Bridging the Divide: Promoting Serendipitous Discovery of Opposing Viewpoints with Visual Analytics in Social Media

Mahmood Jasim *
University of Massachusetts Amherst

Mumtaz Fatima †
Mount Holyoke College

Sagarika Ramesh Sonni ‡
University of Massachusetts Amherst

Narges Mahyar §
University of Massachusetts Amherst

ABSTRACT

While social media promises open access to information, prior works suggest that it also plays a role as a catalyst for the social divide, which is often attributed to a shift towards algorithmic content curation based on users' digital footprints. To combat this issue, methods that support serendipity has received attention in recent years that aim to provide information beyond a user's viewpoint or preference. However, the utility of systems that promote serendipity in raising awareness of opposing viewpoints remains underexplored, especially in the political context. To that end, we conducted a study where we asked 14 participants to explore tweets about two politically charged topics — gun control and immigration — using an interaction-driven visual analytics tool that visualizes users' exploration patterns and provides serendipitous suggestions from opposing viewpoints. We found that as participants explored the tweets, they gradually became aware of opposing viewpoints and identified information they did not consider before which helped them gain knowledge about arguments from all sides. We also found while people were keen to use technology that promotes serendipity to cover more topical information, they do not necessarily trust the information found on social media. We hope that our work will motivate future researchers to investigate serendipitous aspects in visualizations to promote a more holistic exploration of various viewpoints.

Index Terms: Human-centered computing—Visualization—Visualization application domain

1 INTRODUCTION

Social media is becoming more integral in our lives. Today, approximately 4.7 billion people are active social media users, which constitutes over 60% of the global population. It provides an opportunity for individuals to communicate, connect, consume content, and stay up-to-date with current affairs [6, 18]. Despite the benefits, social media is often considered to be a catalyst for social divide as social media users often band together around common ideas based on their own beliefs and ignore opposing viewpoints [23]. This phenomenon is often attributed to an aggressive move towards algorithmic curation of social media content based on users' digital footprints [4, 20]. These algorithmics often shape user experiences on social media by deciding for the users what content they may or may not have access to. More often than not, they are designed based on perceived user preference, relevance, and popularity [16]. As such, they often inadvertently play a role in creating filter bubbles [10], echo chambers [11], promoting out-group animosity [23] and homophily [5].

*e-mail: mjasim@umass.com
†e-mail: fatim25m@mtholyoke.edu
‡e-mail: ssonni@umass.edu
§e-mail: nmahyar@umass.edu

Prior works in information visualization have explored methods and technologies to combat this issue by highlighting opposing viewpoints [9, 17]. One area that has seen particular attention in information-seeking tasks is *Serendipity*, which has been defined by researchers in different ways [16, 25] but boils down to stimulation of exciting yet unexpected discoveries [25]. Researchers have also shown interest in visualizing information that is diverse and beyond relevance or popularity to enable a holistic understanding of the underlying data by increasing people's data coverage from alternate viewpoints [12, 14, 24]. However, previous research suggests that people often cling to their pre-existing ideas and beliefs [13, 26]. Especially, when political information from multiple viewpoints on social media is visualized and people are coerced to explore opposing viewpoints, they may become further resistant to views that are different from their own [3, 24]. While prior works promote serendipity, often they do not allow dynamic adjustment to exploration stimulus and the effect of such interaction-driven serendipitous information discovery remains underexplored.

In this work, we explore whether the serendipitous discovery of opposing viewpoints on social media enables people to be aware of these viewpoints and whether interaction-driven tools that promote serendipity for data diversification and bias mitigation can be applied in the social media domain to negate the formation of echo chambers by informing social media users of opposing viewpoints. To that end, we conducted a study with 14 participants where we used an interaction-driven visual analytics tool called Serendyze [15] that visualizes peoples' data exploration patterns and provides serendipitous suggestions from opposing viewpoints to balance how people explore political opinions on social media. For this study, we collected tweets based on critical yet contentious discussion topics such as immigration and gun control from left-leaning, centralist, and right-leaning influencers and quoted tweets that supported or opposed their perspectives. We asked the participants to explore these tweets using Serendyze and conducted semi-structured interviews with them to learn about their experiences and whether Serendyze helped them to be more aware of the opposing viewpoints.

