

Analysis of silo formation of political thought in social media: special focus on TikTok

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Abstract

This research project investigates the phenomenon of political siloing on TikTok, focusing on the personalized content delivery by the platform's algorithm and the formation of echo chambers. In an era where social media plays a pivotal role in shaping political discourse, understanding how platforms like TikTok contribute to the polarization of political thought is crucial. Through a comprehensive analysis of TikTok users' interactions with political content, this study examines the rate at which the algorithm personalizes content for users and explores how political silo chambers are formed. This paper offers to provide a glimpse at how social media algorithms put us into self-affirmative echo chambers. Drawing upon a combination of data collection techniques and analytical methods, our findings reveal insights into the mechanisms underlying content personalization and the implications for political discourse. The results highlight the need for greater awareness of the potential consequences of political siloing on social media platforms and offer recommendations for promoting diversity of viewpoints and mitigating silo formation and polarization. This research contributes to the broader understanding of the role of algorithms in shaping online discourse and informs strategies for fostering healthier digital environments for political engagement.

Keywords

Echo chamber, personalization algorithm, recommendation system, silo formation, political discourse

Introduction

In the landscape of contemporary digital communication, social media platforms have become ubiquitous channels for political discourse, influencing public opinion[1], mobilizing activism, and shaping public policies and electoral outcomes [2]. Among these platforms, TikTok has emerged as a prominent space where users engage with a wide array of content, including political discussions and commentary[3][4]. However, as social media algorithms increasingly personalize content delivery to users[5], concerns have arisen regarding the potential for these platforms to exacerbate political polarization[6][7] and foster the formation of echo chambers, or "siloes" communities of like-minded individuals[8]. This phenomenon, known as political siloing, has profound implications for democratic societies, as it may hinder constructive dialogue, limit exposure to diverse perspectives, and contribute to social fragmentation[9].

Against this backdrop, this research paper aims to investigate the phenomenon of political siloing on TikTok, focusing on two primary objectives: first, to examine the rate at which the platform's algorithm personalizes content for users who engage with political content, and second, to explore how these personalized algorithms contribute to the formation of political silo chambers within the TikTok community. By shedding light on the mechanisms through which TikTok's algorithm shapes users' exposure to political content and the resulting impact on ideological segregation, this study seeks to contribute to a deeper understanding of the dynamics of online political discourse.

Drawing upon insights from existing literature on social media algorithms, political polarization, and echo chambers, this research employs a mixed-methods approach, combining quantitative analysis of user interactions with political content on TikTok with qualitative examination of the characteristics of political silo chambers within the platform. Through data collection by creating bots based on survey on human social media usage behaviors, this study endeavors to offer nuanced insights into the complex interplay between algorithmic personalization, user behavior, and the formation of digital echo chambers.

By explaining the mechanisms through which political siloing occurs on TikTok, this research seeks to inform strategies for promoting diversity of viewpoints, fostering informed civic engagement, and mitigating the negative consequences of ideological segregation in online spaces. In doing so, this study contributes to a broader understanding of the role of social media platforms in shaping political discourse and offers valuable insights for policymakers, plat-

form developers, and users seeking to navigate the complex terrain of digital democracy.

Background

What is TikTok?

TikTok is a hugely popular social media platform that shows users an endless string of short form videos. It uses advanced and highly secretive artificial intelligence algorithms to get an intimate estimation of the user’s profile, likes and dislikes so that it can recommend the most engaging content and engage users into using the app for maximum amount of duration. With over a billion downloads on multiple platforms and some million monthly users[10], TikTok has become a global phenomenon, and has an outsized influence on many people. The widespread penetration of TikTok in our society opens the opportunity for TikTok to have huge influence on political discourse around the world[11].

TikTok collects device data, keeps track of user interactions on its platform such as likes, comments, shares and a host of other user information [TikTok’s Privacy Policy] to inform its algorithm in order to personalize the contents suggested to each user. They use these collected data as a feedback to personalize their video suggestion algorithm automatically[12].

