Private Sharing of Public Content on Facebook

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Abstract

In many social networks, there are public and private spaces (e.g. public Facebook pages/groups, and private groups). Content could start spreading on private spaces and spill over to the public parts (or vice versa). Previous studies have acknowledged the potential for content to transition between public and private domains, but a quantitative assessment of such spillover has been lacking. In this paper, we obtain aggregate counts of shares in public and private spaces on Facebook. By comparing the ratio of private shares to the total shares of a piece of content, we provide a first look at information dynamics in private spaces, and to what extent researchers might be missing data if focusing only on public parts of a social network. Through data collected from a diverse set of sources, our study reveals that a significant portion of prominent news content is shared within private networks. By examining this ratio across a diverse range of news topics and social media platforms, the study provides valuable insights into the sharing dynamics of news content.

The findings reveal nuanced patterns in private sharing behavior across different types of content and sources. We observe significant disparities in private-to-public share ratios between mainstream news outlets and biased or fringe sources. Over half of the shares from mainstream news sources occur in private spaces, indicating their critical role in shaping public discourse. There's a considerable variance in private sharing across content categories; while entertainment and sports are mainly shared publicly, content relating to identity groups and topics prone to misinformation–such as vaccines and abortion–are often shared privately. These insights emphasize the significant role of private networks in the dissemination and perception of various types of information, thereby highlighting areas that may be underexplored in existing research focused solely on public sharing. It also emphasizes the necessity for researchers to understand and adapt their results to the scale and significance of private sharing.

1 Introduction

In social media, the dichotomy between public and private spaces presents a compelling and yet largely unexplored frontier for research. Platforms such as Facebook, with its sprawling public pages and groups, offer an enormous treasure trove of data, rich in its potential to inform everything from marketing strategies to policy decisions. However, these public spaces are merely the tip of the iceberg. Beneath the surface lies an intricate web of private interactions–closed groups, direct messages, and personalized feeds–that are largely inaccessible to external researchers but are equally, if not more, influential in shaping public opinion and discourse. Such monopolistic information access effectively marginalizes external stakeholders, including researchers, journalists, and civil society organizations to partial vistas, often mediated through APIs.

The absence of a robust, quantitative understanding of these private spaces is not merely a gap in academic literature; it's a gaping hole in our understanding of contemporary society. The dynamics of private sharing are critical in shaping real-world outcomes, from elections to public health. For instance, while public forums are instrumental in the mass dissemination of information, the discussions and content sharing that happen in private spaces often form the bedrock of individual opinions. Whether it's the spread of misinformation, the organization of social movements, or the propagation of hate speech, the private spheres play an indispensable role.

Addressing this complex issue is fraught with both technical and ethical challenges. On the ethical front, privacy laws such as the General Data Protection Regulation (GDPR) in Europe and the California Consumer Privacy Act (CCPA) in the United States set strict parameters on what data can be collected and how it can be used. These limitations are more than just legalities; they touch upon deeply rooted ethical considerations around user consent and data ownership. Technological constraints further complicate the matter. Unlike public spaces, where APIs often provide a wealth

of data, private spaces are closely guarded, accessible only to platform owners and thereby excluding external scrutiny.

The challenge is compounded by a misalignment of incentives between social network providers and external researchers. Platforms have little to gain and much to lose by opening up their private spaces to public scrutiny. Whether it's the risk of exposing vulnerabilities that could be exploited by malicious actors or simply the fear of bad press, the gatekeepers of these platforms have historically been reluctant to provide the level of access that a comprehensive study would necessitate.

The limitations of existing research tools have further constrained the scope of prior work. Tools like CrowdTangle, for example, focus exclusively on public interactions on Facebook, providing a skewed representation that fails to account for the complexity and nuance of human interaction on social media platforms. Previous academic focus has been disproportionately aimed at more transparent platforms like Twitter or Reddit, where public data is more readily accessible. This has resulted in a lopsided, incomplete understanding of social dynamics online. There are probably thousands of studies using Twitter and Reddit data and hundreds using CrowdTangle, the only source to study Facebook.[1]

Our research aims to break new ground by studying the prevalence of public content shared in private spaces. Utilizing CrowdTangle, we obtain aggregated metrics on private interactions of public content, such as URLs of news articles. We furnish, for the first time, quantitative metrics elucidating the scale at which identical pieces of information permeate both public and private networks. Public counts are sourced directly from CrowdTangle and represent interactions on public pages and groups. Private counts, on the other hand, encompass all other Facebook interactions, even extending to private shares via Facebook Messenger. These private counts are accessed via CrowdTangle's browser extension, CrowdTangle Link Checker [Fac23].

The main metric we are interested is the ratio of counts of content shares privately vs. publicly, i.e., the ratio of private shares to total shares (public + private) for various content types. Through this metric, we offer insights into the dynamics of private sharing of various types of URLs. Our study conducts a nuanced examination of URL sharing from a diverse array of news sources. This encompasses mainstream outlets such as The New York Times, biased publications like Breitbart, low-quality websites known for propagating fake news, as well as personal blogs hosted on platforms like Substack. Additionally, we incorporate popular content from other social platforms, specifically WhatsApp and YouTube, to offer a more comprehensive view. To capture temporal shifts in sharing behavior, our analysis also includes longitudinal data, allowing us to track how these trends evolve over time.

Our findings reveal stark disparities in the sharing behavior across different types of content and sources, from mainstream news outlets to fringe groups. Over 50% of shares from mainstream news outlets occur in private spaces, while a majority of shares from low-quality sources are also confined to these hidden networks. Moreover, we find that content popular on other platforms, such as WhatsApp, is mostly shared privately on Facebook. Content related to identity groups and conspiracy-prone topics is predominantly shared privately, emphasizing the role of these secluded spaces in forming public opinion on sensitive issues.

Our findings illuminate the pivotal role of private spaces in shaping public discourse, challenging the current research focus on public data. This calls for a reevaluation of existing methodologies and has significant implications for policymakers and social media platforms. The dynamics uncovered in our study should inform both regulatory frameworks and algorithmic design to more accurately reflect the nuanced ways information spreads–whether reliable or misleading. We aim to catalyze further research in this area, guiding policy and ethical considerations for data collection and usage.