We analyzed the interviews using thematic analysis. Our findings suggest that while using Serendyze, the participants identified interesting information and gradually became aware of opposing viewpoints. We also saw that the participants were keen to seek out new information based on what they have learned to increase their knowledge. The majority of the participants (10/14) attributed their increase in awareness and knowledge of opposing viewpoints to having access to serendipitous information via the visualization of their exploration patterns as well as suggestions. While our participants wanted to have tools like Serendyze that promote serendipity in exploring social media posts, the trust they put on information found in social media posts varied widely from people who trust the source of the information as a validation point to people who do not trust information from social media at all. Our findings suggest the benefits of investigating serendipity in visualizations to raise awareness of opposing viewpoints in social media posts.

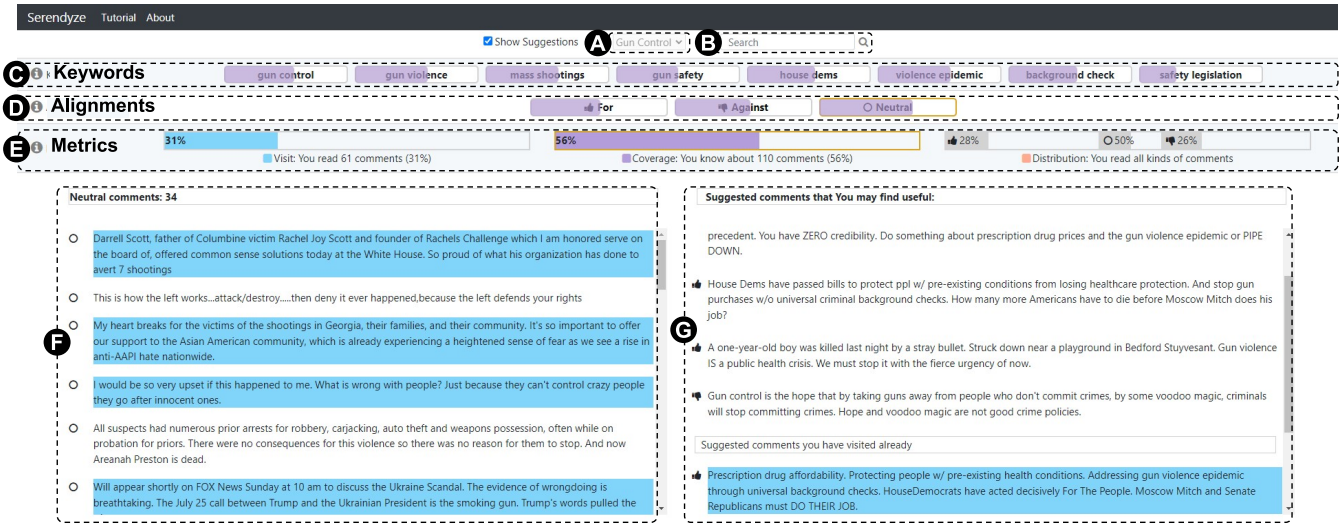

Figure 1: Serendyze interface: A) a dropdown option for selecting a topic, B) a search bar to search for any word present in the social media posts, C) a set of filters corresponding to representative pairs of keywords, D) filters for social media posts with For, Against, and Neutral alignments, E) the exploration metrics - Visit, Coverage, and Distribution, F) all social media posts, and G) suggested social media posts generated by the bias mitigation model that the readers may find interesting. This snapshot was taken during P14's exploration of social media posts.

2 Related Works

2.1 Social Media and Echo chambers

While some argue that news disseminated in social media involves controversy, questionable legitimacy, and quality [22], undeniably, social media is becoming a dominant news source for many in the United States (US) [1]. Furthermore, many social media platforms have moved towards implementing algorithmic curation and filtration of contents based on users' digital footprints on social media [20]. Such algorithms can choose what contents the users are exposed to and create filter bubbles [10, 21], promoting out-group animosity [23] and leaving the users oblivious to the bigger picture of current affairs in virtual social spaces [19]. Researchers argue that such algorithmic curation may corral social media users into echo filter bubbles [10] or chambers [11] that promote homophily [5] and generate out-group animosity [23].

