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Applying Automated Text Analysis to Detect Ideologically-Motivated Manipulations in Mass-Media News

Short Paper

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Abstract

Partisan interest groups manipulate news to cultivate certain viewpoints; the partisan-oriented public creates demand for such polarized information; this forms a harmful feedback loop that amplifies societal polarization. This study presents the application of automated text analysis methodology to detect stylistic and semantic differences between mass-media news sources of different ideological leanings and radicalism levels to identify text characteristics that might indicate information manipulation. 640 articles on four contentious topics from four mass-media news sources, representing combinations of ideological leanings and radicalism levels, were collected from a seven-year period at times of low and high public interest and analyzed using DICTION software. Results showed significant effects of ideological leaning, radicalism level, and the level of public interest on twelve stylistic and semantic text characteristics. These findings were interpreted in the context of possible information manipulations. As a result, we proposed key text characteristics that might indicate information misrepresentation.

Keywords: polarization, ideology, radicalism, mass-media news, manipulation, misinformation, text analysis, semantic analysis

Introduction

In recent years, the polarization of public opinion on multiple topics of global importance has dramatically increased (Abramowitz and Saunders 2008; Hetherington 2009). Societal polarization may lead to increased public reliance on partisan online news (Druckman et al. 2013; Sparks and Hmielowski 2023). However, news outlets may not always present news in a dispassionate and unbiased way. Concern about information misrepresentation in mass-media news garnered more research attention following the 2016 US presidential elections and the COVID-19 pandemic (Freelon and Wells 2020; Ngai et al. 2022; Rosinska 2021).

Although real news and fake news are often viewed as binaries, information distortion or manipulation is not often distinct or definite (Golbeck et al. 2018). For example, news outlets may present truthful facts, but subject them to subtle modifications of the text's semantic, stylistic, and affective characteristics to manipulate information and bias public opinion. This, in turn, may lead to the spread of misinformation (defined as “deceptive messages that may cause harm without the disseminators’ knowledge”; Freelon and Wells 2020, p. 145). Understanding the types of cognitive processing involved in the consumption of news may shed light on the ways news media could manipulate the readers’ perception of the presented information.

Central route processing (CRP) requires readers to attentively evaluate information with cognitive effort and energy, whereas peripheral route processing (PRP) functions by appealing to low cognitive effort heuristic cues (Areni 2003; Petty and Cacioppo 1986). Previous research found that fake news triggers PRP by reducing the cognitive load of the text (e.g., using fewer technical words, shorter words, and more lexical redundancy), whereas objective news activates the readers’ CRP by presenting complex, strong arguments and inviting the audience to critically evaluate them (Carrasco-Farré 2022; Horne and Adali 2017; Newman et al. 2003). Deceptive communications also featured fewer self-references (Hancock et al. 2007; Newman et al. 2003). Moreover, emphasis on negative emotions (e.g., anger, fear, aggression) triggers PRP (Cano-Orón et al. 2021; Park 2015). Reportedly, untruthful sources tend to overuse affective language and overproduce negative tone (exaggeration of sentiment) relative to truthful ones (Conroy et al. 2016; Newman et al. 2003). Thus, specific stylistic, semantic, and sentiment features of text may signal media sources’ attempts to manipulate individuals’ reception of information (Conroy et al. 2016; Sterling et al. 2020).

Importantly, disinformation and misinformation often propagate in politically motivated debates when partisan media tries to sway public opinions in a specific direction to gain support and increase the electorate (Cano-Orón et al. 2021; Freelon and Wells 2020; Montiel et al. 2016). Recent political psycholinguistic research identified text characteristics corresponding to specific ideological leanings. For example, analysis of social media using the Linguistic Inquiry and Word Count software revealed that liberals used language featuring benevolence, achievement, and affiliation, whereas conservatives used language that emphasized tradition, power, threat, inhibition, and religion (Sterling et al. 2020). While providing argumentation in support of specific decisions and actions, liberals would focus on “rights” and “access”, whereas conservatives would focus on “God” and religious implications (Montiel et al. 2016). Furthermore, some previous research suggested that conservative news sources tend to feature more simplistic language (Cichocka et al. 2016; Schoonvelde et al. 2019). However, others argued that the degree of radicalism, rather than ideological leaning per se, is associated with more simplistic presentation of information (Sparks and Hmielowski 2023). Also, a higher level of radicalism (irrespective of ideology) was found to be associated with language featuring certainty, resistance to change, inhibition, anger, anxiety, and negative affect (Bischof and Senninger 2018; Sparks and Hmielowski 2023; Sterling et al. 2020). Thus, we see that the same text characteristics that reportedly signal misinformation (e.g., simplicity of text, negative affect) also vary between media sources with different ideological leaning or level of radicalism. These findings may suggest attempts of information manipulation by certain news media outlets motivated by a certain ideological leaning.

