platforms. Understanding this complexity, we see missing puzzle pieces in prior debates about practices of OTT-media in their algorithmic content curation.

Missing Puzzle 1: Do Users Follow Preferences?

Here are some facts. According to Netflix's estimate, an automatic recommendation is responsible for 80% of content selection. On YouTube, as much as 70% of time spent is on watching videos recommended by its algorithm (Cooper, 2021). This is startling, as it indicates that the content selection is influenced by the platforms, not by users, telling that preferences are being built algorithmically, rather than users finding the "right" content matching their preferences.

Empirical research on media audiences is not optimistic about human agency. In the earlier broadcasting era, we were inundated by an abundance of agenda-setting research telling us that traditional media audiences are not good at selecting "what to think about" (McCombs, 2005; Proferes & Summers, 2019). The literature on new media audiences quickly piled up to reveal a flimsy side of user agency in regulating their data. Scholars documented: confusion, lack of knowledge, and inadequate data management (Büchi et al., 2017); psychological resignation (Draper & Turow, 2019); technological fatalism (Lutz & Tamò-Larrieux, 2021); and third-person effect (privacy violation only serious to others) (Kim & Hancock, 2015).

The evidence offers us a clue that users' participation in algorithmic personalization is a product of feeble decisions—namely, a binary choice on whether to opt-in or out of an OTT platform. Put differently, users remain set up algorithmically in a position to be "pushed" for the disclosure of personal data, which is curated to prioritize certain content (DeVito, 2017; Park, 2021).

Missing Puzzle 2: Do OTT-Media Platform Follow Preferences?

In a perfectly transparent world, OTT platforms know precisely what user preferences are, thus their algorithms would be used to find the best match between content and individuals. But is it the case? This question is seldomly asked concerning the internal validity of algorithmic performance (Sandvig et al., 2016). From a managerial standpoint, there is no more ethical practice than "doing it right" than to deliver the "right" content matching preferences as promised in exchange for personal data. We raise two questions, however.

First, technical infeasibility: Personal data may be the best proxy used to estimate individual preferences. However, whether user preferences will be accurately captured in curated data raises the issue of feasibility, that is, how feasible it is to recognize and aggregate idiosyncratic tastes into patterns, and rank users according to a programmable schema (Napoli, 2019). Data inferences introduce bias to certain demographics, and the distance between "what is measured of a user" and "what she/he is" remains technically elusive to overcome (Livingstone, 2019; Park, 2021).

Second, economic infeasibility: Setting aside imperfect algorithmic performance, allocating an infinite number of content precisely according to diverse tastes in endlessly fragmented markets is not economically viable. Certainly, overselling their capacities to predict and match distinctively unique preferences is a smart business strategy appealing to advertisers as well as platform subscribers, but a dubious one. Despite a drop in production cost, developing (and maintaining) "good" platform content that achieves economies of scale is an expensive enterprise, involving the risk of being high-sunk with a "hit or miss" (Vonderau, 2015).

Algorithmic Personalization—Tailored, Pushed, or Fair?

The fact that a user is likely to click on algorithmically-assigned entertainment on Netflix or YouTube is not necessarily evidenced that aggregated content is the "right" one. Instead, it may be simply the case of availability bias—users choose what algorithm has made available for immediate choices at moment. What seems to be working in favor of OTT, however, is platform choice, that is, explicit decisions are to be rendered upon the entry into a platform to access its content. Cognitive psychology literature (Park, 2022; Shin et al., 2021) tells us that when people are presented with limited sets of options, they opt for immediately accessible convenience—preferring instant gratification over the cognitive burden of deliberately sorting out preferences, or even contradicting their expressed interests.

The thesis that we put forth in this forum is that algorithmic personalization is a construct of deliberate choices as OTT platforms set up the conditions with finite choices that proximate user preferences. A profound myth to debunk is that it is possible to detect *what users want* (tastes) and deliver *what they need* (content), as if there were an intrinsic relationship between the accuracy of the personalization and the extent of data collection—a false premise regarding the validity of algorithmic personalization. We are not denying the growing power of algorithmic personalization. Rather, it is our invitation in this forum to attend to the condition of algorithmic systems in which OTT-media assume unsolicited roles of custodianship by pushing preferences (Gillespie, 2020), amplifying particular voices, content, and viewpoints that serve platform interests, thus eliminating others. The reason why it is critical to understand this custodianship is that personalization is built upon selectivity, a construct deliberately chosen to link curated data to estimate what users want and need. The specifics of this construction get never negotiated or altered, but being simply assigned to users based on their contribution to the bottom line.

Blind Spots in Algorithmic Fairness Debate

The lesson is that what users *want and need* is algorithmically constructed with multiple options reduced to a handful of offerings in highly selected fashion. We must critically attend to the claim by OTT-media about capacities (of finding and matching preferences), as their algorithmic calculus cannot simply detect and deliver what people want and need, but rather create it. In this regard, the power of the OTT-media

platform lies in dictating users *what to choose from*, not *what to choose, watch, or like* (Couldry & Mejias, 2020; Park, 2021).

