Examining Fake News Echo Chambers Across Political Facebook Groups

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Introduction

Prior to the 2016 American Presidential Election, fake news was a rarely used term, largely confined to liberal-conservative spats regarding the bias and legitimacy of "news" sources such as *Fox News*, *The Daily Show* and *The Huffington Post*. Academics certainly weren't throwing around the term or focusing their research on it. Rather, researchers were interested in the role of the internet and cable in creating more diversified sources of news, those of which were increasingly biased or slanted toward one side of the ideological spectrum but ultimately strayed from propagating utter falsehoods.

However, following the victory of Donald J. Trump and revelations of the proliferation, efficacy and popularity of so-called fake news on social media, specifically Facebook, the term, popularized by the president-elect in his use of it to describe the mainstream liberal media, took on a life of its own. According to GoogleTrends, the phrase fake news has historically remained obscure in Google queries, rating five percent as popular as the most searched term for a given week in the United States for most of the last twelve years. At the end of November, searches for the term fake news spiked, with the phrase peaking as the most searched at the beginning of January (GoogleTrends). Many believed this new, intentionally misleading and sometimes completely falsified media had swung the election in favor of Donald Trump.

In this paper, I aim to contribute to the growing literature on fake news by examining common links, with a focus on fake news sources, across partisan political Facebook pages. Specifically, I will examine whether there are echo chambers created by the fake news sites shared within different ideological communities or whether there is commonality in the fake news sites shared on both conservative and liberal pages. I will also explore whether fake news contributes to more exclusive echo chamber communities than news from legitimate, mainstream sources.

Background

Polarization has become a major theme in American politics, resulting in gridlock, government shutdowns and historically low approval ratings for Congress. In terms of policy, roll call analysis of congressional voting and analysis of party platforms both indicate a growing divergence between Democrats and Republicans (Iyengar et al. 2012). Iyengar et al. point to

growing polarization among American citizens based on social distance, as exhibited by increasingly negative views of the out-group (e.g., members of the other party) and increasingly positive feelings towards members of one's own party, with individual views of partisans affecting interpersonal relations. Whether polarization is due to growing divergences in policy preferences or social identity, researchers have cited increasingly partisan media as a potential cause. Levendusky finds that the proliferation of cable news, talk show personalities and Internet media, which frame issues and selectively present stories to fit their ideological viewpoints, has led consumers of this media to become more polarized, extreme in their political beliefs, less trusting of the opposition party and less open to compromise (Levendusky 2013).

Following the 2004 American Presidential election, an analysis of citations between partisan blogs indicated both liberal and conservative blogs were more likely to link to ideologically similar blogs than blogs with contrasting viewpoints, but overall conservative blogs linked to each other in a denser pattern. Further, conservative and liberal blogs linked to different mainstream news sites and cited popular news stories at different frequencies (Adamic and Glance 2005). More recently, an analysis of links shared by commenters on the Facebook pages of the *Rachel Maddow Show* and the *O'Reilly Factor* demonstrated that the liberal and conservative audiences utilized a small amount of news sources and "shared an even smaller number of information resources in common" (Jacobson et al. 2015). These studies point to a significant trend in the development of echo chambers online, in which people are only exposed to information that matches and confirms their viewpoint or ideology.

The spread of fake news has only exacerbated concerns that these media enclaves and selective exposure will continue to contribute to political polarization and social tensions. Aside from fears that fake news is more partisan than its predecessors in terms of prominent ideological media, its information is partly or completely falsified, largely with the intentional aim of misinforming voters for partisan or ideological reasons. In a survey conducted by Ipsos Public Affairs for BuzzFeed News following the election, American adults rated fake news stories as somewhat or very true 75% of the time; Republicans were more likely to believe that fake news stories were accurate compared to Democrats (Silverman et al. 2016).