The polarization of public opinion around divisive societal topics forms a harmful amplifying feedback loop with partisan agendas propagated through news media. This threatens political, social, and economic stability and security within individual countries and on the international stage. Developing automated analytical methodologies to identify possible manipulations of the news content offers a possibility to create attenuating feedback loops in socio-technical systems. However, previous research mostly focused on applying stylistic and semantic text analyses to speeches by political figures and *social media* sharing political news (e.g., Bischof and Senninger 2018; Luo et al. 2021; Ngai et al. 2022; Park 2015; Sterling et al. 2020; Stewart 2020), and there has been limited research into how information distortion may manifest in text characteristics of *mass-media news*. By extension, there has been a limited exploration into the difference in stylistic, semantic, and affective characteristics of news text presented by news media outlets of different ideological leanings or levels of radicalism. Also, researchers have yet to explore differences in text characteristics between periods when a topic was of low interest to the public and when it became highly disputable and dividing. Finally, previous research did not explore possible interactions among the variables of ideological leaning, level of radicalism, and the amount of public interest in a topic as they affect text characteristics.

The purpose of the current study was to further investigate differences in a wider range of stylistic and semantic text characteristics (as measured by DICTION) between news media sources with different ideological leanings and levels of radicalism, while also considering fluctuations in public interest in a topic. Our assumption was that text characteristics associated with a higher level of news sources' radicalism and times of increased public interest might be indicative of the news outlets' tendency to manipulate news presentation to sway public opinions in a specific direction (see Sparks and Hmielowski 2023). We attempted to answer the following research question: *What text differences between news sources of opposing ideological leanings, different levels of radicalism, and times of varying public interest may indicate possible information manipulation?* The following hypotheses have been tested: **(H1)** There are significant differences in stylistic and semantic variables between left- vs. right-leaning sources, sources featuring moderate vs. high levels of radicalism, and times of low vs. high public interest; **(H2)** There are interactions among the variables of ideological leaning, level of radicalism, and the amount of public interest in a topic as they affect text characteristics; and **(H3)** The identified text characteristics that differ between left- vs. right-leaning sources, moderate vs. high radicalism sources, and times of low vs. high public interest will map on text characteristics recognized by previous research as ones that signal possible misinformation.

Methodology

Sample

A total of 640 news articles were collected from four news media sources that represent different ideological leanings (left vs. right) and levels of radicalism (moderate vs. radical) during times of various public interest (low vs. high).

Timeline Selection

Articles were collected during a seven-year period, from September 2015 through September 2022. This period corresponds to the recent proliferation of news media published primarily online; an earlier period would not represent modern news disbursement.

Topic Selection

Four topics were selected for this study: 1) gun control (GUN); 2) immigration (IMG); 3) COVID vaccination (VAC); and 4) abortion (ABR). These topics have remained divisive and polarizing within public discourse over the years, with clear attitude distinctions between liberal and conservative camps. Topics were selected based on their popularity recorded on Google Search Trends during the specified seven-year period in the United States in the categories of "News" and "News Search" (Google LLC n.d.). Other topics were considered (e.g., climate change, critical race theory), but failed to display multiple distinct periods of public's high vs. low interest over this seven-year period.

News Source Selection

In this pilot study, the following four news sources were selected to represent all possible combinations of ideological leaning (left vs. right) and radicalism (moderate vs. radical): 1) MSNBC News – moderate left (Roper 2020); 2) The New Republic – radical left (Peck n.d.); 3) Fox News – moderate right (Mitchell et al. 2014); and 4) Breitbart News – radical right (Pew Research Center 2014). These sources were selected based on public perception of the source's political stance, accessibility of articles published online through archiving, and consistent publishing schedules.