Subsequently, what we posit in this forum is an ethical conundrum, often construed as a rational choice between the need for data surveillance and algorithmic performance, as that choice is built upon the false notion that fairness is a function (F) of personal data—that is:

- $F(\Sigma X) = Y$, where X = data surveilled and Y = the extent of algorithmic fairness, given greater return of content utility is equal to greater aggregate sum Σ of personal data N (i.e., a cumulation of separately observed incidents, n).

Final Notes

One might shrug off to suggest that the current landscape of the digital ecosystem, particularly of OTT media, is still at its best in the absence of better alternatives. We beg to differ, by offering fruitful lines of considerations for media managers, scholars, and policymakers to ponder about ethical data practices. We propose that the debate should start with the honest acknowledgment that purely mathematical solutions will never reach the optimal point of fairness. We are not expressing this as a vacuous statement, but as an invitation for realistic assessment regarding algorithmic (in)capability in its uninvited custodian roles, which cannot achieve complex ethical objectives by having more data points or different model choices.

Yong Jin Park
Howard University

Jeong Nam Kim
The University of Oklahoma

It's Not (Just) the Algorithm: Studying the Complex System of Algorithmic Media Curation

Algorithmic media curation reflects a complex socio-technical system that includes human and non-human actors with different motivations, pressures, values, and normative expectations. Any supposed deviation of normative expectations of media distribution, whether that be partisan bias, availability of misinformation, radicalization, and so on, emerges from a complex interplay of actors—algorithms, users, and content creators—and must, therefore, be evaluated as such. In this essay, we first describe the role of several of the actors in the complex system of algorithmic media. Then, we propose a few research paths to explore the impact of the relationships between actors, which help to focus research beyond the analysis of only the algorithms themselves.

Previous work on algorithmic media bias tends to focus on the frequency of the representation of sources or content (Muddiman, 2013). Often, that work is

specifically about partisan or ideological bias (Diakopoulos et al., 2018; Hu et al., 2019; Kulshrestha et al., 2019; Metaxa et al., 2019; Puschmann, 2018; Robertson et al., 2018), sometimes exploring where bias can come from, including the role of user input (Lurie & Mulligan, 2021; Trielli & Diakopoulos, 2020), and personalization (Bozdag, 2013; Le et al., 2019). We argue for a wider interpretation of curation in algorithmic media, looking not only at the algorithm or the users in isolation but also at the intersections in curation processes between algorithmic mediators, the actions of the users, and the availability of content provided by publishers or creators.

The Actors in Algorithmic Media

The most prominent actor in algorithmic media is the algorithm itself. Much has been studied about the potentials and harms caused by algorithms in the distribution of media (Goldman, 2008; Müller et al., 2018). The work that is specific to media has been inspired by wider studies of automated decision-making processes. We know that biases emerge from the algorithms themselves as they make their human-defined editorial choices (Bozdag, 2013; DeVito, 2017). But there are still opportunities to study the degree to which these algorithms are sensitive to and dependent on the input of users and limited by the availability of content.

When it comes to users, research has explored their role in algorithmic bias, using and updating traditional media theories of the 20th century, such as selective exposure theory (Knobloch-Westerwick et al., 2015), and how algorithms reinforce or counteract individual-level bias in media selection (Knobloch-Westerwick et al., 2015; Trielli & Diakopoulos, 2020). Other work has focused on the potential benefits or harms of personalization and customization (Goldman, 2008; Müller et al., 2018) and collaborative filtering, in which media is recommended according to taste predictions (Bozdag, 2013). An under-explored element in algorithmic media is on the supply side: The corpus available for algorithmic curation generated by media creators. As algorithms try to supply users with relevant media, they make that selection on large, but limited media inventories. Some algorithmic media platforms such as streaming services limit inventory based on content licenses. Others, such as search and social media, can restrict what type of media based on curation criteria (e.g., Google reducing the visibility of low-quality websites). These criteria can also be conduits for bias, such as if low-quality correlates with political orientation. Content creators, however, are increasingly aware not only of the needs of the user but the demands of the algorithm as well (Petre, 2021).

As we see, just describing the actors in algorithmic media curation makes it hard to disentangle one from the other: The algorithm is shaped by the values imbued in it by designers, but also by the needs of the user and the opportunities of the source media; the user shapes and responds to the algorithm in search for the available content; the available content is shaped by the needs of the user as refracted through the pressures of the algorithm as understood by the creators. This is the classic description of a complex system (Meadows, 2008), with intricate flows and

feedback loops that give rise to the stock of media and information provisioned by the system.