Another study by BuzzFeed found that 38% of all posts on three hyperpartisan right-wing websites were either a combination of true and false or mostly false, compared with 19% of posts on three hyperpartisan left-wing websites. Hyperpartisan pages received more engagement than

mainstream pages, with the most factually inaccurate pages and posts receiving a higher number of median shares. Ring-wing pages almost never cited mainstream sources, while left-wing pages frequently did so. Furthermore, popular fake news stories were disproportionately pro-Trump or anti-Clinton (Silverman and Singer-Vine 2016). These findings are especially concerning given that 62 percent of adults report receiving news from social media (Allcott and Gentzkow 2017).

So far, little research has been conducted to directly explore whether fake news is exacerbating polarization by creating more exclusive and harmful echo chambers on social media. My aim is to determine if partisan Facebook pages are creating fake news echo chambers through which partisan followers become further polarized via introduction to fake news that confirms their viewpoints and possibly makes them more ideologically extreme. To do so, I will examine if partisan Facebook pages share fake news links frequently and only with ideologically similar Facebook pages or if they commonly share links across ideological boundaries.

Methods and Data

My research examined public pages on Facebook that supported either partisan ideologies, political groups or major political candidates. These pages contain posts by administrators and comments by the pages' followers (people who have liked the page). I selected pages that exhibited a range of ideologies and candidates along the left-right spectrum, but most of the pages could be considered "hyperpartisan" (significantly liberal or significantly conservative). This is due to the reality that moderates are not likely to create or attract significant support for Facebook pages or political movements in general. Rather, strong partisans are more likely to be engaged and share their opinions on social media while seeking out and creating groups of politically like-minded individuals. Nonetheless, I tried to pick some pages that seemed to be relatively left of center and right of center, such as "College Democrats of America", "I'm with Hillary 2016" and "Republicans", although these pages averaged less followers (likes) than the hyperpartisan pages.

Overall, I selected seven "liberal" pages and seven "conservative" pages for my analysis based on the number of likes that the page has received. The pages range from "Tea Party Patriots" and "Conservative Daily" to "Occupy Democrats" and "The Other 98%". The liberal pages average slightly over 2,1 million followers, the page with the least followers being "College Democrats of America" at 27.000 and the highest being "Occupy Democrats" at almost 6,5

million. Conservative pages average slightly more than 2,8 million followers, with the page "Republicans" maintaining the least followers at 156.685 and the page "Conservative Daily" carrying the most followers at 8.035.050. Two liberal pages ("The Other 98%" and "Occupy Democrats") and six conservative pages ("Donald Trump for President", "Freedom Daily", "Right Wing News", "Eagle Rising", "Conservative Daily" and "Tea Party Patriots") are platforms for administrators to share links from their own news sites, all of them propagating what could be considered fake news, although they share links from other news sites too.

The data used in my research were the links posted on these pages. I collected up to 5.000 of the most recent posts on each of these pages from Facebook API using R Statistical Software and the package "RFacebook". I then took the links from these posts and shortened them to just their domains (e.g. 'nytimes.com') by removing 'http://' or 'https://' and anything after '.com', '.org', etc. I also removed any posts that didn't contain links and any links that contained the domains either 'facebook.com' or 'youtube.com'. Using the remaining domains, I created a network of the pages, which I then used to compare the amount of shared sources across pages with respect to their partisan affiliation.

Using a list of 1.001 sites suggested for review and analyzed for falsified, inaccurate or misleading content by Melissa Zimdars, assistant professor of communication and media at Merrimack College in Massachusetts, I removed any domains that weren't considered fake news, clickbait, unreliable, conspiracy theory, hate news, extreme bias, junk science, rumor mill, state news or unknown according to her criteria.

Dr. Zimdars' explicit definition of fake news includes "sources that entirely fabricate information, disseminate deceptive content, or grossly distort actual news reports" (Zimdars 2016). For the purpose of my study, I expanded the definition of "fake news" to serve as an umbrella term by including her other categories (clickbait, extreme bias, conspiracy theory, etc.), which refer to new sources that may not be intentionally false but are unreliable, misleading and outside the scope of legitimate mainstream news sources. Extreme bias refers to sources that use propaganda, "decontextualized information", and opinions framed as facts to promote a certain ideology or point of view (Zimdars 2016). Clickbait involves sources that contain legitimate, accurate information but use "exaggerated, questionable or misleading headlines, social media descriptions and/or images" to encourage people to view links to their site and stories, which is important

criteria when examining links shared through posts on political Facebook pages (Zimdars 2016). Often, Dr. Zimdars' news categories work in conjunction with each other; For example, news sources considered conspiracy are often labeled as fake news too.