2 Background and Datasets

2.1 Private content on Facebook

We first define what private content actually means on Facebook. CrowdTangle is a 'public insights tool from Meta that makes it easy to follow, analyze, and report on what's happening with public content on social media.' According to the FAQ page,[2] "CrowdTangle tracks influential public accounts and

[1] The exact number of studies using datasets from these platforms maybe hard to count, but just to get a sense of the scale, using Google Scholar for search terms related to Twitter/Reddit/CrowdTangle return thousands of hits.

[2] https://help.crowdtangle.com/en/articles/4201940-about-us

groups across Facebook, Instagram, and Reddit, including all verified users, profiles, and accounts like politicians, journalists, media and publishers, celebrities, sports teams, public figures and more. ... CrowdTangle does not track any private accounts. ... CrowdTangle's database currently includes (on Facebook): 7M+ Facebook pages, groups, and verified profiles. This includes all public Facebook pages with more than 50K likes (automated via API), all public Facebook groups with 95k+ members, all US-based public groups with 2k+ members, and all verified profiles." On top of this information, users can add public pages and groups (of any size) manually and retrieve all the messages shared in these pages/groups. Once any CrowdTangle user adds a page/group, it becomes indexed and searchable for all other CrowdTangle users. However, there is no catalog of which pages were added by the user and which were included by default according to CrowdTangle's definition of 'public' content (defined in the previous sentence).

So to be conservative, it might be safe to assume that content not present on CrowdTangle, which we define as 'private content' is content shared in public pages which have lesser than 50k likes, public groups which have less than 95k members, private pages/groups, individual accounts, and on direct messages sent through Facebook Messenger. The data we obtain from CrowdTangle link checker [Fac23], which contains private counts is defined as "... the number of interactions (including reactions, comments, and shares) that a link has received in all of the Facebook posts that have linked to it. This number is NOT limited to CrowdTangle data, and includes all Facebook posts that have linked to this URL, whether public or private."[3]

2.2 Datasets

To concretely understand how information is shared publicly and privately, we collected a wide range of datasets, spanning popular news sources, content covering different topics, from multiple platforms and spanning a wide time frame. Each dataset is a collection of URLs covering a different context. For each dataset, we used the CrowdTangle API[4] to obtain the public share count and the CrowdTangle Link Checker Chrome extension [Fac23] to obtain the total share count (including the public and private count).

Our unit of analysis is a web link, primarily because links offer a standardized and easily trackable form of content. Furthermore, using links aligns well with CrowdTangle's API capabilities, thereby ensuring compatibility and ease of data retrieval. Opting for links as the unit of analysis is thus both a practical and a methodological decision, facilitating streamlined and accurate data collection.

COVID News. Our first dataset contains COVID News obtained from a news aggregation company Aylien,[5] and is a comprehensive collection of articles sourced from an archive of 1,673,353 articles from 440 global news outlets–predominantly from the US and UK. The dataset spans from November 2019 to July 2020, including the peak COVID surge, offering a critical window for examining the dynamics of COVID-related information flow. To enhance our analyses, the dataset comes pre-enriched with extracted entities and sentiment data. We randomly sampled 20,000 articles from this corpus in this study. This dataset has been widely employed in recent research, validating its significance and utility [DMML23, HMC+21, AGP+17].

Mainstream News. To robustly investigate the interplay between political orientation and private sharing behaviors, we collected data from four mainstream news sources spanning the political spectrum: New York Times (center-left), Fox News (center-right), Breitbart (right), and Newsmax (far-right). The choice of these outlets enables us to study the relationship between an outlet's political leaning and the likelihood of its content being shared privately. For each website, in December 2022, we obtained the sitemap and obtained a list of all the URLs published by these websites during that month, which gave us a total of 28,332 URLs.

Huffington Post. To study longitudinal trends in private sharing, we obtained a large dataset of 210,000 URLs from Huffington Post [MG21], spanning from 2014 to 2021. Apart from the urls, the data includes the categories the news belongs to, such as politics and entertainment, providing us the opportunity to explore how different subject matters exhibit unique sharing behaviors over an extended period. The comprehensive timeframe and diverse content categories enrich our COVID-19-focused insights with a more generalized understanding of information-sharing dynamics. We sampled 20,000 URLs at random for the study.

[3] https://help.crowdtangle.com/en/articles/2566227-the-crowdtangle-chrome-extension
[4] https://github.com/CrowdTangle/API/wiki
[5] https://aylien.com/resources/datasets/coronavirus-dataset

Low-Quality Sources. We also included data from low-quality news sources, often sharing rumors and misinformation. We sourced this data from a list of one million URLs from [HD23] identified as unreliable by Media Bias Fact Check.[6] From this extensive list, we randomly selected and analyzed 10,000 URLs. This dataset is a good contrast to the earlier datasets from mainstream sources and enables us to examine the extent to which such unreliable information permeates both public and private sharing networks.

Fact-checking. The primary solution we currently have to misinformation is prominent fact-checking websites like Politifact and Snopes. While fact-checking serves as a common tool for debunking rumors and false information, the actual reach and consumption patterns of these fact-checked articles remain under explored. Specifically, there's a gap in understanding whether these articles are shared privately by users or mainly disseminated through top-down broadcasts by the fact-checking organizations themselves. To address these questions and gain insights into the extent to which fact-checked information is shared privately, we scraped a list of all fact-checks published in December 2022 from Snopes and Politifact, the most prominent fact-checking agencies in the U.S.

Social media. To grasp the complexities of information sharing across diverse platforms, we extend into the realms of both mainstream social media and emerging alternative media. Specifically, we delve into cross platform content sharing, capturing dynamics that transcend individual platforms. From WhatsApp, we collected content that was 'forwarded many times' from [GNV23], which gave us 128 URLs which were viral on WhatsApp.[7] From YouTube, we scraped trending URLs from YouTube's Trending page[8] daily in December 2022 which gave us 2,210 URLs which were popular on YouTube. We also obtained the top 2,000 URLs which were most shared on Reddit using the COVID news dataset. Analysis on this dataset reveals whether content that gains prominence on one platform is similarly shared on others, thus providing insights into the universality or specificity of information dissemination behaviors across platforms. This is particularly interesting given the different affordances of the platforms – WhatsApp being a private chat network, YouTube being an open content sharing network and Reddit being a completely open social network.