TikTok has published different versions of the app across the world. Each country might have different versions of the app, and there could be different versions of the app within a particular country. The versions could be different based on location, the type of device it is being used on, and whether the latest version is downloaded or not. The differences in each version could be features, security updates and content policies. The personalization algorithm that TikTok uses is also different between some countries[13]. However, investigating these differences between the algorithms and features of different versions is not the focus of our study. Therefore, we ran the bots in the following controlled conditions: location (Montreal, Canada), browser(Chrome version=124), operating system(Windows 10), language preferences (English) and made sure the bots were using the latest TikTok version(from April 2024).

The latest version of TikTok in Canada has 5 pages. There are mainly 6 different ways users can interact with a short-form video on this platform(clicking on tags, clicking account names, clicking on like, comment, save or share buttons). All types of interaction with the apps affects the personalization algorithm. We have restricted the bots to visiting only 2 different types of pages

and interacting with a video in 2 different ways (clicking on Like and/or save buttons).

The *For You* feed on TikTok is adapted to what users watch over time. When clicking on the search bar, the search bar section suggests past searches, and also suggests some popular searches. The main focus of our study is to investigate how the videos suggested in the *For You* page for an entity with mainly political interests changes over time.

Survey Experiment

0.1 Purpose

We conducted a survey to investigate some TikTok user behaviors. The survey was done so that we can collect data of TikTok usage behaviors on our target population (16-29 years old, currently residing in Montreal), so that we can code the scroll and scrape algorithm based on human TikTok usage behaviours. The survey experiment also allowed us to cross reference the survey results with the data that we collected after running our bots to see if our hypothesis and investigation results match with ground reality. The results of the survey helped us get new insights as well related to the social media usage behaviors and political silo situation on the platform.

0.2 Survey Questions

The survey contained 14 questions and was arranged into three key sections to gain a comprehensive understanding of TikTok user behaviors within our target population (16-29 years old, residing in Montreal):

Demographics: In this section, we collected basic demographic information such as age, gender, nationality, and ethnicity. These data points allowed us to categorize respondents into distinct groups, enabling detailed analyses to determine how user behaviors vary across different demographic segments. We did not use these demographic information to code our scraping algorithm, since our study did not focus on investigating the differences in political silo formation across genders or ethnicities. However, understanding these demographic factors is critical for interpreting TikTok usage patterns in the broader context of user diversity.

TikTok Usage Behaviour: The second section explored respondents' self-reported usage patterns on TikTok. It covered various aspects, including the

frequency of platform use, common user practices (such as the use of specific features, and interactions with content), and the level of engagement with different topics. This section provided us with a deeper understanding of how users navigate and interact with TikTok, which proved instrumental in developing our web scraping algorithm to simulate typical usage behaviors.

Content Preferences and Recommendations: In the final section, respondents had the opportunity to share their content preferences and offer recommendations relevant to our study. By asking about favorite creators, trending tags, and recommended content, we gained valuable insights into the content types that resonate with users. This feedback not only helped us understand the current trends within TikTok’s ecosystem but also offered a glimpse into the topics and narratives that contribute to the formation of social media echo chambers.

Together, these three sections provided a comprehensive overview of TikTok user behaviors in our target demographic, enabling us to draw meaningful conclusions about the platform’s usage patterns and the potential for content siloing. This information was crucial for guiding the design and focus of our study on social media usage and political siloing.

0.3 Survey Results

The survey was mainly distributed amongst McGill University undergraduate students. We collected 140 responses. Through data cleaning using Python Data Analysis, and after removing responses from under-represented genders and age groups, the final dataset retained 127 relevant responses.

Based on the analysis of these responses, we gained valuable insights into TikTok usage patterns, informing the design of our web scraping bot and revealing trends in user behavior. Here is a summary of key findings from the survey:

Demographics: We segmented ages into the four following groups: Youth (up to 19 years), Young Adults (20 to 29 years), Adults (30 to 64 years), and Seniors (65 years and older). The majority of respondents fell into the Young Adult category, accounting for 84.25%, while the Youth group comprised the remaining 15.75%. Since the Adult and Senior cohorts were below our minimum threshold of 15% representation, their data was excluded to ensure accurate analysis.