Studying the Complex System

Here, we propose opportunities for applying critical perspectives to the interplay among the actors in these systems, focusing on two main issues: power and values. Power here is each actor's ability to shape the algorithmic curation. This power varies according to the type of platform (i.e., search engines are triggered by the user including keywords; social media platforms by the user choosing to follow other accounts) and by individual platforms (different search engines might have different sensitivities to keywords; different social media platforms might nudge new accounts to follow more often). The power of each actor to shape curatorial bias is ripe for algorithmic accountability investigations used to measure the impact of each actor (Trielli & Diakopoulos, 2020). Such investigations need to be cognizant of system complexity in accounting for responsibilities, including the design orientation of platforms that give or take more power to and from the user. Yet the difficulty of isolating actors (and responsibilities) in the tangled relationships of the complex algorithmic media system underscores the challenge ahead for research.

Second, there is the issue of values: How congruent are the values between the actors in the interaction, and where do they conflict. For example, in platforms that curate news content, there might be a conflict between the journalistic value of the content producer and the value of engagement of the platform. In platforms that are created in the United States and used in other countries, there might be conflicts of local cultures and values in determining important or harmful content. Even commercial values of ad revenue or subscription-oriented content can generate conflict. This type of research on the congruence of values from each actor encourages mixed-methods research about different instances of algorithms in media, and the understanding of the motivations for each actor in those instances (e.g., news; entertainment; DeVito, 2017; Trielli & Diakopoulos, 2019).

From the critical perspectives of power and values, we can explore specific social and technical manifestations of the interplay between actors. One of those manifestations is collusion: What happens if two of the three actors are beholden to the same interests, particularly commercial ones? Another would be colonialism, where global platforms export their values with little room for local dissent.

Complexity as the Future of Algorithmic Media Research

Algorithmic media is a complex socio-technical system that includes different actors whose motivations, pressures, and values influence the curation of content. We described three actors for illustration, but the system is even more complex, including producers such as advertisers and end-users. Future work should delineate more complex relations in this system. In addition, we offered two lenses to analyze the interplay between actors in algorithmic media systems: power and values. Ultimately, we argue

for research incorporating a wider interpretation of curation in algorithmic media, looking at the social and technical intersections of the actors embedded in these complex systems.

Daniel Trielli and Nicholas Diakopoulos
Northwestern University

Matters of Responsibility for AI in Journalism: Directions for Future Research in the Socio-Technical Study of News

To understand AI, we need to better understand society. In recent academic and policy debates, there has been considerable focus on "responsible" AI—such as building systems that respect professional values and human rights. Similar emphases have been made in conversations about artificial intelligence (AI) in relation to media and journalism (e.g., Broussard et al., 2019). The recent draft of the European Commission for AI Regulation is just one of many examples of initiatives to make AI more human-centric, ethical, and responsible. AI is, in this context, typically understood from a technological venture point as a form of software (see Art. 3(1) of the Draft AI Regulation), automated processing (Art. 22(1), General Data Protection Regulation), or technical system that relies on the analysis of large quantities of data (European Parliament, Directorate-General for Parliamentary Research Services, 2019). Technological systems, however, cannot be more responsible than the users and institutions that adopt them, and the design, operationalization, and functioning of AI-driven applications are influenced by a diverse ecology of agents (AlgorithmWatch and Bertelsmann Stiftung, 2020; Diakopoulos, 2019; Kitchin, 2017) as well as the governance systems that shape their relationships (Van Dijk, 2020). This realization contains an uncomfortable truth: It is not enough to make technology more responsible or to design fairer, more diverse, or transparent systems. We need to account for responsibility at the level of society—of the institutions and powers that wield the technology.

Changing the perspective from AI as a technology to AI as a broader socio-technical system opens new avenues for research into responsibility and the way that AI is implicated in the practice and scholarship of journalism. We conceive of responsibility as connected to accountability and the moral and/or legal requirements associated with any agent (e.g., see the "technology paternalism" perspective described in Spiekermann & Pallas, 2006). Building on the Four A's socio-technical framework put forward by Lewis and Westlund (2015), we approach AI as a socio-technical system that, as a key technological *actant*, intersects with social *actors* that are central to the shaping of media production (i.e., journalists, publishers, regulators, platforms, etc.) as well as diverse *audiences* (i.e., media users, or those on the consumption side of media distribution). These actors, actants, and audiences are interconnected through the *activities* of media work, and it's in the interactions that occur among them—the stuff of which

a socio-technical system is made—that we proceed to discuss central developments relating to questions of AI and responsibility and offer our recommendations for a future research agenda. Given the space limitations of this essay, we focus particularly on a set of key agents—from publishers and platforms, on one hand, to audiences, regulators, and researchers, on the other—and consider their AI-related roles and responsibilities as well as potential directions for future research.

Publishers

The responsibility for AI among publishers involves the IT/tech department as well as top managers from editorial and business departments. Publishers must focus on systemic solutions taking into account the organizational structures as well as institutional dependencies on third-party AI providers. Publishers use AI for analytics, production of news, personalized news distribution as well as programmatic advertising, and so forth. We call for research focusing on how publishers take organizational responsibility for AI in such activities, involving both proprietary and non-proprietary technology solutions.