2.2 Serendipitous discovery of data

Previous research in data visualization has explored ways to support serendipitous discovery and analysis of data [2, 8, 14]. For instance, Bohemian Bookshelf provides visualizations for exploring book collections that enable people to discover trends and relations within the collection in a playful manner [25]. Footprints is another analytics tool that uses multiple interconnected visualizations to help users navigate through news articles [14]. Footprints also enable people to tag the data as *Read*, *To Read*, and *Useful* to track exploration progress and data coverage. Data portraits [12] is a social media exploration tool that visualizes users' characterizing topics and tweets where tweets from opposing viewpoints on sensitive topics are injected to motivate indirect connections between dissimilar people. Spinde et. al. visualized news overviews [24] on a political topic from left-, central-, and right-leaning outlets. Some of these works found that recommending and visualizing opposing perspectives through deception or coercion can incur negative emotions [12] and even become further resistant to such viewpoints [3,24]. In this work, we explore how dynamically adjusting serendipitous data discovery might enable people to be more aware of opposing viewpoints.

3 Methodology

3.1 Serendyze

To examine people's social media exploration patterns when provided with serendipitous information, in this work, we used a visual text analysis tool that supports serendipitous discovery and analysis of short free-form text called Serendyze [15]. It enables readers to explore, analyze, and gather knowledge from short-free form texts, such as product reviews and social media posts. Serendyze has two features to support serendipitous discovery and analysis. First, it visualizes three interaction-driven exploration metrics — Visit, Coverage, and Distribution. These metrics are designed to function as an awareness mechanism to help people track and understand their social media exploration progress and patterns through visual indicators. The *Visit* is a measure of posts a reader has marked as read and has explicit knowledge about. The *Coverage* is a measure of posts a reader has implicit knowledge about. They might not have read these particular social media posts, but these posts are similar and redundant to the ones that the reader has already read. And *Distribution* is a measure of the true distribution of categories associated with posts that a reader has read. In this work, we categorized the social media posts used for the study into For, Neutral, and Against.

The second feature that supports serendipitous discovery and analysis is called the bias mitigation model. The model aims to diversify the social media analysis process by suggesting data points that are semantically and category-wise different from what the user has seen. It was designed to improve knowledge discovery, increase data coverage, and mitigate bias toward a particular category of alignment while exploring social media posts. Essentially, it implicitly guides readers toward a more holistic understanding of the data that reflects the semantic and category-wise diversity present in the social media content for a particular topic, as opposed to providing what seems to be more relevant or popular. To do so, Serendyze tracks how a reader has been reading social media posts to generate suggestions that are semantically and category-wise different from what they have read. For instance, if a reader is reading too many posts that support an idea, the model will suggest posts that present opposing arguments or posts that represent a neutral stance and vice versa.

Serendyze's components include a dropdown option for selecting a topic (Fig. 1(A)), a search bar to search for any word present in posts (Fig. 1(B)), a set of filters corresponding to the most frequently occurring keyword pairs (Fig. 1(C)), filters for posts categorized

as for, neutral, and against alignments (Fig. 1(D)), the exploration metrics are visualized as bar charts including the visit, coverage, and distribution (Fig. 1(E)). and finally, two sets of social media posts — all posts (Fig. 1(F)), and suggestions generated by the bias mitigation model (Fig. 1(G)). Hovering over the metrics bar triggers the scented widget embedded with the keywords and alignment filters to visualize how much of the posts pertaining to them have been visited or covered by the readers.

3.2 Dataset

For this work, we used social media posts from Twitter, which remains one of the most popular social media platforms in the United States, despite recent events. To curate the dataset, first, we explored topics that are contentious topics relevant to the United States' political situation. These topics included gun control, inflation, immigration, the war in Ukraine, defunding the police, and gerrymandering. Based on the relevancy of the topic and traction on social media, we settled on gun control and immigration. Next, we compiled a list of public figures including politicians, journalists, and celebrities who self-report or have identifiable political affiliations such as running for office or political affiliation listed in their Twitter bio. With the list, we scraped tweets with the relevant keywords from their official Twitter accounts. For gun control, we used keywords such as "gun control", "second amendment", "2A", "shootings", "mass shootings", "gun violence", "gun laws", and "background checks". For immigration, we used "immigration", "southern border", "illegals", "illegal immigrant", "skilled immigration", "H1B", and "border crossing". We also scraped the relevant quote tweets to understand the public sentiment and comments on the original tweets by using the tweet ids as the reference. We collected a total of 8000 tweets this way. We removed all tweets that the smaller than 5 words, in a different language other than English, or were irrelevant to the topic. That way we ended up with 912 tweets for gun control and 685 tweets for immigration. However, the tweets were not fact-checked as verification of tweets used was not within the scope of this study and was left to the reader's discretion.