In terms of gender demographics, most respondents identified as female,

representing 68.5% of the sample, while males made up the remaining 31.5%. The respondents were from diverse nationalities and ethnicities.

It is worth highlighting that our sample primarily consists of young individuals of both genders, with a significant range of nationalities. The most defining demographic characteristic is age, with all respondents being 29 years old or younger, which matches with the target population of this study.

TikTok Usage Frequency: An overwhelming majority of 85.04% of the participants reported using TikTok at least once a day, indicating high levels of engagement with the platform amongst our respondents. The remaining 14.96% stated that they use TikTok at most once a week, suggesting a significant difference in usage patterns among a smaller subset of users.

Entry Points and Popular Pages: Upon opening the TikTok app, 85.83% of the respondents indicated that they first entered the "For You" page, underscoring its importance in the TikTok experience. Other entry points included "Following" (4.72%), "Friends" (3.94%), "Discover" (1.57%) and "Search bar" (3.15%). Notably, 87.4% of participants found recommendations on the "For You" page interesting at least often, reinforcing its importance in content discovery.

How often do you see content related to your interests in the For You page?

140 responses

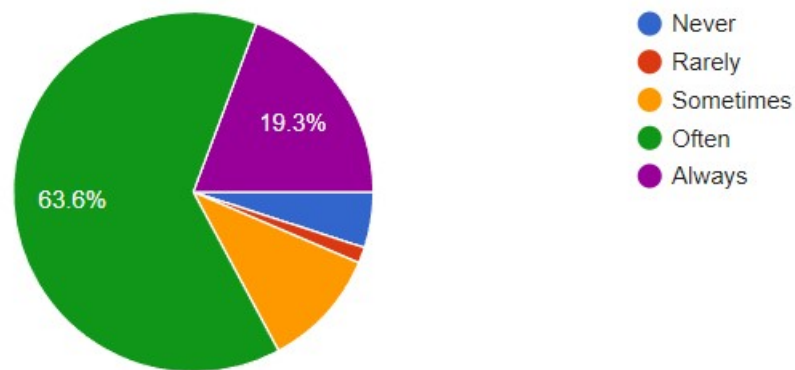


Figure 1: Piechart of survey responses of question on For You page

Video Consumption Habits: Regarding video consumption per account visit, the majority of users (74.80%) reported viewing between 1 and 5 videos, while 23.62% watched up to 10 videos. A smaller fraction of 1.57% rarely viewed videos from individual accounts. This suggests that most users engage with a

moderate number of videos during each session.

Engagement with Different Features: In terms of engagement with specific TikTok features, the *For You* page remained the main hub of activity, with 89.66% accessing it at least often. The *Search bar* was used at least sometimes by 76.38% of users, indicating that many users conduct searches but often return to the *For You* page. This behavior is reflected by the fact that 76.38% of users reported returning to the *For You* page after conducting a search, suggesting that users often prefer the platform’s algorithm-driven recommendations over manually searching for content.



Figure 2: Responses on the actions conducted after using search feature

Regarding interaction with other features, 59.06% of users consistently liked videos, while commenting, following, and indicating disinterest were less common activities. Only 40.94% expressed disinterest in videos at least occasionally, indicating that many users tend to engage positively with content. Furthermore, the usage of the refresh feature varied, with 4.72% always refreshing, and an additional 20.75% doing so often.

User Viewing Preferences: The survey results revealed a diverse range of viewing preferences among TikTok users. While many users exhibited non-viewing habits across topics such as conspiracies (92.91%), sports (84.25%), eating habits (78.74%), and politics (76.38%), others showed strong interest in content related to entertainment (67.72%), memes (65.35%), and food (57.48%). We used the responses from this question to gauge people’s interest in topics other than politics, so that we can include some of these interest topics in the interest list of each bot alongside political tags and creators. This was done as

users in real world usually are interested in watching more one topics on social media platforms.