Removing solely satirical, solely political and otherwise credible sources from her list, I established a list of 858 sites. Using the domains from the Facebook pages that matched this list, deemed to be "fake news" for the purpose of this study, I created a new network with the pages as nodes and shared linked domains as edges. I used this network to determine which types of partisan Facebook pages were sharing fake news and which were sharing the same fake news sources.

In both networks I measured the density, or the number of edges within the network divided by the total number of possible edges. Higher density means higher connectivity within the network. Using edge betweenness, a measure of network centralization that calculates the "sum of the fraction of all-pairs shortest paths that pass through" a given edge, I determined if each network is separated into polarized clusters based on the ideology of the pages ("Edge_betweeness_centrality" 2016). In simpler terms, edge betweenness centrality is "defined as the number of the shortest paths that go through an edge in a graph or network" (Girvan and Newman 2012). I utilized a method that removes the edges with the highest betweenness until the network breaks into components or clusters and modularity decreases. The method operates on the assumption that the edges with highest betweenness "are bridging communities together" (Fagan 2015). I also gathered basic statistics on the shared domains between different sets of pages, referring to the number of instances of shared domains or the cumulative edge weight between sets of pages as the total connections between these pages.

My main aim in examining and comparing the two networks — one with all domains linked by the chosen Facebook pages and one with only the domains categorized as "fake news" — is to determine if the sharing of fake news sources by partisan Facebook pages contributes to more polarization in the form of echo chambers than just the sharing of mainstream or legitimate, mostly accurate news sources. In other words, I aim to determine if partisan Facebook pages form more polarized communities in their sharing of fake news than regular news.

Results

Primary Statistics

Overall, conservative pages posted more links from "fake news" sources, with a higher proportion of total links and links per page being categorized as fake news compared to liberal pages. Conservative pages averaged approximately 3.425 links per page, for a total of 23.981 links. Of these links, 13.752 were from sites matching the fake news criteria, with an average of approximately 1.964 links to fake news sites per conservative page. More than 57 percent of links shared on the conservative pages were directed to fake news sources, with an average of over 45 percent of links per page deemed fake news.

Liberal pages posted a total of 15.027 links, with an average of more than 2.146 links per page. All together, the pages posted 5.620 links to fake news sources, for an average of almost 803 fake news links per page. More than 37 percent of links shared on the liberal pages were considered fake news, with an average of 33 percent of links per page leading to fake news sites.

Network of Pages with All Shared Domains

First, I created a network of pages that linked the pages based on all shared domains, regardless if they were categorized as fake news or not. The network exhibited a density of over 0,81, indicating high linkage between the pages. Overall, there was no clustering within the network, indicating high connectivity across all pages. Liberal pages had the most instances of shared domains amongst themselves along with the most edges, shared domains per edge and average connections per page. Cross-ideology connections outnumbered connections amongst conservative pages in terms of total connections, edges and average connections per page.

Between liberal pages there were 1.083 connections. These connections occurred across 21 edges (flows indicating at least one shared domain between two pages). All liberal pages shared an edge with all other liberal pages. There were over 51 domains shared per edge, with each page sharing an average of almost 155 linked domains with all other liberal pages.

Conservative pages shared 253 total connections with each other across 15 edges, for an average of almost 17 domains shared per edge. Each page shared an average of more than 36 linked domains with all other conservative pages. All of the conservative pages shared at least one domain with all of the other conservative pages with the exception of the page "Donald Trump for President", which posted 4.981 links from the same domain and didn't share an edge with any other page.