Three independent coders individually categorized these tweets into for, neutral, and against alignment. For represents those tweets that are in support of the topic and against represents the tweets that are opposed to the idea. Neutral represents tweets that do not lean towards either side or bring in a different perspective. The inter-coder reliability across three coders was measured using Krippendorff's alpha at 0.85. We randomly sampled 200 tweets from each set of tweets to construct the final dataset for the study. For gun control, we had 85 for, 81 against, and 34 neutral tweets. For immigration, we had 93 for, 88 against, and 19 neutral tweets.

3.3 Participants

We invited participants using word of mouth and posted a call for participation on popular social media platforms including Twitter, Facebook, and Reddit. We also used emails to reach out to potential participants through listservs at 6 large universities in the US. We selected a total of 14 participants (P1-P14) for our study based on a first-come-first-serve basis. We only selected participants who are currently residing in the United States through screening so that the topics discussed would be pertinent to them. For their participation, we provided each participant with a $15 Amazon gift card.

In the pre-study questionnaire, 7/14 participants used He/Him as their pronouns, 6/14 used She/Her, and 1/14 used They/Them. The average age of participants was $27.43(\pm 6.53)$ years. The average number of years they are living in the US was $6.82(\pm 9.65)$ years. 6/14 participants' political orientation was left, 4/15 participants were central, and 3/14 participants preferred not to disclose their orientation. 6/15 participants spent less than 15 minutes reading political posts on social media, and 4/15 participants spent 15-30 minutes and 30-45 minutes each. When asked about their topic of interest, 7/14 mentioned gun control, 5/14 mentioned immigration, and 2/14 did not have a preference. 8/14 were in support of their chosen topic, 3/14 were against it, and 3/14 were neutral. All 3 oppositions were against gun control. When asked for their reasons to oppose gun control, mentioned safety concerns and second amendment rights. In contrast, participants who supported gun control mentioned mass shootings and a desire to control gun violence in the US. Finally, the participants who supported immigration mentioned its benefits toward cultural diversity and societal contribution.

3.4 Procedure

The study took place online via Zoom. Before the study began, we asked participants to provide us with consent to participate in the study. Each study session began with the participants filling up a pre-study questionnaire that included questions about their age, gender, political alignment, time spent on social media reading about political topics, and preferred topics. After the pre-study questionnaire, we demonstrated Serendyze and its features and functionalities. During this demonstration, we used a dataset containing product reviews with different categorizations to avoid participants from having access to the Twitter dataset used for the study. We allowed participants to ask questions about the tool anytime during the demonstration or the study. They also had access to a tutorial on how to use Serendyze available anytime. After the demonstration, we asked the participants to explore social media posts using Serendyze. We asked them to read the posts for at least five minutes to as long as they wish. They were allowed to stop anytime they wanted after five minutes based on whether they thought they read enough posts or learned everything they had to learn in that session. Participants spent an average of $16.42(\pm 7.11)$ minutes reading social media posts using Serendyze. After they were done reading, we conducted a semi-structured interview with the participants to learn about their experiences of using Serendyze to read social media posts, their input on the tweets they read, whether they found any information interesting, and their feedback on Serendyze as a social media exploration tool. The complete study took an average of $47.51(\pm 5.36)$ minutes to finish.

3.5 Data Collection and Analysis

We collected the pre-study questionnaire responses and audio and video-recorded the study sessions using Zoom's recording features. During the study, we also took observational notes. In total, we collected over 600 minutes of video and audio. The video was transcribed and corrected for errors. We analyzed the collected data using thematic analysis [7]. The first author open-coded the collected data through several rounds of iterations. The research team then performed multiple rounds of discussion sessions to identify patterns and combined them into themes. The themes were verified and finalized by the research team over multiple sessions. The pre-study questionnaire responses, video transcripts, codes, and themes are provided as supplementary materials.