Recommendations: We received a variety of recommendations on the political topics, hashtags and accounts that the survey respondents see and interact with on TikTok. We used these responses to create the list of interests for each bot, so that the preferences of the bots are based on the preferences and watch history of real users.

These results provided a comprehensive overview of TikTok usage and engagement patterns among our target demographic, shedding light on how different features and topics influence user behavior. The data points to the "For You" page's centrality in the TikTok experience, varied user engagement with features, and distinct preferences for content genres, which can inform the development of algorithms and strategies to better understand and address the impact of social media on user behavior.

0.4 Comparison of survey responses across genders

Given the considerable differences in responses between genders, with 68.50% identifying as female and 31.50% as male, we conducted a quantitative analysis to examine the potential differences in the survey responses by gender. This gender comparison analysis aimed to identify statistically significant variations in user behaviors. Although the results of this analysis were not used to inform the development of our TikTok scraping algorithm, we were nonetheless illuminated with key insights on usage behaviours across genders, and the results can be used for future investigation into this matter.

Our analysis began with a t-test with a significance threshold of 0.05, comparing the average ages of male and female respondents. The results did not indicate significant differences in age between the two groups, providing a consistent baseline for further gender comparisons. This uniformity in age distribution meant that any differences observed in the survey responses would not be confounded by age-related factors.

To investigate gender-based variations in other survey responses, we used a chi-square test of independence, ideal for analyzing categorical data and exploring relationships between gender and other categorical variables in the survey. This analysis revealed some intriguing trends and significant differences, as well as areas where gender had no noticeable impact.

In particular, there were no significant gender differences in several key ar-

eas, such as interest in content, frequency of video consumption per account visit, overall platform usage (excluding the "Friends" page), and most video engagement actions (excluding page refreshes). Furthermore, there were no significant differences in engagement with most content topics, with the exception of entertainment, pets, and gaming content.

However, some gender-based disparities emerged in TikTok usage patterns. Female respondents were more likely to visit the "Friends" page compared to male respondents. Similarly, women used the search bar more frequently, often engaging in consecutive searches and continuous scrolling, while men used it less frequently. Additionally, a marked difference was observed in the use of the refresh feature: most males rarely or never used it, while females were more likely to use it often.

These findings suggest that while some areas of TikTok usage exhibit notable gender differences, many others do not. These insights contribute to our understanding of gender-specific usage behaviors on TikTok and could guide further studies into how gender influences social media interaction.

Algorithm

At first, we manually registered TikTok accounts for the purpose of using these new accounts to run our scroll and scrape algorithm and see how the personalization algorithm works based on our script for accounts that have newly joined TikTok. We stored the account information (TikTok user name, password, age and date of birth) of the bots in a json file. The age that we used to create the bots were sampled from the survey and was within our target population (ages 16-29). In this json file we also added properties such as interests (which stored lists of some TikTok accounts and tags specific to each bot that it used while running the search algorithm of our script) and a watch count list to keep track of the total number of videos the bot stopped to watch and the total number of videos scrolled through in the bot account. We decided to investigate the TikTok algorithm within the accounts we created so that we did not lose the progress of the personalization algorithm after each session.

```
1 "botA1": {
2     "account_password": "justice2023!",
3     "age": "16",
4     "user_name": "brian.waters5",
5     "dob": "05/20/2007",
6     "interests": {
7         "creators": ["cbc","cnn","bbc","aljazeera",
8             "nytimes","washingtonpost","reuters"
9         ],
10        "tags": ["#waringaza","gaza","#genocide",
11            "politics","iran","hamas",
12            "#freepalestine","#genocideingaza","memes"
13        ]
14    },
15    "watch_num": [
16        0, // total number of videos watched
17        9 // total number of videos scrolled through
18    ]
19 }
```

Listing 1: bots.json

We created a login script where it grabbed the TikTok account name and password of a specific bot from the json file, starts a browser session and automatically logged into the TikTok account. TikTok often asks users to solve a puzzle before allowing users to log in on its platform. We encountered three different kinds of puzzle during the login process. We used a third party API [flyCaptcha by reversecoders] to solve the puzzle during the log-in process. We also created a separate login script which allowed us to solve the puzzle manually in case the API does not work. Once the bot logs into its TikTok account,

it runs the *scrapper.py* script. This file contains the code that controls the rest of the bot activity.