Substack. Complementing this, we also examine the burgeoning role of Substack in shaping public discourse. Substack, a platform that empowers individual authors to connect directly with their audiences, has been rising in influence, especially for voices that diverge from mainstream narratives [Ore21, Fis22]. We obtained the top 20 authors on the politics leaderboad[9] and scraped up to 100 articles from each substack. This includes prominent and controversial journalists such as Aaron Rupar, Glen Greenwald and Matt Taibbi, along with anti-vax proponent Alex Berenson, thus helping us understand how such alternative narratives are shared privately on Facebook.

In summary, our dataset is a collection of diverse, multi-dimensional data sources, each chosen to address a specific facet of our research questions. From the urgency of pandemic-related news to the ideological leanings of mainstream media, from non-credible sources, fact-checking agencies to the alternative voices in platforms like Substack, our datasets aims to provide a holistic, 360-degree view of the complex landscape of private information dissemination on Facebook.

2.3 Data Integrity and Validation

. In the course of our study, we identified a few challenges pertaining to data integrity and validation, particularly arising from limitations in the CrowdTangle API, which occasionally returned inaccurate counts. These were mostly cases where the total shares (public + private) were lower than the private shares. To address these inconsistencies, we consulted with CrowdTangle support and referred to their help center resources [Cro22], which advised treating such counts as 'directional estimates' that are generally reliable, but not guaranteed. The support staff indicated that these stats come from different databases, and sometimes due to technical issues syncing between the databases for certain URLs, the counts might not be totally accurate.[10] Guided by this understanding, we eliminated approximately

[6] https://mediabiasfactcheck.com/

[7] WhatsApp labels content that has been forwarded in a chain of at least five users as forwarded many times. These could be considered the 'viral' content on WhatsApp. https://faq.whatsapp.com/1053543185312573

[8] https://www.youtube.com/feed/trending

[9] https://substack.com/browse/politics

[10] Personal note: As a researcher, I am surprised to hear that such inconsistent data is provided. I feel it is irresponsible for Facebook to provide a tool for researchers which returns incorrect data. This just shows the effort and investment that Facebook has in CrowdTangle. However, upon manually verifying this data, I found that it does match with the actual numbers shown on the website for over 90% of the cases, which led me to continue working with the data.

10% of URLs where the total count was lower than the private count. We examined this pruned set for any sampling biases by qualitatively comparing the top named entities represented in these URLs to those in the broader dataset. Our validation confirmed that there was no significant bias introduced, as 19 of the top 20 entities in both sets matched.

3 Analysis

The key measure we use in our study is the ratio of public to total shares (public + private) for each link, which we denote with `Ratio`. This ratio serves as a robust indicator of the extent to which content is being disseminated within private networks. `Ratio` nearing zero signals that a piece of content is predominantly shared in private spaces, whereas one approaching one suggests the converse–widespread sharing in the public. By examining this ratio across various topics and content types, we offer a first-of-its-kind quantitative insight into the often-overlooked realm of private sharing and its implications for both research and public discourse. We first plot the Cumulative Distribution Functions (CDF) of `Ratio` for various datasets. The CDF measures, on the y-axis the fraction of URLs which have a ratio less than a certain x value.

3.1 Mainstream news

Our first line of analysis looking at the sharing patterns of mainstream news outlets. Figure 1 shows that the CDF of mainstream news outlets like The New York Times and Fox News shows a striking similarity: nearly 70% of their URLs have a share ratio of less than 0.2. This suggests that only about 20% of shares from these outlets are public, indicating a prevalent trend of private sharing. On the other hand, biased outlets like Breitbart and NewsMax exhibit a substantially different pattern. Contrary to expectations that politically charged content might be shared more privately, we found that a majority of URLs from these sources (70%) are shared publicly at least 50% and 70% of the time, respectively. This counterintuitive result calls into question the role of political bias in shaping public versus private sharing behaviors. Additionally, we note that a small but notable percentage of shares for NewsMax (5%) and Breitbart (7%) are exclusively public, confined to posts by their official Facebook pages. This suggests that these platforms exercise a certain degree of control over their public messaging.

The divergent patterns between mainstream and biased outlets may be influenced by audience size. For instance, The New York Times and Fox News have more than 18 million likes on their Facebook pages, while Breitbart and NewsMax lag behind with 4.4 million and 3.5 million likes, respectively. Though audience size might play a role, it may not be a reason why we observe this pattern as this is not consistently supported across all types of news sources. This inconsistency indicates that other factors, possibly the nature of the content or the demographic characteristics of the audience or the activity of the news source on Facebook and news feed ranking patterns, might also play a significant role.

When benchmarked against these findings, our COVID-19 news dataset occupies a middle ground, neither mirroring the private sharing trend of mainstream outlets nor the public sharing bias of more politically inclined sources. This intermediate position may reflect the dataset's diverse range of content, which could attract a more balanced sharing dynamic.

The findings from the CDFs have several implications for our understanding of information dissemination on social media platforms like Facebook. The high degree of private sharing for mainstream news outlets like The New York Times and Fox News indicates a prevalent trend of information consumption within private networks. This could suggest that users prefer discussing major news within their private circles, possibly to avoid the contentious public debates that often occur on social media. It's a pattern that calls for a re-evaluation of how we measure the impact of news articles, as focusing solely on public shares would significantly underestimate their reach and influence.