Selection of Periods Representing Various Levels of Public Interest

Periods of low and high public interest in the four selected topics were identified through the number of topic searches represented in Google Trends, which tracks searched terms by month (Google LLC n.d.). We assumed that when the topic is of high interest to the public (peak), it will appear in many searches, whereas low public interest (bottom) would be associated with very few searches. This allowed us to visually inspect the Google Trends trajectories and identify the two most significant peaks and two distinct bottoms over

the explored seven-year period. Ten articles were selected from each peak period and each bottom period (20 articles for periods of low public interest and 20 articles for times of high public interest), resulting in a total of 40 articles collected from each source for each topic (thus, producing a total sample of 640 articles). When lacking ten articles published within a specific peak or bottom period, supplemental peaks or bottoms of similar impact were selected to address the gaps. Typically, each identified peak or bottom represented a one-month period. However, because the bottom periods were characterized not only by low public interest but also by low publication rates, bottom periods were often extended to a five-month collection period to ensure the necessary amount of data.

Article Selection

Online media source archives were utilized to access articles from the specified seven-year period. Articles were located using search tools and tags for Fox News, Breitbart News, and The New Republic sources, and manually based on month and year for MSNBC. Key terms associated with each topic were used to identify articles within each news sources' archives. For the GUN topic, key terms included "Gun Control", "NRA", "Shooting", and "Assault Weapons". For IMG, key terms were "Immigration", "Muslim Ban", "Border Wall", "ICE", "Refugee Crisis", and "DACA". For VAC, key terms included "Vaccination", "COVID", "FDA", "Pfizer", "Moderna", "Johnson & Johnson", and "Fauci". For ABR, key terms were "Abortion", "Roe v. Wade", "Reproduction", "Church v. State", "Pro-life", and "Pro-choice". Articles were selected if they: 1) fell within the specified time period of a low vs. high public interest; 2) featured the key terms listed above; and 3) were at least 150 words long. Priority was given to longer articles and those authored by different journalists.

Procedures

The text analysis software DICTION 7 was used to identify the stylistic and semantic characteristics of text. DICTION uses 31 dictionaries to quantify specific lexical features of text in order to detect salient themes and dimensions of communication styles (Hart and Carroll 2013; Sterling et al. 2020). The raw quantitative output of DICTION can be used in further statistical analyses. The following stylistic variables were evaluated: 1) *Average Word Size* – an average word size in a passage; and 2) *Unique Words* – the number of unique words in a passage (Hart and Carroll 2013). In this pilot study, the following semantic variables were evaluated: 1) *Certainty* – "language indicating resoluteness, inflexibility, and completeness and a tendency to speak ex cathedra"; 2) *Ambivalence* – "words expressing hesitation or uncertainty, implying a speaker's inability or unwillingness to commit to the verbalization being made"; 3) *Self-Reference* – "self-references are treated as acts of indexing whereby the locus of action appears to reside in the speaker and not in the world at large thereby implicitly acknowledging the speaker's limited vision"; 4) *Aggression* – "dictionary embracing human competition and forceful action"; 5) *Cognitive Terms* – "words referring to cerebral processes", such as consider, deliberate, re-examine, question, and analyze; 6) *Diversity* – "words describing individuals or groups of individuals differing from the norm"; 7) *Exclusion* – "a dictionary describing the sources and effects of social isolation"; 8) *Insistence* – "repetition of key terms indicates a preference for a limited, ordered world"; 9) *Variety* – "a high score indicates a speaker's avoidance of overstatement and a preference for precise, molecular statements"; and 10) *Complexity* – "convoluted phrasings make a text's ideas abstract and its implications unclear" (Hart and Carroll 2013, pp. 5-11). In total, the DICTION analysis output produced 12 outcome variables.

Statistical Analyses

Three-way ANOVAs in SPSS 29 were performed to evaluate the effect of ideological leaning (L), radicalism (R), and public interest (I) on the above-mentioned stylistic and semantic characteristics of text. Thus, this study implemented a 2 (L: left vs. right) x 2 (R: moderate vs. radical) x 2 (I: low vs. high) factorial design, which allowed the evaluation of the main effects, as well as two- and three-way interactions among the main factors. To ensure the generalizability of findings, the current analyses did not distinguish among individual topics but combined all the topics into one pool of data.