We created a python video module [*video.py*] to keep track of all the data related to each video (account name, music name, number of likes, comments, and saves, video tags found on the video and the TikTok URL to the video) that we collected and stored in a csv file [*videos.csv*].

```
1 class Video:
2     def __init__(self, creator, music, likes, comments, saved, tags,
3         date_watched, video_url):
4         self.creator = creator
5         self.music = music
6         self.likes = likes
7         self.comments = comments
8         self.saved = saved
9         self.tags = tags
10        self.date_watched = date_watched
11        self.video_url = video_url
12
13    def save_to_csv(self, filename):
14        with open(f'video_watch_info/{filename}', 'a', newline='', encoding=
15            "utf-8") as csvfile:
16            fieldnames = ['creator', 'music', 'likes', 'comments', 'saved',
17                'tags', 'date_watched', 'video_url']
18            writer = csv.DictWriter(csvfile, fieldnames=fieldnames)
19            writer.writerow(
20                {'creator': self.creator, 'music': self.music, 'likes': self
21                    .likes, 'comments': self.comments,
22                    'saved': self.saved, 'tags': self.tags, 'date_watched':
23                    self.date_watched, 'video_url': self.video_url})
```

Listing 2: code snippet from video.py

We traverse the TikTok platform in two of the following way:

1. Scroll the For You page
2. Decided on one of the following actions, such as refreshing page, using the search bar to search for specific terms and scrolling through the search features, or continuing to scroll on its current page

The bot begins by visiting the For You page and starts scrolling through the recommended videos on the page. Then, the bot either refreshes the page to see new suggested videos(19% of the time), or enters a tag or an account name on the search bar from its list of preferred tags to visit the Search page (24% of the time), or it continues to scroll on its current page. If the bot reaches the Search Page, it either scrolls through the videos suggested on the page(17%), uses the search bar again to enter a new search term from its list of interests (7%), or returns to the For You page(76%).