3.2 Fringe news and popular content on other social media

Next we look at the sharing dynamics of low-quality sources, along with popular content on WhatsApp, Reddit, and YouTube. The findings, presented in Figure 2, reveal a complex interplay of factors influencing public and private sharing. For low-quality sources (labelled 'fakenews' in the figure),

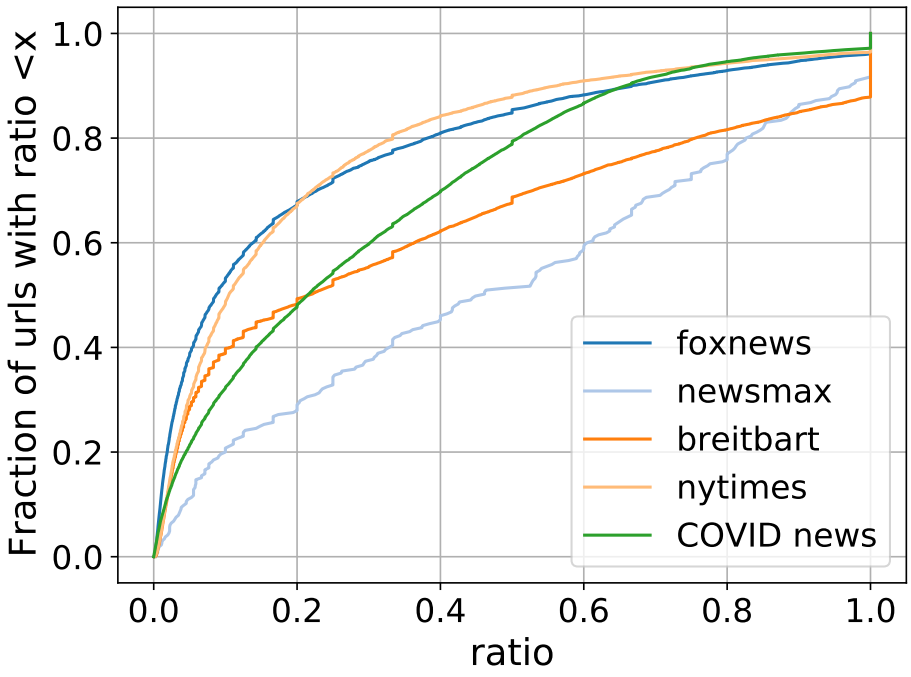

Figure 1: Cumulative Distribution Function (CDF) of `Ratio` for mainstream news sources.

we observed that over 50% of URL shares are private. This trend might be attributed to a variety of factors. A simple reason could be that the low-quality sources might not have the distribution channels like the mainstream platforms do, or are not allowed to be distributed by Facebook's algorithms. For instance, users may refrain from public sharing due to concerns over their online reputation. Another scenario could be private sharing for critical discussion or debunking, highlighting the dual role such sources can play: both as disseminators of poor information and as subjects for critical analysis.

In the case of WhatsApp, the propensity for private sharing aligns well with the platform's design and primary use-case, which is private communication. Unlike Facebook, WhatsApp lacks a public news feed, inherently encouraging content to be shared within closed, personal circles. This may explain why content that gains popularity on WhatsApp through 'frequent forwarding' doesn't necessarily translate into widespread public sharing on Facebook, a platform with different sharing affordances.

YouTube presents a contrasting scenario. Despite a video's popularity on YouTube, it doesn't guarantee a similar reception on Facebook. Our data suggests that roughly 75% of trending YouTube URLs are only shared publicly 20% of the time on Facebook. This could be due to the differing natures of the two platforms: YouTube is specialized for video content consumption, while Facebook serves multiple functions, from social networking to news dissemination. Additionally, user demographics and content preferences may vary significantly between the platforms, affecting the cross-platform sharing dynamics.

Reddit, distinctively, is a platform designed for public data sharing and discussion. While we didn't delve deeply into Reddit's sharing patterns, its inherent public nature sets it apart from platforms like WhatsApp and YouTube. This could have implications for how information flows from Reddit to other platforms, a subject that warrants further study.

These findings underscore the intricate nature of sharing dynamics, which are shaped by a multitude of factors including the credibility of the source, the original platform's design, and the type of content. This complexity necessitates a nuanced approach to understanding information dissemination across different social media platforms, particularly when considering the implications for public discourse and the spread of misinformation.

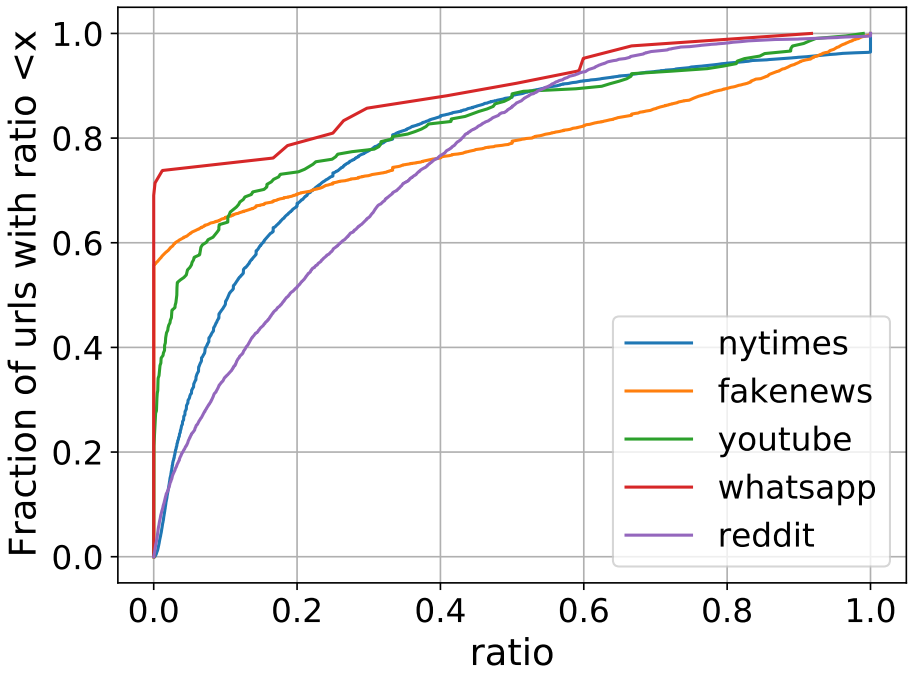

Figure 2: CDF of the ratio of public to total shares for low-quality news sources, YouTube, WhatsApp and Reddit.