Preliminary Results and Discussion

The current results showed significant differences in text characteristics between news media sources with different ideological leanings, levels of radicalism, and periods of high vs. low public interest in a topic.

Stylistic Characteristics of News Text

The *Average Word Size* increased with an increase in radicalism for left-leaning sources and decreased for right-leaning ones; the same pattern was observed at both levels of public interest (L*R: $F(1, 632)=6.42, p=.012$, see Figures 1 A-B). Left- and right-leaning sources showed approximately the same number of *Unique Words* per unit of text in the medium-radicalism condition at both levels of public interest; however, with an increase in radicalism, this text characteristic increased significantly for the left-leaning sources at both levels of public interest, remained the same for the right-leaning sources at the low level of public interest, and decreased slightly for the right-leaning sources at the high level of public interest (L*R*I: $F(1, 632)=4.40, p=.036$). Thus, stylistic variables seem to suggest that the text content of liberal sources becomes more sophisticated (i.e., longer words and more unique words) with an increase in radicalism, while more radical conservative sources tend to simplify text for their audience (i.e., shorter words and fewer unique words).

Semantic Characteristics of News Text

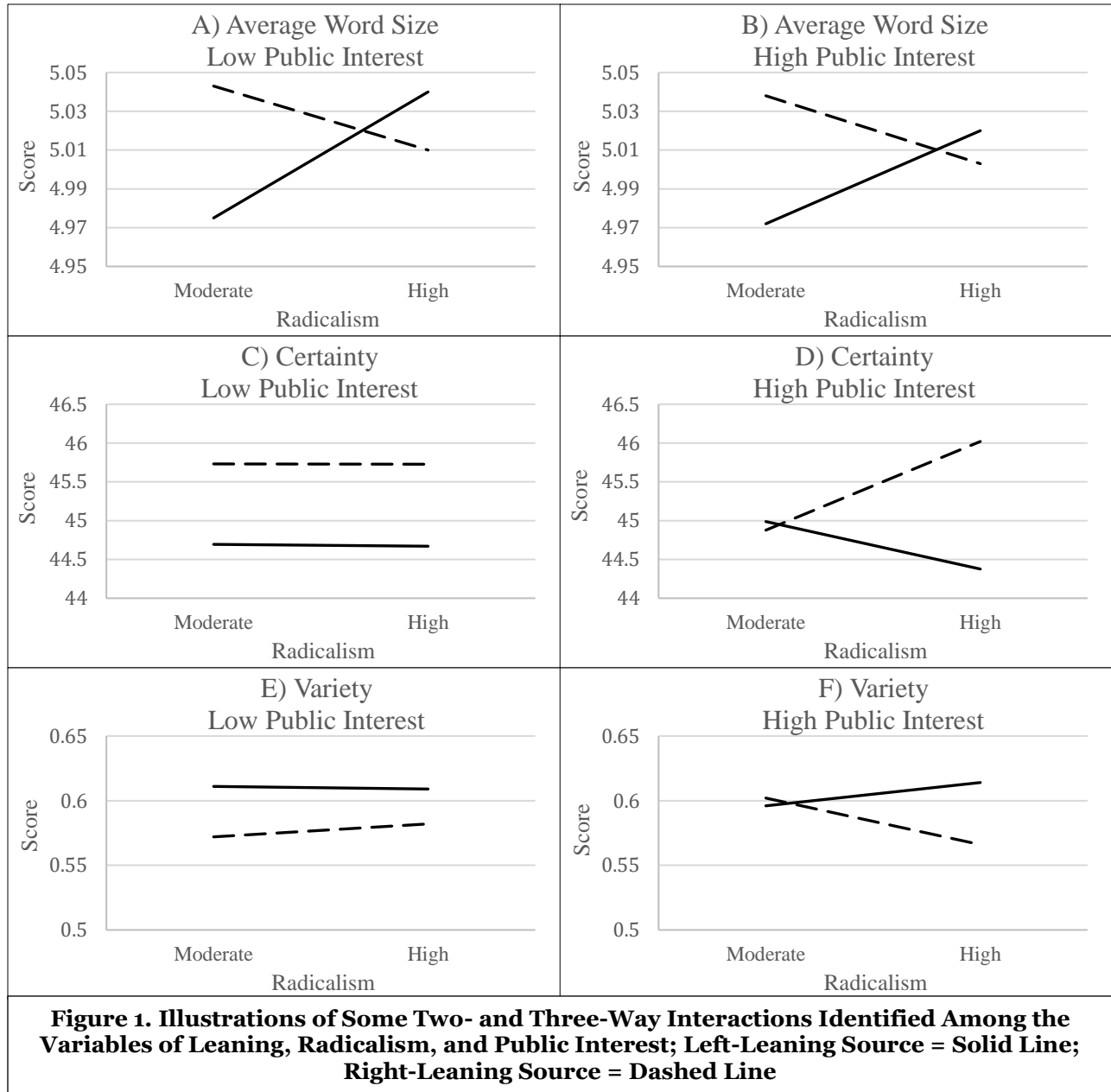
Ambivalence (L: $F(1, 632)=139.04, p<.001$), *Self-Reference* (L: $F(1, 632)=4.44, p=.035$), and *Cognitive Terms* (L: $F(1, 632)=17.33, p<.001$) were higher for left-leaning sources compared to right-leaning ones. These findings may suggest that liberal sources are less likely than conservative ones to commit to a position or opinion strongly, and more likely to invite their audience to re-evaluate available facts critically and emphasize that an article's position represents the view of the author that should not be treated as absolute truth. Moreover, *Cognitive Terms* were also higher in sources with a lower level of radicalism (R: $F(1, 632)=8.85, p=.003$): with an increase in the level of radicalism, news sources seem to become less likely to encourage their readers to critically analyze the information they receive and deliberate different possibilities and implications.