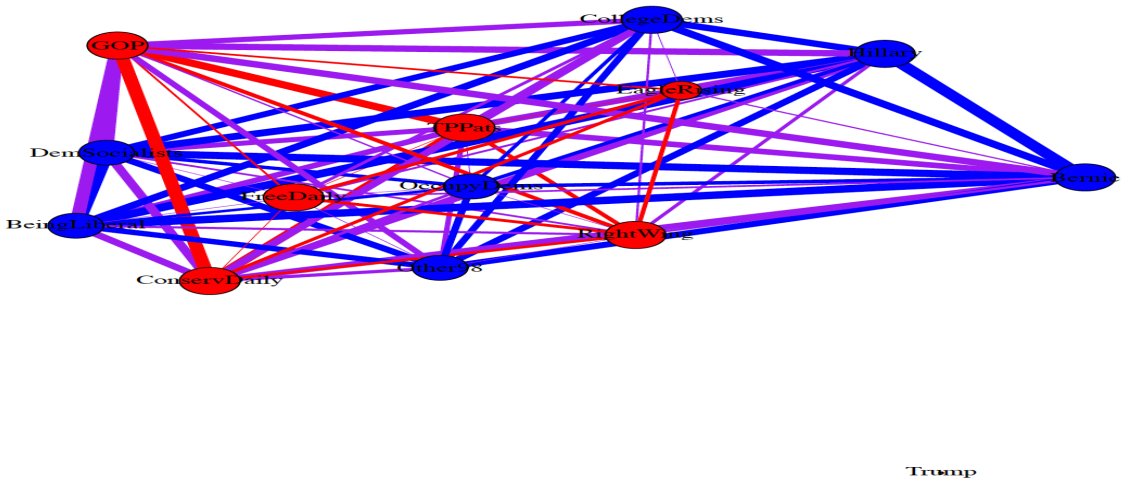

Fig.1: Network of Partisan Facebook Pages Based on Shared Linked Domains

Red nodes indicate Conservative pages, Blue nodes indicate Liberal pages. The size of the node indicates the number of connections (cumulative edge weight), or total instances of shared domains, the page has with all other pages. Blue edges indicate shared domain(s) between Liberal pages, Red edges indicate shared domain(s) between Conservative pages and Purple edges indicate shared domain(s) between Liberal and Conservative pages. The edge width represents the number of shared domains between two pages (edge weight).

There were 655 total instances of shared domains between pages of contrasting ideologies across 38 edges. There was an average of over 17 shared domains per edge and each page shared an average of almost 47 linked domains with pages on the opposite side of the ideological spectrum. All pages connected to at least one page across the ideological spectrum, with the exception of the page "Donald Trump for President". Each page averaged almost three edges with pages of the opposing ideology.

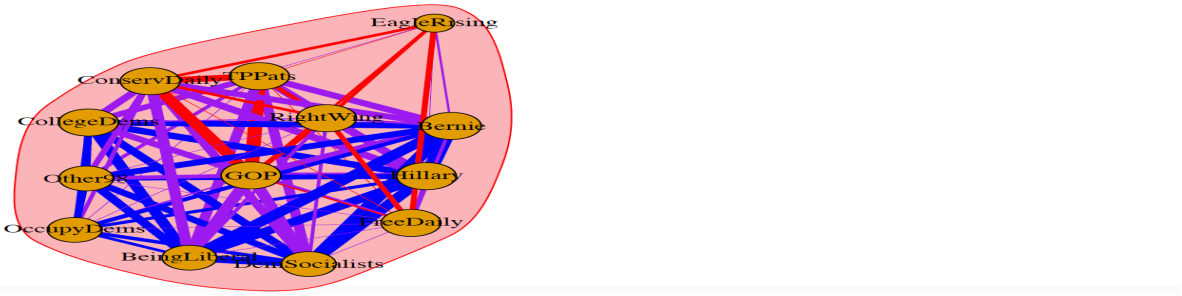

Fig.2: Network Clustering of Partisan Facebook Pages Based on Shared Linked Domains

Different colored bubbles represent different clusters or communities of pages, while node color indicates which cluster a page belongs to.