Bot Diagram

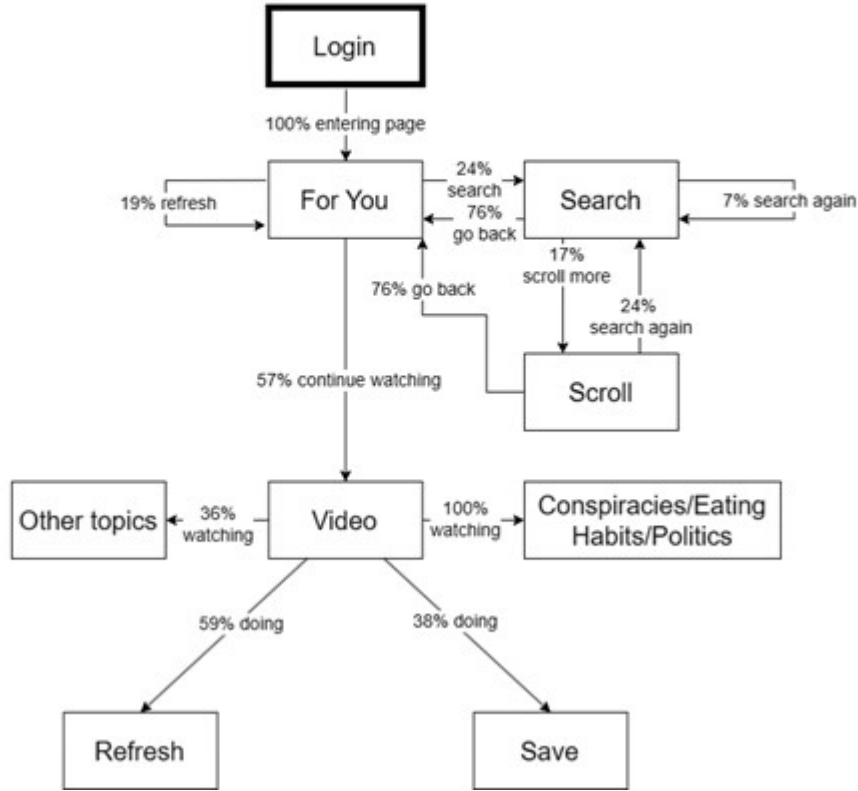


Figure 3: Diagram detailing the action plan of the bot algorithm

When it comes across one of the recommended videos, it retrieves the duration of the video, along with the tags and other information related to the video (such as account name, like, comment, save counts), and saves all the information in a csv file. If any of the retrieved tags or account name is present among the list of preferred tags and accounts of the bot, it stops to watch the full duration of the video. This shows that the bot is mainly interested in watching videos of specific interests. Otherwise, it scrolls down to watch the next recommended video. When the bot decides to watch a video, there is 60% chance of clicking the like button, and 30% chance of clicking on the save button. This is to mimic the interaction of humans with their preferred content on social media. The probabilities used to determine the actions of the bot are based on our survey results.

Each bot has a distinct list of creators and hashtags that is set as their preferences. The lists were curated from survey responses and from most popular political topics found on TikTok over the month of April. We have decided to

categorize the bots into three different categories based on their list of preferred hashtags and creators: *Left-wing politics*, *Right-wing politics*, *Non-politics*.

We have run three bots, each with three different set of interests mentioned in the table below. However, each bot used the same login script and algorithm that controlled their actions on the TikTok platform.

"Left-wing politics"	#waringaza, #gaza, #politics, #freepalestine, #genocideingaza, liberalpolitics, feminism, @cnn, #memes
"Right-wing politics"	#trump, @trumpofficial, "conservative politics", @foxnews, "conservative party", "pierre poilieve" #dance
Neutral	#fyp, #dance, #movies, "popular music", "Taylor Swift", "gaming"

Table 1: Lists of interest hashtags and creators for each bot subgroup

The scraper algorithm of each bot runs within an indefinite loop until manually terminated, gathering data from fully watched videos. Finally, we used the findings to assess whether the frequency of videos with preferred tags watched has increased over time.

The code, images and survey data analysis jupyter notebooks can be found in this GitLab repository.

Results

Three bots were used in this experiment. Each of the bots ran in three different sessions, each session lasting around 25 minutes. During the experiment, we have collected the data of the videos watched by each bot, the total number of videos each bot stopped to watch based on its list of interest tags and creators, and the total number of videos each bot scrolled through. The results of the experiment are shown in the table below:

Bot	Interest group	Session no.	No. of videos watched	Total number of videos scrolled	Number of searches	videos watched/ total videos scrolled
A1	Left-wing	1	18	156	15	11.5%
A1	Left-wing	2	23	164	18	14.0%
A1	Left-wing	3	19	158	13	12.0%
A2	Right-wing	1	18	128	16	14.1%
A2	Right-wing	2	21	130	13	16.1%
A2	Right-wing	3	20	120	14	16.7%
A3	Neutral	1	32	140	18	22.8%
A3	Neutral	2	48	156	17	30.8%
A3	Neutral	3	56	148	17	37.8%

Table 2: Results of running the scrolling algorithm for each bot

The bot in the *left-wing* subgroup did not show any increase in the percentage of number of videos watched by the end of third session, indicating that the number of recommended videos that matched the account’s interests did not increase over time, which means the the recommendation algorithm did not personalize yet based on the account’s interests.

The bot in *Right-wing* political subgroup showed a small increase in the percentage of videos that the bot stopped to watch based on its list of preferences. However, the increase is not significant and does not sufficiently indicate that the recommendation system has personalized for the particular account. In addition, it is very important to note that most of the videos that both the bots in left-wing and right-wing political subgroups watched were during scrolling through the search results, indicating that these two bots found very few videos that matches their interests while scrolling in the For You page.