By contrast, *Exclusion* (L: $F(1, 632)=10.29, p=.001$), *Complexity* (L: $F(1, 632)=5.58, p=.018$), and *Aggression* (L: $F(1, 632)=5.83, p=.016$) were higher for right-leaning sources compared to left-leaning ones: conservative sources were more likely than liberal ones to use convoluted language, which may obscure the meaning of the message, and utilize wording featuring social exclusion and aggression.

Aggression was also higher in more radical sources (R: $F(1, 632)=5.69, p=.017$): messages tend to become more forceful and aggressive with an increase in the radicalism of the news outlets. *Insistence* was lower in left-leaning sources at the moderate level of radicalism and further diminished with an increase in radicalism, whereas right-leaning sources showed an increase in *Insistence* with an increase in the level of radicalism (L*R: $F(1, 632)=14.35, p<.001$): repeating the same ideas, apparently to hammer them down in the heads of the readers, seems to be a strategy of radical conservative news outlets.

Furthermore, the effect of public interest on text characteristics was found only for the *Certainty*, *Diversity*, and *Variety* variables. At the low level of public interest, left-leaning sources scored lower on *Certainty* than right-leaning ones, irrespective of the level of radicalism; at the high level of public interest, there was no difference between the two ideological leanings at the moderate level of radicalism, but with an increase in radicalism, there was a significant increase in *Certainty* scores in right-leaning sources and a significant decrease in left-leaning ones (L*R*I: $F(1, 632)=4.56, p=.033$, see Figures 1 C-D). Thus, not only do conservative sources tend to use more language suggesting determination, authority, and inflexibility of positions and opinions than liberal outlets, and this tendency becomes even more pronounced at a higher level of radicalism during periods of high public interest.

In general, *Diversity* was higher in left-leaning sources than in right-leaning ones (L: $F(1, 632)=14.61, p<.001$). Although there was little difference in *Diversity* between the two ideological leanings at moderate



levels of radicalism, left-leaning sources showed a sharp increase with an increase in radicalism, whereas right-leaning sources showed a corresponding sharp decrease (L*R: $F(1, 632)=9.33, p=.002$). Periods of high public interest featured higher levels of *Diversity* than those with low public interest, across all ideological leanings and levels of radicalism (L: $F(1, 632)=7.09, p=.008$). Thus, celebrating diversity becomes more of a theme for liberal sources with high radicalism and less of a topic of interest for conservative radical outlets; diversity is also discussed more during times of high public interest.