Network of Pages with Shared Fake News Domains

Next, I created a network of pages with connections based on the number of shared domains that fit the fake news criteria. Overall, the network exhibited a density of over 0,37. The network was separated into four clusters — one representing the community of liberal Facebook pages, one representing the community of conservative Facebook pages, one representing the page "Donald Trump for President" (which shared no links in common with any other page) and one consisting of the conservative page "Tea Party Patriots", which served as the bridge between the two main partisan communities. Again, liberal pages outnumbered conservative pages in terms of total connections, edges and average connections per page amongst pages of similar ideology. However, the conservative-conservative connections averaged more shared domains per edge than their liberal counterparts and totaled more connections, edges, shared domains per edge and average connections per page compared to cross-ideology connections. Further, almost 19 percent of the total connections between conservative pages were based on fake news domains, compared to approximately six percent of liberal-liberal connections and two percent of cross-ideology connections.

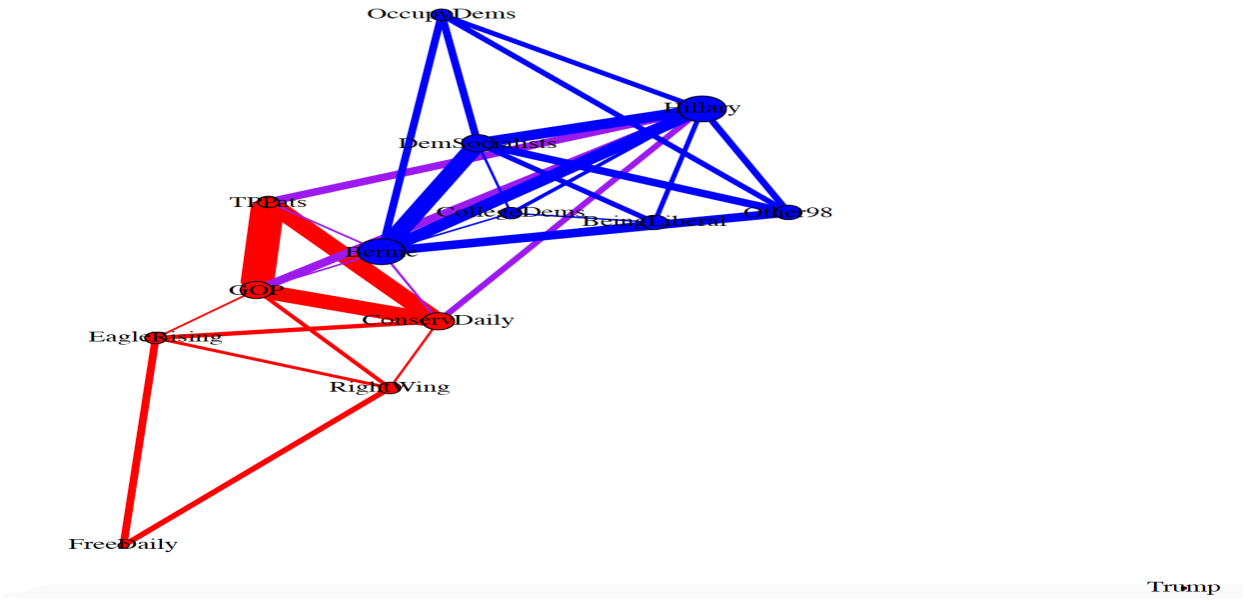

Fig.3: Network of Partisan Facebook Pages Based on Shared Faked News Domains

Red nodes indicate Conservative pages, Blue nodes indicate Liberal pages. The size of the node indicates the number of connections (cumulative edge weight), or total instances of shared domains, the page has with all other pages. Blue edges indicate shared domain(s) between Liberal pages, Red edges indicate shared domain(s) between Conservative pages and Purple edges indicate shared domain(s) between Liberal and Conservative pages. The edge width represents the number of shared domains between two pages (edge weight).

Liberal pages shared a total of 62 connections across 18 edges. Each page shared an edge with at least one other liberal page, with an average of over 2,5 edges per page. There was an average of over three shared domains per liberal-liberal edge. Each page shared an average of almost nine shared domains with other liberal pages.

Conservative pages exhibited a total of 47 instances of shared fake news domains across 10 edges, with an average of 4,7 shared domains per edge. Each page shared an average of almost seven domains with all other conservative pages. Each page shared an edge with at least one other conservative page, with the exception of the page "Donald Trump for President". There was an average of 1,4 edges per conservative page.