Platforms

Although there are many platform companies in the world, a small number of these have gained tremendous power on a global scale as key providers and users of AI-driven applications. These players are under growing pressure from governments around the world to make their content moderation and recommender systems more responsible. Doing so cannot be a matter of technological fixes alone. Taking responsibility for their recommendation and content moderation algorithms also requires taking responsibility for those that develop the systems (and ensuring they do so taking into account human rights and public values), those that use the systems (and adopting effective and non-discriminatory ways of enforcing community standards), those that contribute to fixing the systems, such as human content moderators and trusted flaggers (creating fair and humane conditions under which they can do this important work), and those that are affected by their algorithms, including the publishers that depend on them. We call for research that brings together this broader picture of platform responsibility. In addition, future research would do well to investigate how platforms could employ AI to reduce forms of dark participation (Quandt, 2018), rather than fuel such to drive engagement and advertising revenue.

Audiences

Audiences can be conceived of as recipients of and active participants in news, as well as approached by publishers and advertisers as measurable commodities (Lewis & Westlund, 2015). In addition, audiences can and should participate in the responsible uptake of AI—for instance, by becoming more familiar with how their

engagement with (or non-use of) particular platforms or services, and the tracking and personalization associated with that, contributes to the kind of media experiences they encounter. Although it would be unrealistic to expect news consumers to bear the kind of responsibility associated with tech providers or media publishers, there is ample opportunity to enhance ongoing efforts in media literacy to include greater literacy in AI technologies and techniques—thereby giving people more tools in making sense of how information is made and how it moves in the world. We call for research focusing on how audiences' intended as well as unintended media-related activities relate to developing responsible AI in journalism.

Regulators

The current techno-centric focus in policy initiatives such as the Digital Services Act (EU) and related attempts at identifying high-risk AI systems is an important first step in regulation (and in a specific part of the world)—but it only partially achieves the larger goal of fostering public values and responsible technology adoption. Regulating for responsible AI also means regulating for the responsible use, implementation, oversight, control, and contestation of AI systems. We call for research placing AI in context—assessing, for example, how the implementation of AI changes internal distributions of power and responsibility, how structural dependencies to external actors arise, and how governance frameworks are needed to set the rules of the game not only for technology but also for the actors dealing with it.

Researchers

Focusing on AI in its societal context has important implications for research and the training of researchers. An emphasis on AI in its wider societal, institutional, and economic context broadens the research agenda where the Social Sciences/Humanities meets Computer Science (SSH-CS), from the design of fair and responsible algorithms to the design of improved institutions, professional workflows, and social relationships. We call for researchers to study AI in concrete organizational settings for purposes of understanding how AI affects the distribution of responsibilities in the broader network of actors—and, to this end, to consider research collaborations that involve a larger range of disciplines and stakeholders involved.

Natali Helberger
University of Amsterdam

Seth C. Lewis
University of Oregon

Oscar Westlund
Oslo Metropolitan University

The Bias in Media Regarding Algorithmic Bias of AI

Applications of artificially intelligent (AI) algorithms are becoming increasingly common in many realms of life to assist with making or even fully automating decisions. AI technologies suffer from current hype, according to which their potential borders on utopian, while at the same time, they are being fiercely criticized for being culturally biased, unfair, unethical, or downright evil. Although media have become deeply engaged in the debate, especially in supporting critical positions (Kaplan & Haenlein, 2020; Müller et al., 2018), there are still few academic studies of the phenomenon in media and journalism research (Baumann, 2020). Why are we seeing such a sharp split in the arguments around AI in public discourse and, simultaneously, a reluctance to engage in the debate in the scholarly sphere? This contribution aims at shedding light on AI by clarifying what it actually is and hence doing away with some of the misconceptions underlying the discussion. It also outlines ideas about the beneficial use of AI technologies and describes some limitations and challenges.

Let's start with a few misconceptions. A common misunderstanding is that AI is a single technology, when in fact AI refers to a broad array of technologies; Machine Learning is currently the most prominently applied type. AI technologies have in common that they mimic human intelligence as they interpret external data and use what they learn to flexibly adapt their behavior to achieve specific goals and tasks (Guzman & Lewis, 2020, 2022; Kaplan & Haenlein, 2020). AI technologies are categorized into evolutionary stages—narrow, general and super-intelligent—and are often classified as analytical, human-inspired, or humanized depending on their cognitive, emotional, and social competencies. The discussion of AI often mixes up these different stages and types, which creates confusion about the term "AI" itself (Chan-Olmsted, 2019).

The uses of AI technologies are manifold, touching on all realms of life. Prominent examples include their use or potential use in self-driving cars, health monitoring systems, recruitment tools, and, of course, military equipment. Potentially adverse applications and undesirable results of AI systems, such as accidents, and automated recommendations that are clearly biased are typically featured in media coverage. Negative examples attract a larger audience. Positive examples of AI applications are underrepresented in current reporting on AI technologies, and so it's fair to state that the media carry a negative bias against AI.