4 Findings

Based on the thematic analysis of the interviews, we identified five main themes presented in Table 1. These themes suggest that while using Serendyze to explore social media posts, participants gradually became more aware of opposing viewpoints, identified interesting and thought-provoking information, and gained insights — otherwise difficult to gain using current social media platforms.

Participants found and became aware of opposing viewpoints. The majority of the participants (11/14) gradually became more aware of the opposing viewpoint while using Serendyze to explore social media posts. Many of them (10/14) mentioned how having a visual categorization of different opinions broken down into for, against, and neutral quickly helped them to understand that the posts are not homogeneous and that the topic has a mix of different

Table 1: This table presents the result of the questionnaire responses from the survey participants. The codes associated with the categories and their description is also presented in the table.

Themes	Example Codes	Descriptions
Opposing viewpoints	opposing argument, other viewpoints, visibility, different viewpoints, downvote	Awareness of the opposing viewpoints
Opinion coverage	all opinions, reasoning, relevant, unbiased, forming opinions, diverse, good distribution	Covering different opinions on a topic
Gained insights	surprising, interesting, didn't think, didn't know, thought-provoking, statistics, exposure	Insights gained from social media posts
Trust and validation	verify, source, news outlet, trusted source, multiple sources, publications, don't trust	Validating social media posts
Enhanced experience	combat bias, variation, a mix of thoughts, fresh, comparison, utility, filter, time-saving	The experience of using Serendyze

viewpoints. One participant (P3) — who explored posts about gun control mentioned, *"So you can see the clear difference between the for and against. The people who are for are more concerned about the safety of themselves and others. And people who are against, they are more concerned about safety and their guns being taken away. [...] I think both sides have fair arguments."*. Another (P8) mentioned, *"While I support gun control, I see how Americans are fearing rising crime rates, and taking away guns from law-abiding owners puts them in danger. [...] Maybe if people are scared about safety, as a government, actions should be taken to increase security."* P13 mentioned, *"You don't really see both sides in social media nowadays. All you get is a flat list of posts, with ads in between. After scrolling for a while it becomes difficult to find the other side of the story because there is really no easy way for casual users to find them. So, you are kind of stuck with one side of the argument."*

Participants sought out more posts to increase their knowledge. When exposed to a post that struck participants' interest, the majority of them (12/14) sought out new information that are relevant both in terms of supporting or opposing the idea. On average, participants read 62 ± 26 posts during their exploration. 9/14 participants mentioned how visualizing the coverage information helped them with this task as they could explore the information beyond what they have learned. 7/14 participants mentioned how the distribution visualization made them perform *"course corrections"* (P11) so that they do not keep exploring one side of the argument too much. For instance, P6 combined coverage and distribution to find new posts — *"The information that's being provided and the way I can hover over the coverage and I see what topics have been covered is great! When was browsing, I mixed that up with distribution. [...] I saw that I read 16 for but only 4 against, so I used the filter to look at more against posts."* P7 mentioned, *"I like the distribution a lot because this is something I try to do when I use social media. I try to get different perspectives from people, especially people who I don't already agree with. I feel like you need to understand the concerns of people you disagree with, even to convince them of your own opinion. Here [using Serendyze], a way to keep track of this really helps."* This suggests that visualizing people's exploration patterns can be beneficial for both those who seek out information explicitly or are willing to explore opposing viewpoints when exposed to them.

Interaction-driven serendipity helped people find new insights. Many of our interview participants (10/14) mentioned how the serendipitous suggestions helped them learn new, surprising, or interesting insights. 7/14 participants mentioned that they found information that did not think about before and 4/14 participants mentioned how these new insights might impact their decision-making in the long run. For instance, P2 mentioned, *"It did open my eyes about a lot of things that I wouldn't have thought. Like, it says California has the strictest gun control but has the most gun violence. That was very interesting because I personally wanted to move to California thinking it was safe like Massachusetts. And you know, you usually have this opinion that Texas is dangerous. So if somewhere asked me yesterday, what state has the most gun violence, I would say Texas or Illinois, but not California.* P1 mentioned how it was important to keep the Serendipitous information balanced, *"It had a variety of posts, which I liked because it shouldn't just be an echo chamber of what you want to see. It should provide a healthy diet of all types of opinions, and I like that about the tool. It did provide me with varied perspectives.* However, 4/14 participants mentioned that they could not find any information that was interesting or new, which could be attributed to a limited dataset of 200 tweets per topic we used or the participants' exposure to the topic of discussion.