There were 16 total connections between pages of opposing ideologies and six edges shared between liberal and conservative pages. Only two liberal pages shared an edge with a conservative page and only three conservative pages shared an edge with a liberal page, with an average of 0,4 cross-ideology edges per page. There was an average of almost three shared domains across these edges.

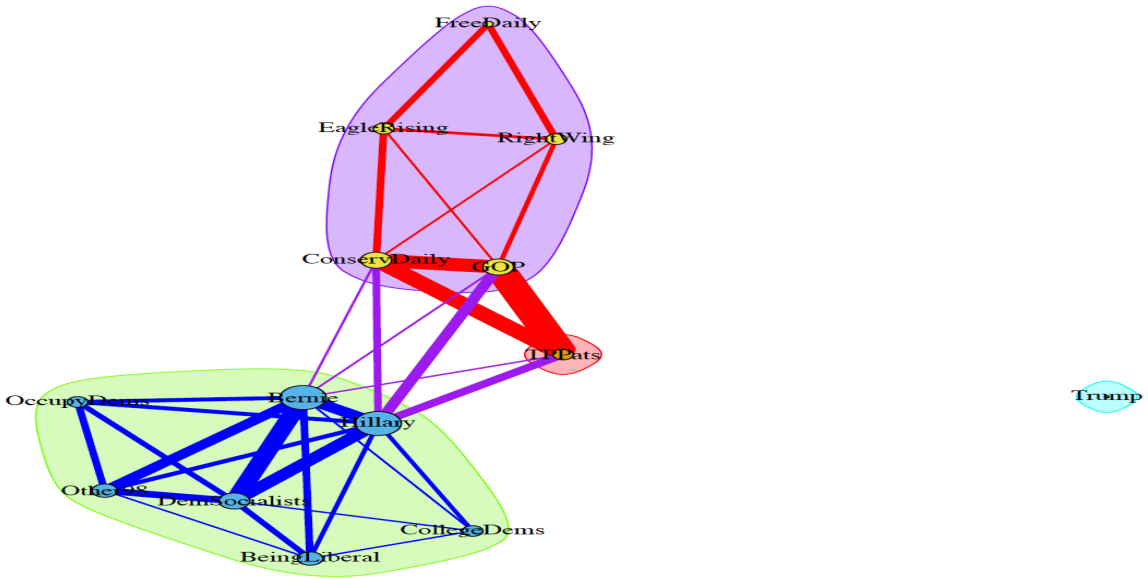

Fig.4: Network Clustering of Partisan Facebook Pages Based on Shared Faked News Domains

Different colored bubbles represent different clusters or communities of pages, while node color indicates which cluster a page belongs to.

Conclusion

The network of pages and all shared domains exhibited high connectivity between pages of all ideologies. Although liberal pages displayed higher connectivity amongst themselves, there was also significant connectivity amongst pages of opposing ideologies. These occurrences and the lack of clustering within the network indicate that there is no evidence of echo chambers amongst these partisan Facebook pages in terms of general domains. However, within the network of pages and only fake news domains, there was much greater polarization, exhibited by an 84 percent decrease in cross-ideology edges and an almost 98 percent decline in total cross-ideology connections. Two major clusters formed within this network, representing the distinct liberal and conservative communities. Thus, the sharing of fake news on partisan Facebook pages not only contributed to echo chambers within liberal and conservative communities on the social media site, it created echo chambers amongst communities where they ostensibly didn't exist before.

Another surprising finding is that, despite the evidence that these conservative pages share more links to fake news sites and fake news was overwhelmingly pro-Trump and anti-Clinton during the election, liberal pages exhibited higher connectivity within their community in terms of fake news domains. Perhaps this is due to the existence of a more select array of left-wing fake news sites and a more extensive selection of right-wing fake news sources. Further research is necessary to examine the types and variety of fake news sites shared by conservative and liberal Facebook pages, along with the effects these fake news echo chambers might have on voting behavior.

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