Let's investigate bias against AI in more detail. AI technologies are being criticized for having an algorithmic bias, which means that supposedly malicious algorithms are at the heart of the problems with AI. In media discourse, the term "algorithm" has almost become synonymous with something we cannot control, as if algorithms have lives of their own. But what exactly is an algorithm? It is nothing more than a unique set of instructions for solving a problem (or a class of problems) or achieving a goal. A cooking recipe is an algorithm. It tells us which ingredients we need in what quantities and describes the steps to follow to create a final dish. Thus, algorithms consist of a finite number of well-defined individual steps. These steps can be formulated in human languages, as in a recipe, or implemented in an executable computer program.

Although people can commonly read a recipe and follow the instructions, programming languages are typically unfamiliar. However, they are simply a way of formulating instructions, just like sheet music captures the instructions for playing a certain musical piece. Instructions can carry bias if the human who formulates them intentionally or unintentionally ingrains bias into the computer program. Thus, it is not the algorithm that is biased, but the human creator.

AI technologies have also been criticized for producing biased results and recommendations (e.g., Ananny & Crawford, 2018; Shin et al., 2022). An overly cited example is that of AI systems engaged in job selection that favor certain genders or ethnicities. The alleged conclusion is that AI technologies invariably produce biased outputs. To explain what happened in these cases, two important variables need to be considered: the input data and how the training of a machine learning type AI system works. The main difference between AI and traditional solution-seeking methods is that the latter uses a given method to transform input data into (unknown) output data, while in AI existing data is used to train the system, which then finds the "method" to produce expected outputs (Chivers, 2021; Moore et al., 2021). The outputs are assessed by humans and their feedback helps the AI system further improve the "method." Bias can occur if the training data contains an inherent bias, for example, that in the past recruiters favored particular age groups or genders. Likewise, bias can occur during the output assessment if the humans involved (consciously or unconsciously) transfer their own biases to the system. In both cases, the bias is human-made and should not be blamed on the AI per say. In fact, the AI system merely holds up a mirror that reflects the bias already inherent in the setting. And if this leads to making implicit bias explicit, the ensuing debate can help to pave the way to reducing or even eliminating such bias.

Another concern regarding AI is that it is unknown how an AI system operates internally, especially given that the learning process of such a system creates nontransparent dependencies between input data and outputs (Meske et al., 2022). This "black box" phenomenon has raised calls for "explainable AI," explainable in the sense that it enables human users to appropriately understand and effectively manage the systems as a prerequisite of a trustworthy and responsible AI (Adadi & Berrada, 2018; European Commission & Directorate-General for Communications Networks, Content and Technology, 2019; Thiebes et al., 2021).

Applications of AI systems in media and journalism can have many benefits. AI systems can support humans in cumbersome tasks such as analyzing and organizing large datasets (Hartmann et al., 2019) and in making appropriate decisions. For specialized cases such as, for example, creating metadata, they already reach or even surpass the task performance of humans. In customer interaction, they play a major role by recommending engaging content and allowing for targeted information distribution (Baumann, 2021; Chen et al., 2019). Nevertheless, super-intelligent general AI systems are still far in the future and the purported danger that AI systems will eventually become fully human-like will not happen any time soon. Judgment used by AI systems relies on trained reasoning, but humans can also use imagination, reflection, valuation, and empathy. We should not forget our moral responsibilities—and that

includes avoiding bias in reporting on AI technologies. Otherwise, we may miss out on harnessing AI technologies for the benefits they can bring.

Sabine Baumann
Jade University of Applied Sciences

References

Adadi, A., & Berrada, M. (2018). Peeking Inside the Black-Box. *IEEE Access*, *6*, 52138–52160. https://doi.org/10.1109/ACCESS.2018.2870052

AlgorithmWatch and Bertelsmann Stiftung. (2020). *Automating society report 2020*. automatingsociety.algorithmwatch.org

Ananny, M., & Crawford, K. (2018). Seeing without knowing. *New Media & Society*, *20*(3), 973–989. https://doi.org/10.1177/1461444816676645

Arendt, H. (1967, February 25). Truth and Politics. *The New Yorker*. https://www.newyorker.com/magazine/1967/02/25/truth-and-politics

Baumann, S. (2020). Guest editor's introduction: Strategic media management at a junction. *Journal of Media Business Studies*, *17*(1), 1–12. https://doi.org/10.1080/16522354.2020.1740564

Baumann, S. (2021). Media management and business: Old vs. new. In M. Mahoney & T. Tang (Eds.), *The handbook of media management and business* (pp. 407–425). Rowman & Littlefield.

Bennett, L. W., & Livingston, S. (2018). The disinformation order: Disruptive communication and the decline of democratic institutions. *European Journal of Communication*, *33*(2), 122–139. https://doi.org/10.1177/0267323118760317

Borgesius, F., Trilling, D., Möller, J., Bodó, B., Vreese, C., & Helberger, N. (2016). Should we worry about filter bubbles? *Internet Policy Review*. https://policyreview.info/articles/analysis/should-we-worry-about-filter-bubbles

Bozdag, E. (2013). Bias in algorithmic filtering and personalization. *Ethics and Information Technology*, *15*(3), 209–227.