People's trust in information from social media posts is mixed. During the interviews, we asked participants about why they trust the information they read on social media and if they have any strategy to validate or verify the information they deem to trust. The response to these questions varied widely from people who would trust anything coming from a source such as a person they like or a news outlet they consider to be truthful (6/14), to people who validate the information across multiple outside sources (3/14), to people who do not trust any information found on social media at all (5/14). One such participant (P4) mentioned, *"I don't. I don't trust any information that comes through tweets. Take tweets for news channels for example. The San Diego shooting [...] I think CNN had like a completely different narrative. They were trying to portray the [shooter] to be a very nice [person] but other sources say that [they] had some problems beforehand, but [they] still manage to do this and no one did anything about it."* Another participant (P10) said he does not consider information from social media posts to be facts — *"So I, do not want to, take them as hard knowledge. I want to take them as knowledge about people's perspectives, not knowledge about the incident."*. On the other side of the spectrum, P2 mentioned, *"Usually, I trust a valid source or a popular account with many followers because that means people agree with them. A valid source could be any major media, I'd say, BBC, CNN, Fox. I like Reddit too, I go to r/politics r/US to get political information."*

Tools like Serendyze can enhance social media exploration. Many participants (8/14) mentioned how tools like Serendyze that promote the serendipitous discovery of information can not only raise awareness of opposing viewpoints but also enhance the social media exploration experience by providing unbiased and fresh perspectives. P14 mentioned, *"I often feel completely lost in social media nowadays. I would see a bunch of posts that are not really interesting but I'd start doom scrolling to find something that would be interesting or unique. But all I see are more bad news. When using this tool [Serendyze], I felt like okay, not everything is bad. There are still good ideas and opinions too. [...] And it goes both ways. Even if you support an idea, you really need to see the other side too. Even if you won't change your mind, at least you know about them."* Another participant (P9) mentioned, *"I'd absolutely use this. You can't find any of these features with current social media and I am not sure easy it will be to add it to these platforms. But if it can be, I think it will help a lot of people to save a lot of time and you also get to know why people are against something that you support."*

5 Conclusion

In this work, we interviewed 14 participants to learn how tools that promote serendipity can enable people to be aware of opposing viewpoints from social media posts on politically sensitive topics. The findings suggest that while using Serendyze, participants gradually

became aware of differing perspectives and discovered elusive new insights. These newly gained insights aided in their understanding of arguments on the topic from various viewpoints, which highlights the potential for such tools in combatting echo chambers. While we do not claim that our findings will be holistically applicable to all political conversations on social media, we argue that using tools such as Serendyze designed to promote serendipity through interaction with posts might be beneficial in enabling people to be more cognizant about different viewpoints.

REFERENCES

[1] Social media outpaces newspapers in the u.s. as a news source, 2018.

[2] E. Alexander, J. Kohlmann, R. Valenza, M. Witmore, and M. Gleicher. Serendip: Topic model-driven visual exploration of text corpora. In *Proc. IEEE Conf. on Visual Analytics Science and Technology (VAST)*, pp. 173–182. IEEE, 2014.

[3] J. An, M. Cha, K. Gummadi, J. Crowcroft, and D. Quercia. Visualizing media bias through twitter. In *Proceedings of the International AAAI Conference on Web and Social Media*, vol. 6, pp. 2–5, 2012.

[4] R. Bhargava, A. Chung, N. S. Gaikwad, A. Hope, D. Jen, J. Rubinovitz, B. Saldías-Fuentes, and E. Zuckerman. Gobo: A system for exploring user control of invisible algorithms in social media. In *Conference Companion Publication of the 2019 on Computer Supported Cooperative Work and Social Computing*, pp. 151–155, 2019.

[5] H. Bisgin, N. Agarwal, and X. Xu. A study of homophily on social media. *World Wide Web*, 15(2):213–232, 2012.

[6] D. M. Boyd and N. B. Ellison. Social network sites: Definition, history, and scholarship. *Journal of computer-mediated Communication*, 13(1):210–230, 2007.

[7] V. Braun and V. Clarke. *Thematic analysis.* American Psychological Association, 2012.