The percentage of videos the *Neutral* bot stopped to watch increased over each session. In addition, the percentages in each session is larger compared to that of the political bots. This indicates that the algorithm for the neutral bot account got personalised over time, and more videos that were recommended

matched with the neutral account’s interest tags and creators, compared to the political bots.

The reasons for not enough personalised videos recommended to the bots in political subgroups could be several. It is apparent that the bots did not spend enough time in the platform, and did not scrolled across enough recommended videos. In addition, the list of hashtags and creators is probably not large enough.

The comparison between the results between bots with political interests and the bot with non-political interests might indicate that TikTok does not readily recommend political content to new users on its platform, in contrast to content related to entertainment and some other non-political categories being shown to new users in more volume. However, in order to assert this claim, the number of bots used in the experiment needs to be increased, since the contents shown by the recommendation system can vary across different accounts, and only one bot was run in each subgroup due to time constraints.

Conclusion

The primary objective of this research was to explore whether the TikTok recommendation system has the potential to silo users into content that promotes very specific political views. To simulate a real user experience, we designed web-scraping bots that reflected the patterns observed in our user survey results. However, our experiment faced several challenges in accurately replicating human behavior on the platform, which may have impacted the results.

A notable limitation was the difficulty in simulating human interactions with TikTok content. Unlike our bots, human users can visually assess and determine if a video aligns with their interests without relying solely on hashtags or creators. This inability to replicate such nuanced behavior could lead to significant differences between bot interactions and actual user experiences. Additionally, the time constraints of our experiment—three sessions of 25 minutes each for each bot—might not have been sufficient to establish clear siloing patterns based on specific interests. Given more time, the algorithm might have shown a more defined trend in recommending political content, allowing for better analysis of potential siloing effects.

Despite these limitations, our results indicated that while the bots with political interests (left-wing and right-wing) did not show significant increases in personalized content over time, the neutral bot gravitated toward entertainment

and viral trends. This suggests that TikTok might not aggressively recommend political content to new users, focusing instead on broader, non-political topics.

Although the project did not produce conclusive evidence of TikTok’s tendency to silo users into specific political views, the findings suggest that the platform may be more inclined to recommend general, trending content to new users, potentially delaying the onset of siloing for those seeking politically charged material.

Overall, this research contributes to the ongoing conversation about the role of social media algorithms in shaping user experiences and political discourse. It also sheds light on the complexities of replicating human behavior in a digital environment. While the experiment’s results were inconclusive, they provide valuable insights into how TikTok’s recommendation system operates and suggest areas for further investigation. Future work could involve extending bot runtime, enhancing behavioral simulation, and incorporating a broader range of interests to achieve a more accurate representation of user experiences. The research underscores the need for platforms to promote diverse viewpoints and suggests that more extensive studies are needed to explore how content recommendations can impact political polarization on social media.

Future Work

The actual scope of this research project is far beyond the limited amount of questions asked and the issues investigated in this report. This paper aims to investigate and understand the basic principles of silo formation in social media, and the code and results from this project can be used to investigate various aspects of social media algorithms. Due to limited timeframe, I was able to run very few bots. Thus, the result and accuracy of this project can certainly be improved, by increasing the number of bots and the time spent by each bot to probe the algorithm. Thus, to get a more accurate idea of the silo formations in TikTok, more bots need to be used to probe the TikTok algorithm. Many of the variables that might affect my investigation can also be expanded to get a more accurate and general idea of the TikTok algorithm, such as increasing the age range of the bots, running the bots from more locations. This project can be used as a basis to investigate the contribution of each feature/data point of the app to the personalization algorithm. The code for this project can very easily be refactored to investigate the silo formation of any other popular topic in social media as well.

A similar research plan can also be followed to investigate personalization algorithms and silo formations on other popular social media platforms. Although the focus of this paper is solely on the formation of echo chambers in social media, the algorithms and results of this study can be used to better understand the inner workings of the personalization algorithm used in the application itself. The results of running the bot algorithm can also be used to investigate the claim of increasing the polarization of political content as the TikTok recommendation system becomes more personalized[7].

This project will also open new avenues for investigating important questions on the impact of social media on political discourse in the physical world.

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