3.3 Private blogs, fact checking

Our next line of analysis focuses on private blogs (substacks) and fact checking websites. The inclusion of Substack and fact-checking websites in our analysis provides an expanded view of the nuanced dynamics shaping news consumption and dissemination in today's digital landscape. Substack, in particular, represents a burgeoning model of direct-to-reader journalism that has gained significant traction recently. Our results in figure 3 indicate that Substack articles are predominantly shared in private settings, far exceeding the private sharing metrics of mainstream news outlets like The New York Times. There are several potential reasons for this. First, the individualized nature of Substack newsletters may encourage a more personalized approach to sharing [Ore21], enabling subscribers to disseminate content within targeted social circles. This could be attributed to the intimate relationship that Substack establishes between writers and their readers. Second, the content on Substack often delves into niche or contentious topics, which might make readers more inclined to share privately to mitigate the risk of public controversy or backlash [Fis22].

On the opposite end of the spectrum, our findings for fact-checking websites reveal that they are largely shared publicly. This sharing pattern aligns more closely with biased news sources like Breitbart, as shown in Figure 1. The propensity for public sharing of fact-checking content could be rooted in the websites' core mission: to authenticate information and debunk falsehoods. In this context, sharing fact-checked articles may be viewed as an act of civic responsibility, aimed at combating the spread of misinformation in broader social networks. Additionally, sharing from reputable fact-checking sources may enhance a user's social credibility, thereby incentivizing public dissemination. However, the public nature of these shares also raises questions about their effectiveness. Are these fact-checks reaching the individuals who propagate misinformation, or are they merely reinforcing the views of those already inclined to trust fact-checking agencies? This could have critical implications for ongoing efforts to combat misinformation, suggesting that simply producing fact-checks may not be sufficient. The mechanism of dissemination is equally crucial for ensuring that these corrections actually contribute to a more informed public.

The divergent sharing patterns for Substack and fact-checking websites offer compelling insights into the evolving dynamics of news consumption and the role of social media in shaping public discourse. Substack's high rates of private sharing suggest that the platform may be carving out a unique space

for more intimate, nuanced discussions that are often missing from mainstream dialogues. This could represent a shift towards a more personalized form of news consumption, where individuals are seeking out tailored content that aligns closely with their interests or viewpoints. The implications here are twofold: on one hand, this could foster more engaged, informed communities; on the other, it might risk creating echo chambers where alternative or opposing views are less likely to be encountered.

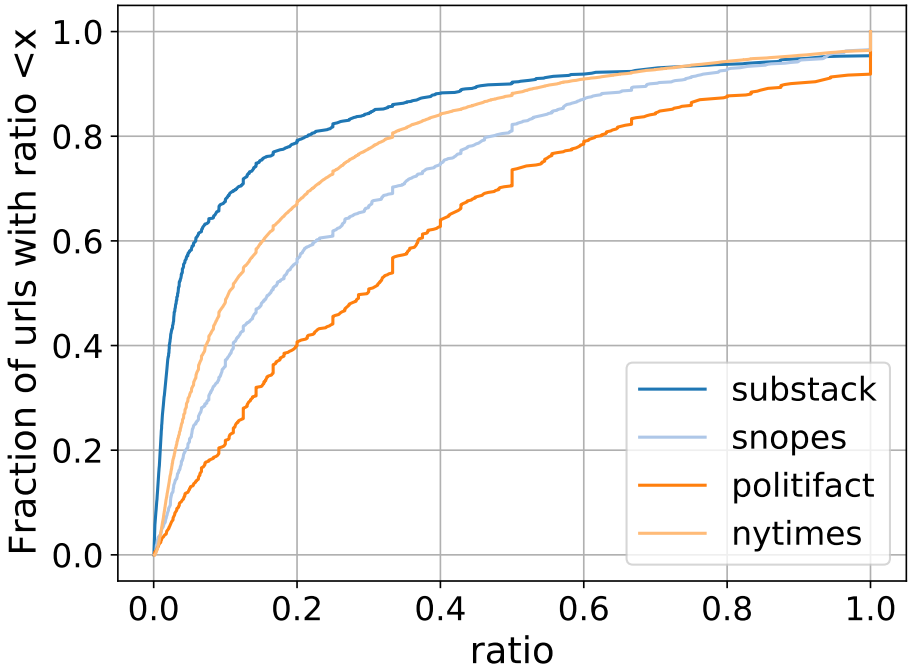

Figure 3: CDF of the ratio of public to total shares for Substack and fact-checking sources.

The implications of the findings from Sections 3.1–3.3 are multi-layered, pointing to a complex ecosystem of information sharing that transcends the boundaries of individual platforms. Most notably, the marked differences in private sharing rates across various source types –from mainstream media to low-quality sources and specialized platforms like Substack– suggest that public discourse is being shaped in more enclosed, less visible spaces. This has critical ramifications for efforts to combat misinformation, as a significant portion of content from dubious sources is being disseminated privately, potentially eluding public scrutiny and fact-checking mechanisms. Furthermore, the varied sharing dynamics between platforms like WhatsApp, YouTube, and Facebook indicate that a one-size-fits-all approach to understanding information flow or implementing interventions is likely to be ineffective. Instead, strategies must be tailored to the unique sharing behaviors exhibited on each platform, taking into account not just the content and its source, but also the specific user interactions that each platform encourages or inhibits.

3.4 Category of the news

Next, we focus on whether certain categories of news have different `Ratio` values. To study this, we use data from Huffington post [MG21], where the category of the news article was also included. Figure 4 shows the relation between news categories and their respective sharing ratios. We can clearly see distinct patterns with certain categories demonstrating a propensity towards private sharing, while others trend towards public sharing.