Broussard, M., Diakopoulos, N., Guzman, A. L., Abebe, R., Dupagne, M., & Chuan, C.-H. (2019). Artificial intelligence and journalism. *Journalism & Mass Communication Quarterly*, *96*(3), 673–695.

Büchi, M., Just, N., & Latzer, M. (2017). Caring is not enough: The importance of Internet skills for online privacy protection. *Information, Communication & Society*, *20*(8), 1261–1278.

Chan-Olmsted, S. M. (2019). A review of artificial intelligence adoptions in the media industry. *International Journal on Media Management*, *21*(3-4), 193–215. https://doi.org/10.1080/14241277.2019.1695619

Chen, G., Xie, P., Dong, J., & Wang, T. (2019). Understanding programmatic creative. *Journal of Advertising*, *48*, 4347–4355. https://doi.org/10.1080/00913367.2019.1654421

Chivers, T. (2021). How to train an all-purpose robot: DeepMind is tackling one of the hardest problems for AI. *IEEE Spectrum* (pp. 35–41). https://spectrum.ieee.org/how-deepmind-is-reinventing-the-robot

Cooper, P. (2021). *How does the YouTube algorithm work in 2021? The complete guide*. https://blog.hootsuite.com/how-the-youtube-algorithm-works/

Couldry, N., & Mejias, U. A. (2020). *The costs of connection: How data are colonizing human life and appropriating it for capitalism*. Stanford University Press.

Dan, V., Paris, B., Donovan, J., Hameleers, M., Roozenbeek, J., van der Linden, S., & von Sikorski, C. (2021). Visual mis- and disinformation. *Social Media, and Democracy. Journalism and Mass Communication Quarterly*, *98*, 641–664. https://doi.org/10.1177/10776990211035395

DeVito, M. A. (2017). From editors to algorithms. *Digital Journalism*, *5*(6), 753–773.

Diakopoulos, N. (2019). *Automating the news: How algorithms are rewriting the media*. Harvard University Press.

Diakopoulos, N., Trielli, D., Stark, J., & Mussenden, S. (2018). I vote for: How search informs our choice of candidate. In M. Moore & D. Tambini (Eds.), *Digital dominance: The power of Google, Amazon, Facebook, and Apple* (p. 22). Oxford University Press.

van Dijk, J. (2020). Governing digital societies: Private platforms, public values. *Computer Law & Security Review*, *36*, Article 105377.

Dörr, K., & Hollnbuchner, K. (2017). Ethical challenges of algorithmic journalism. *Digital Journalism*, *5*(4), 404–419. https://doi.org/10.1080/21670811.2016.1167612

Draper, N. A., & Turow, J. (2019). The corporate cultivation of digital resignation. *New Media & Society*, *21*(8), 1824–1839.

European Commission & Directorate-General for Communications Networks, Content and Technology. (2019). *Ethics guidelines for trustworthy AI*. Publications Office. https://doi.org/10.2759/177365

European Parliament, Directorate-General for Parliamentary Research Services. (2019). *Understanding algorithmic decision-making: Opportunities and challenges*. LU: Publications Office. https://www.europarl.europa.eu/stoa/en/document/EPRS_STU(2019)624261

Gillespie, T. (2020). Content moderation, AI, and the question of scale. *Big Data & Society*, *7*(2), Article 943234.

Goldman, E. (2008). *Search engine bias and the demise of search engine Utopianism web search*. Springer.

Guzman, A. L., & Lewis, S. C. (2020). Artificial intelligence and communication. *New Media & Society*, *22*(1), 70–86.

Hartmann, J., Huppertz, J., Schamp, C., & Heitmann, M. (2019). Comparing automated text classification methods. *International Journal of Research in Marketing*, *36*(1), 20–38. https://doi.org/10.1016/j.ijresmar.2018.09.009

Helberger, N., Karppinen, K., & D'Acunto, L. (2018). Exposure diversity as a design principle for recommender systems. *Information, Communication & Society*, *21*(2), 191–207. https://doi.org/10.1080/1369118X.2016.1271900

Hu, D. S., Jiang, S., Robertson, R. E., & Wilson, C. (2019). Auditing the partisanship of Google search snippets. In *Web conference 2019: Proceedings of the World Wide Web conference* (pp. 693–704). https://doi-org.turing.library.northwestern.edu/10.1145/3308558.3313654

Kaplan, A., & Haenlein, M. (2020). Rulers of the world, unite!. *Business Horizons*, *63*(1), 37–50. https://doi.org/10.1016/j.bushor.2019.09.003

Kim, S. J., & Hancock, J. T. (2015). Optimistic bias and Facebook use. *Cyberpsychology, Behavior, and Social Networking*, *18*(4), 214–220.

Kitchin, R. (2017). Thinking critically about and researching algorithms. *Information, Communication & Society*, *20*(1), 14–29.