During times of low public interest, left-leaning sources showed significantly higher levels of *Variety* than right-leaning ones, with very little difference between the two levels of radicalism. During the times of high public interest, no distinct difference in scores was observed at the moderate level of radicalism; with an increase in radicalism, left-leaning sources showed a steep increase in *Variety* scores, whereas right-leaning sources showed a steep decrease (L*R*I: $F(1, 632)=10.07, p=.002$, see Figures 1 E-F). Thus, liberal sources may tend to avoid overstatements more than conservative ones. Also, for conservative news sources, the combination of high public interest and the outlet's high radicalism significantly increases their tendency to overstate.

Conclusions and Future Research Directions

In this study, we investigated differences in twelve stylistic and semantic text characteristics between four news media sources with different ideological leanings and levels of radicalism, during times of low vs. high public interest in four divisive societal topics. The current results provide support for all three proposed hypotheses. In line with **H1**, we found statistically significant differences in all twelve stylistic and semantic variables between left- vs. right-leaning sources, sources featuring moderate vs. high levels of radicalism, and/or times of low vs. high public interest. In support of **H2**, we found multiple statistically significant two- and three-way interactions among the variables of ideological leaning, level of radicalism, and the amount of public interest in a topic as they affect text characteristics. Importantly, these findings suggest that the effect of each variable on text characteristics may be mediated by the other variables. For example, the effect of radicalism level on text characteristics of news may depend on the ideological leaning of the source and the level of public interest in a topic.

Finally, according to **H3**, we can map the identified text characteristics that differ between left- vs. right-leaning sources, moderate vs. high radicalism sources, and times of low vs. high public interest on certain text characteristics recognized by previous research as signaling possible misinformation. Specifically, a combination of the right ideological leaning and a high level of radicalism was found to be associated with significantly smaller word size and repetition of key words in the text of the news; also, a combination of right leaning, high radicalism, and high public interest in a topic was linked to a significantly lower count of unique words. These identified differences correspond to text characteristics labeled by previous research as indicative of possible misinformation (e.g., using fewer words, shorter words, and more lexical redundancy; Carrasco-Farré 2022; Horne and Adali 2017; Newman et al. 2003). We also found fewer self-references in the news reported by right-leaning news outlets, while low self-referencing was associated with a higher likelihood of deception by previous research (Hancock et al. 2007; Newman et al. 2003). Moreover, the current results suggested higher levels of aggression in the text of right-leaning news sources, and aggression further increased for sources with right leaning and a high level of radicalism. This pattern of results maps well on previous research reporting that negative affect (e.g., aggression) is linked to misinformation (Cano-Orón et al. 2021; Conroy et al. 2016; Newman et al. 2003; Park 2015).

As a result, we propose that ideologically-motivated news tends to feature stylistic and semantic characteristics of text that may trigger in the readers the peripheral route processing (Areni 2003; Petty and Cacioppo 1986), which would make them more susceptible to misinformation (Carrasco-Farré 2022; Horne and Adali 2017; Newman et al. 2003). In summary, our results suggest the following manipulative tactics of news delivery: 1) less complex text featuring shorter words, fewer unique words, and frequent keyword repetitions, which is likely used to reduce the cognitive load on the reader to make the information processing more effortless and more prone to reliance on heuristics; 2) fewer self-references which may signify authors' desire to separate themselves from the narrative in cases of deception; and 3) a higher level of aggression, which is likely to trigger an emotional response that would block the "analytical" central route processing and make the reader more susceptible to misinformation. These key text characteristics could be used for detection of manipulated news content and misinformation through automated text analysis algorithms implemented on various media platforms (François 2020). This would create opportunities to mitigate harmful feedback loops in socio-technical systems. Future research should further test whether the following text characteristics (which are likely to trigger the peripheral route processing) can distinguish fake news from true news: 1) unclear messages; 2) overstatements of specific facts and opinions; and 3) authoritarian style of conveying the news that prescribes and insists on certain opinions, suggests the universality of such opinions, and does not invite the audience to critically evaluate the facts and points of view presented to them.

In the next step in this project, we plan to analyze these data by the topics to test whether the identified effects of ideological leaning, radicalism level, and public interest remain consistent across different polarizing topics. We also plan to perform sentiment and theme analyses of the data using the JMP Pro 16 software to identify possible affective characteristics of news text that may indicate the outlets' tendency to bias public opinion or misrepresent information.

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