Categories including ‘College’, ‘Food & Drink’, ‘Money’, ‘Religion’, and ‘Black Voices’ demonstrate the lowest ratio, indicating a tendency towards private sharing. A potential hypothesis for this pattern could be the personal or sensitive nature of these topics. For instance, ‘College’, ‘Money’, and ‘Religion’ often touch upon personal circumstances or beliefs. Users might prefer sharing these topics privately to avoid broader scrutiny or debate. Regarding ‘Black Voices’, it’s possible that the content is being

shared in more closed, identity-specific circles where the information is considered particularly relevant or valuable.

Conversely, categories such as 'Environment', 'Culture & Arts', 'Weddings', 'Entertainment', and 'Comedy' show a higher sharing ratio, indicating a more public sharing tendency. These categories generally cover topics of wide public interest, often fostering communal discourse. For instance, 'Environment', 'Culture & Arts', and 'Entertainment' are largely universal topics, potentially leading to more public sharing. The public sharing of 'Comedy' might be driven by its entertainment value and the desire to share humor with a wider audience.

An intriguing contrast surfaces when comparing the sharing trends between 'Queer/Latino Voices' and 'Black Voices'. Despite all being identity-centric categories, 'Queer/Latino Voices' appear to be shared more publicly, while 'Black Voices' tend towards private sharing. This discrepancy could potentially be tied to the unique sociopolitical dynamics around these communities. It is possible that the content in 'Queer/Latino Voices' is being shared more publicly to foster wider discourse, awareness, or advocacy while 'Black Voices' might reflect more closed, community-specific discussions or a desire for safe space dialogues away from broader public engagement.

These preliminary observations underscore how news category can impact sharing behavior. It underscores the multifaceted nature of social media engagement, revealing how it's influenced not only by the content's source but also its thematic focus. Further studies are needed to validate these hypotheses and deepen our understanding of these dynamics.

3.5 Topics covered vs. `Ratio`

We expanded our analysis beyond the sharing patterns of URLs and began an in-depth examination of the actual content within the articles. Using the COVID-19 dataset which also contained the text of the articles, we obtained topics from the articles using Latent Dirichlet Allocation (LDA) [BNJ03], an unsupervised machine-learning model that extracts topics from the text of articles. Using the coherence score method [SKAB12], we determined that 40 topics was ideal for our dataset. Each URL was then manually associated with a predominant topic based on the LDA results. The objective was to discern any potential patterns or correlations between the frequency of a topic's occurrence and the privacy levels of its shares. To do this, we first partitioned the ratio into quintiles,[11] and assess whether certain topics were disproportionately represented within each quintile bucket. Particularly, we look at topics which are highly popular in the lower quntiles (highly private) and not so in the higher quintiles (highly public) and vice versa. This helps us get topics which are comparitively more private.

Figure 5 shows the result. Our results indicate a clear disparity among topics in relation to privacy. Topics such as the derailment of a train near a Navy ship treating COVID patients,[12] and vaccines –both of which frequently circulate within conspiratorial discussions– along with abortion, and discussions of remote work were substantially more prevalent in the lower ratio buckets. This suggests that these subjects are predominantly shared within private spaces. On the other hand, topics associated with sports and NBA, news about UK politics, and feel-good content about relationships, were overly represented in the higher ratio buckets, indicating that these subjects are typically shared in a more public context. For a complete overview of all topics, please refer to the appendix.

These findings present an intriguing hypothesis: the degree of privacy with which a topic is shared on social media may be strongly influenced by the nature of the topic itself. Though this may not be entirely surprising, the prevalence of highly controversial and conspiratorial news topics in private spaces is concerning and interesting for research on such topics using public data.

3.6 Sentiment

Next, we looked at whether the sentiment of the article played a role in its private sharing ratio. In the COVID-19 dataset, sentiment scores were already included, computed based on the title of each article. This analysis was performed by Aylien, a company specializing in text analytics. The company's proprietary methodology was used to determine the sentiment associated with each title,

[11] The results also mostly hold with the analysis done with deciles but to allow for larger ranges of what public and private buckets capture, we decided to use quintiles instead of deciles.