Knobloch-Westerwick, S., Johnson, B. K., & Westerwick, A. (2015). Confirmation bias in online searches. *Journal of Computer-Mediated Communication*, *20*(2), 171–187.

Kulshrestha, J., Eslami, M., Messias, J., Zafar, M. B., Ghosh, S., Gummadi, K. P., & Karahalios, K. (2019). Search bias quantification: Investigating political bias in social media and web search. *Information Retrieval Journal*, *22*(1–2), 188–227.

Le, H., Maragh, R., Ekdale, B., High, A., Havens, T., & Shafiq, Z. (2019). Measuring political personalization of Google news search. In *The World Wide Web conference* (pp. 2957–2963). https://doi.org/10.1145/3308558.3313682.

Lewis, S. C., & Westlund, O. (2015). Actors, actants, audiences, and activities in cross-media news work. *Digital Journalism*, *3*(1), 19–37.

Livingstone, S. (2019). Audiences in an age of datafication. *Television & New Media*, *20*(2), 170–183.

Lurie, E., & Mulligan, D. K. (2021). Searching for representation: A sociotechnical audit of googling for members of U.S. Congress. *arXiv*. https://arxiv.org/abs/2109.07012

Lutz, C., & Tamò-Larrieux, A. (2021). Do privacy concerns about social robots affect use intentions? *Frontiers in Robotics and AI*, *8*, Article 63.

Marwick, A., & Lewis, R. (2017). *Media manipulation and disinformation online* (pp. 1–104). Data and Society Research Institute. https://datasociety.net/output/media-manipulation-and-disinfo-online/

McCombs, M. (2005). A look at agenda-setting. *Journalism Studies*, *6*(4), 543–557.

Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing.

Meske, C., Bunde, E., Schneider, J., & Gersch, M. (2022). Explainable artificial intelligence. *Information Systems Management*, *39*(1), 53–63. https://doi.org/10.1080/10580530.2020.1849465

Metaxa, D., Park, J. S., Landay, J. A., & Hancock, J. (2019). Search media and elections. *Proceedings of the ACM on Human-Computer Interaction*, *3*, 1–17. https://doi.org/10.1145/3359231

Möller, J., Trilling, D., Helberger, N., & van Es, B. (2018). Do not blame it on the algorithm. *Information, Communication & Society*, *21*(7), 959–977. https://doi.org/10.1080/1369118X.2018.1444076

Moore, S. K., Schneider, D., & Strickland, E. (2021). How Deep Learning Works. *IEEE Spectrum* (pp. 32–33). https://spectrum.ieee.org/what-is-deep-learning

Muddiman, A. (2013). Searching for the next U.S. president. *Journal of Information Technology & Politics*, *10*(2), 138–157. https://doi.org/10.1080/19331681.2012.707440

Müller, J., Trilling, D., Helberger, N., & van Es, B. (2018). Do not blame it on the algorithm. *Information, Communication & Society*, *21*(7), 959–977. https://doi.org/10.1080/1369118X.2018.1444076

Napoli, P. M. (2019). *Social media and the public interest*. Columbia University Press.

Park, Y. J. (2021). *The future of digital surveillance*. University of Michigan Press.

Park, Y. J. (2022). Personal data concern, behavioral puzzle and uncertainty in the age of digital surveillance. *Telematics and Informatics*, *66*, Article 101748. https://doi.org/10.1016/j.tele.2021.101748

Petre, C. (2021). *All the news that's fit to click: How metrics are transforming the work of journalists*. Princeton University Press.

Proferes, N., & Summers, E. (2019). Algorithms and agenda-setting in Wikileaks'#. *Information, Communication & Society*, *22*(11), 1630–1645.

Puschmann, C. (2018). Beyond the bubble: Assessing the diversity of political search results. *Digital Journalism*, *7*(6), 824–843. https://doi.org/10.1080/21670811.2018.1539626

Quandt, T. (2018). Dark participation. *Media and Communication*, *6*(4), 36–48.

Robertson, R. E., Jiang, S., Joseph, K., Friedland, L., Lazer, D., & Wilson, C. (2018). Auditing partisan audience bias within google search. *Proceedings of the ACM on Human-Computer Interaction*, *2*, 1–22.

Sandvig, C., Hamilton, K., Karahalios, K., & Langbort, C. (2016). Automation, algorithms, and politics when the algorithm itself is a racist. *International Journal of Communication*, *10*, Article 19.