[8] M. Dörk, N. H. Riche, G. Ramos, and S. Dumais. Pivotpaths: Strolling through faceted information spaces. *IEEE Trans. on Visualization and Computer Graphics*, 18(12):2709–2718, 2012.

[9] S. Faridani, E. Bitton, K. Ryokai, and K. Goldberg. Opinion space: A scalable tool for browsing online comments. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '10, pp. 1175–1184. ACM, New York, NY, USA, 2010.

[10] S. Flaxman, S. Goel, and J. M. Rao. Filter bubbles, echo chambers, and online news consumption. *Public opinion quarterly*, 80(S1):298–320, 2016.

[11] K. Garimella, G. De Francisci Morales, A. Gionis, and M. Mathioudakis. Political discourse on social media: Echo chambers, gatekeepers, and the price of bipartisanship. In *Proceedings of the 2018 world wide web conference*, pp. 913–922, 2018.

[12] E. Graells-Garrido, M. Lalmas, and R. Baeza-Yates. Data portraits and intermediary topics: Encouraging exploration of politically diverse profiles. In *Proceedings of the 21st international conference on intelligent user interfaces*, pp. 228–240, 2016.

[13] S. Gupta, A. Karduni, and E. Wall. Belief decay or persistence? a mixed-method study on belief movement over time. In *COMPUTER GRAPHICS forum*, vol. 42, 2023.

[14] E. Isaacs, K. Damico, S. Ahern, E. Bart, and M. Singhal. Footprints: A visual search tool that supports discovery and coverage tracking. *IEEE Trans. on Visualization and Computer Graphics*, 20(12):1793–1802, 2014.

[15] M. Jasim, C. Collins, A. Sarvghad, and N. Mahyar. Supporting serendipitous discovery and balanced analysis of online product reviews with interaction-driven metrics and bias-mitigating suggestions. In *CHI Conference on Human Factors in Computing Systems*, pp. 1–24, 2022.

[16] M. Kaminskas and D. Bridge. Diversity, serendipity, novelty, and coverage: a survey and empirical analysis of beyond-accuracy objectives in recommender systems. *ACM Trans. on Interactive Intelligent Systems (TiiS)*, 7(1):1–42, 2016.

[17] T. Kriplean, J. Morgan, D. Freelon, A. Borning, and L. Bennett. Supporting reflective public thought with considerit. In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work*, CSCW '12, pp. 265–274. ACM, New York, NY, USA, 2012.

[18] J. C. Medina Serrano, O. Papakyriakopoulos, and S. Hegelich. Dancing to the partisan beat: A first analysis of political communication on tiktok. In *12th ACM conference on web science*, pp. 257–266, 2020.

[19] S. Messing and S. J. Westwood. Selective exposure in the age of social media: Endorsements trump partisan source affiliation when selecting news online. *Communication research*, 41(8):1042–1063, 2014.

[20] O. Papakyriakopoulos, J. C. M. Serrano, and S. Hegelich. Political communication on social media: A tale of hyperactive users and bias in recommender systems. *Online Social Networks and Media*, 15:100058, 2020.

[21] E. Pariser. *The filter bubble: What the Internet is hiding from you*. Penguin UK, 2011.

[22] G. Pennycook and D. G. Rand. Fighting misinformation on social media using crowdsourced judgments of news source quality. *Proceedings of the National Academy of Sciences*, 116(7):2521–2526, 2019.

[23] S. Rathje, J. J. Van Bavel, and S. van der Linden. Out-group animosity drives engagement on social media. *Proceedings of the National Academy of Sciences*, 118(26), 2021.

[24] T. Spinde, F. Hamborg, K. Donnay, A. Becerra, and B. Gipp. Enabling news consumers to view and understand biased news coverage: a study on the perception and visualization of media bias. In *Proceedings of the ACM/IEEE joint conference on digital libraries in 2020*, pp. 389–392, 2020.

[25] A. Thudt, U. Hinrichs, and S. Carpendale. The bohemian bookshelf: supporting serendipitous book discoveries through information visualization. In *Proc. SIGCHI Conf. on Human Factors in Computing Systems*, pp. 1461–1470, 2012.

[26] F. Zimmer, K. Scheibe, M. Stock, and W. G. Stock. Fake news in social media: Bad algorithms or biased users? *Journal of Information Science Theory and Practice*, 7(2):40–53, 2019.