[12] https://archive.is/7mlJh

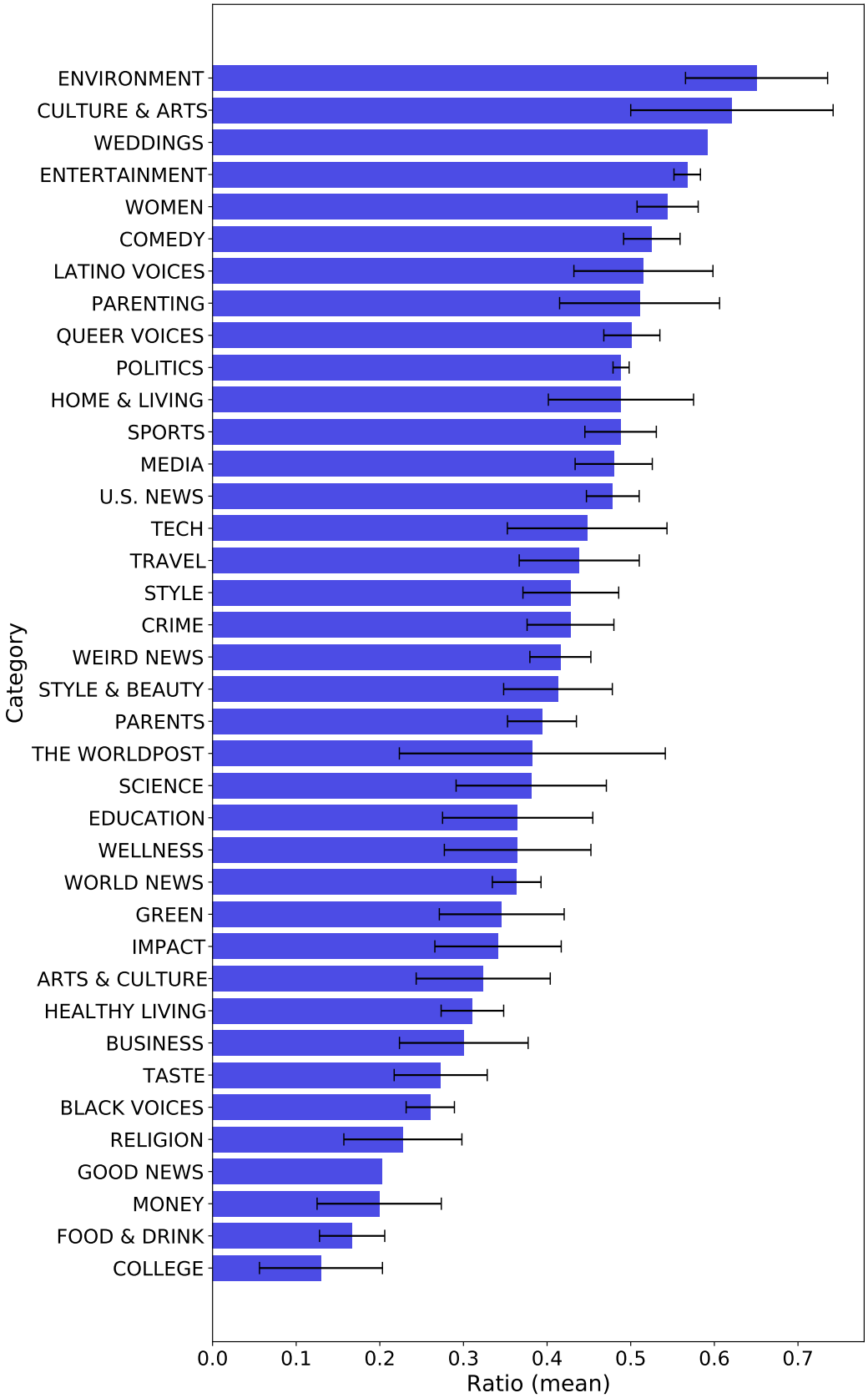

Figure 4: Mean ratio (along with 95% confidence intervals) for various categories of Huffington Post articles.

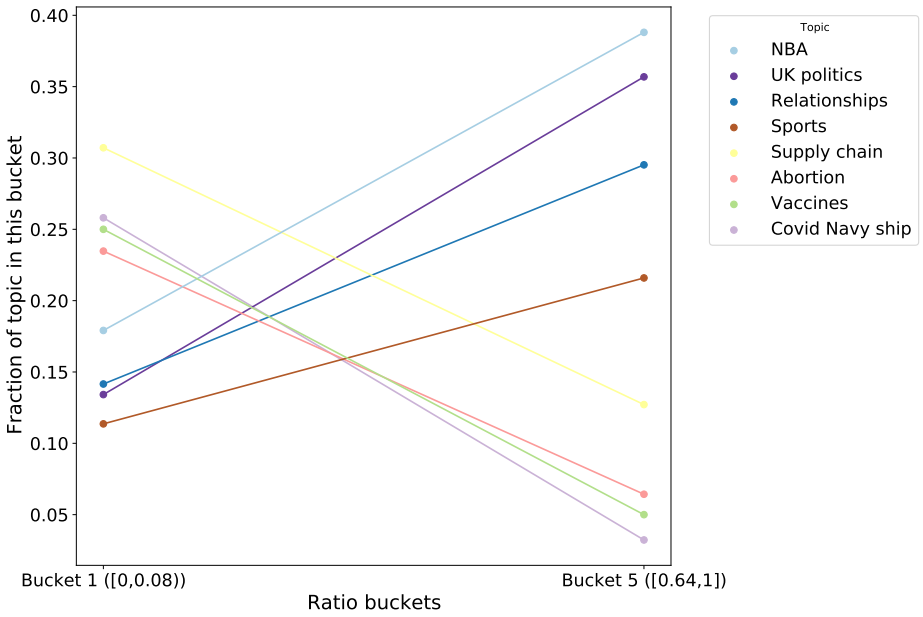

Figure 5: Topics with the highest and lowest prevalence in quintiles of ratio distribution. Topics with high prevalence in bucket 1 (lowest quntile) and low prevalence in bucket 5 (highest quintile) indicate that they are disproportionately shared privately.

classifying it into categories of positive or negative sentiment. In addition to this, a polarity score of the sentiment was assigned to each title, with the possible range of this score spanning from 0.3 to 1.

To facilitate further analysis, the polarity scores were divided into bins of width 0.1, with the mean ratio for each bin calculated subsequently. The distribution of these mean ratios across different sentiment polarity ranges can be seen in Figure 6.

This figure reveals an interesting pattern in how sentiment affects sharing behavior. In a majority of the bins analyzed (5 out of 7), titles with a negative sentiment appear to be more often shared privately as compared to those with a positive sentiment.

This suggests that users might privately share content with negative sentiment, perhaps due to concerns about sparking conflict or appearing overly negative on public platforms. Alternatively, it might indicate that negative news is perceived as more sensitive or personal, leading users to share it in private contexts where they have more control over the audience.

The observation that negative sentiment in article titles correlates with increased private sharing has significant implications for both researchers and practitioners. For one, it signals that emotional content could be a lever for understanding or even predicting user sharing behavior [VRA18]. This is crucial for media organizations aiming to maximize engagement without compromising the public discourse quality. Additionally, it brings forth ethical considerations for news platforms and social media algorithms that aim to promote content. Knowing that negative content is more likely to be confined to private spaces could drive them to re-evaluate how such content is presented or disseminated, to prevent echo chambers or polarization. Lastly, for policymakers and fact-checkers aiming to counter misinformation, understanding the sentiment-sharing relationship is vital. Content that is negative and privately shared may be harder to track and counter, thus requiring novel approaches to mitigate its impact.