Shin, D. (2022). The perception of humanness in conversational journalism: An algorithmic information-processing perspective. *New Media and Society*, *24*(12), 2680–2704. https://doi.org/10.1177/1461444821993801

Shin, D. (2023). *Algorithms, humans, and interactions: How do algorithms interact with people?* Routledge, Taylor & Francis. https://doi.org/10.1201/b23083

Shin, D., & Park, Y. J. (2019). Role of fairness, accountability, and transparency in algorithmic affordance. *Computers in Human Behavior*, *98*, 277–284. https://doi.10.1016/j.chb.2019.04.019

Shin, D., Rasul, A., & Fotiadis, A. (2021). Why am I seeing this? Deconstructing algorithm literacy through the lens of users. *Internet Research*, *32*, 1214–134. https://doi.org/10.1108/INTR-02-2021-0087

Shin, D., Zaid, B., Biocca, F., & Rasul, A. (2022). In platforms we trust? Unlocking the black-box of news algorithms through interpretable AI. *Journal of Broadcasting and Electronic Media*, *66*(2), 235–256. https://doi.org/10.1080/08838151.2022.2057984

Spiekermann, S., & Pallas, F. (2006). Technology paternalism–wider implications of ubiquitous computing. *Poiesis & Praxis*, *4*(1), 6–18.

Starbird, K. (2019). Disinformation's spread: Bots, trolls and all of us. *Nature*, *571*(7766), 449.

Thiebes, S., Lins, S., & Sunyaev, A. (2021). Trustworthy artificial intelligence. *Electronic Markets*, *31*(2), 447–464. https://doi.org/10.1007/s12525-020-00441-4

Thurman, N., Moeller, J., Helberger, N., & Trilling, D. (2019). My friends, editors, algorithms, and I. *Digital Journalism*, *7*(4), 447–469. https://doi.org/10.1080/21670811.2018.1493936

Trielli, D., & Diakopoulos, N. (2019, May). Search as news curator: The role of Google in shaping attention to news information. In *Proceedings of the 2019 CHI conference on human factors in computing systems* (pp. 1–15). https://dl.acm.org/doi/10.1145/3290605.3300683

Trielli, D., & Diakopoulos, N. (2020). Partisan search behavior and Google results in the 2018 U.S. midterm elections. *Information, Communication & Society*, *25*, 145–161.

Vonderau, P. (2015). The politics of content aggregation. *Television & New Media*, *16*(8), 717–733.

Waisbord, S. (2018). Truth is what happens to news. *Journalism Studies*, *19*(13), 1866–1878.

Wölker, A., & Powell, T. (2021). Algorithms in the newsroom? *Journalism*, *22*(1), 86–103. https://doi.org/10.1177/1464884918757072

Zhang, Y., Lukito, J., Su, M.-H., Suk, J., Xia, Y., Kim, S. J., Doroshenko, L., & Wells, C. (2021). Assembling the networks and audiences of disinformation. *Journal of Communication*, *71*, 305–331. https://doi.org/10.1093/joc/jqaa042

Author Biographies

Dr. Donghee Shin, (Ph.D., Syracuse University) is Professor at the College of Communication, Zayed University at Dubai. His research is interested in exploring how computational methods can help advance our understanding of how persuasive messaging works as it intersects with psychological processes, social dynamics, and technological affordances. He is the author of

Algorithms, humans, and interactions: How do algorithms interact with people? Routledge, New York (2023).

Dr. Michael Hameleers (Ph.D., University of Amsterdam) is Assistant Professor in Political Communication at the Amsterdam School of Communication Research, Amsterdam, The Netherlands. His research interests include populism, disinformation, and corrective information.

Dr. Yong Jin Park (Ph.D., Univ. of Michigan) is a professor in the Communication, Culture and Media Studies Department. He teaches Research Methods, Communication Policy, Emerging New Communication Technologies, and Race, Gender, Media.

Dr. Jeong Nam Kim (Ph.D., Univ. of Maryland) is the Gaylord Family Endowed Chair of Strategic Communication at the Gaylord College of Journalism and Mass Communication, at the University of Oklahoma. He serves as a senior editor of the journal Health Communication.

Daniel Trielli is a doctoral student in the Media, Technology and Society program at the Northwestern University School of Communication. He is researching how news reaches the public in our increasingly algorithmically-defined world and how journalists can cover algorithms.

Dr. Nicholas Diakopoulos (Ph.D., Georgia Tech) is an Associate Professor in Communication Studies and Computer Science at Northwestern University where he is Director of the Computational Journalism Lab and Director of Graduate Studies for the Technology and Social Behavior Ph.D. program.

Dr. Natali Helberger (Ph.D., University of Amsterdam) is a Distinguished University Professor Law & Digital Technology, with a special focus on AI at the Institute for Information Law, University of Amsterdam. She studied Law at the Freie Universität Berlin.

Dr. Seth C. Lewis (Ph.D., University of Texas at Austin) is Professor, Director of Journalism, and the founding holder of the Shirley Papé Chair in Emerging Media in the School of Journalism and Communication at the University of Oregon. He is a fellow with the Tow Center for Digital Journalism at Columbia University.

Dr. Oscar Westlund is Professor at the Department of Journalism and Media Studies at Oslo Metropolitan University, where he co-leads the OsloMet Digital Journalism Research Group. Westlund is the Editor-in-Chief of Digital Journalism.

Dr. Sabine Baumann (Ph.D., Paderborn University) holds a full professorship for Business Administration at Jade University. She teaches courses on master and bachelor level in Management, Information Technology, Media, and Production Management.