4 Discussion

This research marks the first comprehensive examination of the prevalence of information shared privately on social media platforms. This novel perspective unlocks new dimensions of understanding the information dynamics within these private spaces. The finding that 80% of mainstream news URLs have at least 50% of their shares privately challenges conventional research methodologies that focus solely on public data (see Figure 1). Entire categories of content are shared mostly privately, such as

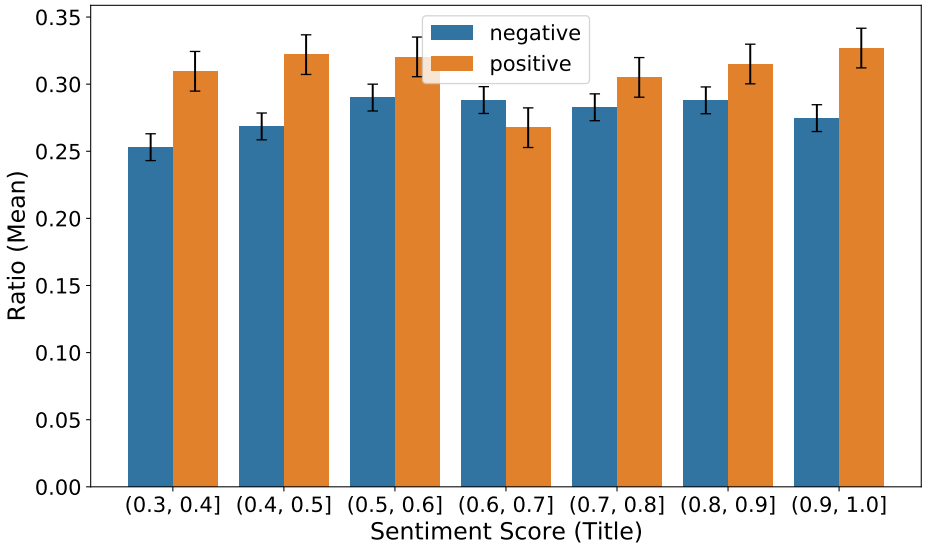

Figure 6: Sentiment polarity of the titles of various articles bucketed into intervals width 0.1.

Religion, Black Voices, and Food & Drink, illuminate that traditional approaches may miss up to 80% of social media content (see Figure 4). This deficiency in data can lead to biased results, misinformed policies, and misguided strategies in various sectors, including marketing, health, and politics.

The findings also suggest that the popularity of content on one social media platform is not a reliable indicator of its popularity on other platforms (see Figure 2). This underscores the complexity of content dissemination across different online ecosystems, each with its unique set of user behaviors and platform affordances. Therefore, a nuanced, platform-specific analysis is essential for a comprehensive understanding of how content gains traction. While a piece may go viral on one platform, that virality does not necessarily translate into widespread public sharing on others. This insight is crucial for stakeholders ranging from media organizations to policymakers, as it necessitates tailored strategies for content dissemination and impact assessment on each platform.

The substantial level of private sharing associated with low-quality websites and blogs presents a hidden obstacle in quantifying the extent of misinformation (see Figure 3). Traditional methodologies may significantly underestimate this prevalence, as shown in previous studies [ACZ+21, CSAL21, HTA22]. This issue has critical implications for policy-making. Recognizing the skewed nature of private versus public sharing is vital for developing effective strategies to combat misinformation without infringing on privacy norms. Our results, as depicted in Figure 2, underscore the need for a more nuanced approach in misinformation studies. A simplistic perspective could lead to ineffective or even counterproductive interventions. The study of misinformation is a multifaceted endeavor, encompassing aspects such as prevalence, production, consumption, and dissemination, each of which is impacted by the focus on private content alone.

The implications of these findings extend beyond the realm of social media. They have important implications for journalism, as news outlets strive to reach diverse audiences and maintain a healthy flow of information. Recognizing the influence of private networks on information dissemination can inform strategies for news organizations to engage with these networks effectively.

Our findings illuminate several avenues for advancing research methodologies and policy. First, they underscore the value of alternative research models like data donation and platform-independent qualitative studies. These methods could be particularly crucial when collaboration with social media platforms is limited, not universally accessible, or not scalable. For example, initiatives like Social Science One do offer URL share data, but the scope of this data may be insufficient for comprehensive analysis. It often provides a snapshot that might lack the depth or breadth required for nuanced understanding of content dissemination. The disparities in access to public and private data create an unequal playing field, potentially biasing research outputs. The study's findings should inform policymakers to cultivate a fair research environment.

Second, the limitations inherent in platform collaboration make it imperative to explore innovative

policy solutions for data sharing. There could be improved methods to anonymize and share data that serve both the research community and the platforms' privacy concerns. In essence, our research not only provides insights into social media behavior but also serves as a clarion call for more adaptable, scalable, and cooperative research frameworks that can inform future policy and practice.

In conclusion, the insights gained from this study not only highlight the previously underestimated importance of private sharing dynamics but also pose vital questions and challenges for researchers and policymakers alike. The study emphasizes the necessity of considering private sharing dynamics in crafting data-sharing regulations and stresses the urgency of devising robust, scalable solutions that preserve the integrity and accuracy of social media research.

Limitations. While our study sheds light on the nuances of private and public content sharing on social media, it is constrained by several critical limitations. Primarily, the research is descriptive, limited by the capabilities of Facebook's CrowdTangle tool, which restricts us from understanding the nature of privately shared content. For example, we cannot determine whether content related to vaccines is privately shared due to its conspiratorial content or for reasons of personal privacy. CrowdTangle's limitations extend to its inability to capture content from individual users, even when set to public visibility. This, along with Facebook's search constraints –perhaps designed to safeguard private interactions– adds an opaque layer to our methodological approach. As a result, we're hindered from delving into the 'why' behind emerging patterns, even when examining publicly shared posts from individual users. Adding to these limitations is the partial view we have of information dissemination online. Complete data is proprietary to the platforms themselves, curtailing our—and by extension, the broader research community's—ability to fully grasp online information dynamics. This highlights the need for more transparent data-sharing practices between social media platforms and researchers.

Another area that remains under-explored due to these data limitations is the impact of sharing behavior on user beliefs and actions. While we can describe patterns of public and private sharing, we cannot assess their relative impact on users, particularly in private spaces where content might influence beliefs differently. This gap is particularly concerning given the potential for private sharing to have an outsized influence on user beliefs and actions. Finally, the limited availability and transparency of data from social media platforms pose a significant challenge. The study relies on a constrained dataset, which affects the robustness and generalizability of our findings. This scarcity underlines the urgent need for more transparent and cooperative data-sharing practices between these platforms and the research community.

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