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### What happens on the fringes, stays on the fringes?

*Information flows in the contemporary media system*

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*Chapter 5*

# **General discussion and conclusion**

## General Discussion and Conclusion

People nowadays are exposed to a wide array of offline and online information sources of varying sizes, accessibility, and publicness such that enable them to pick and choose not only where they get their news from, or how they consume news in general, but also which outlets and information sources they trust to provide reliable information according to their own beliefs. One no longer needs to turn the TV on, listen to the radio, open a newspaper or tap on a news app to find out what is the latest on the grapevine. Joining a news-related channel or group chat on a messaging app such as Telegram, listening to a podcast or following opinion leaders on social media may quench some citizens' thirst to get informed about socially and politically relevant information.

The ease with which information can be shared in the dynamic, multi-layered information ecosystem (Starbird et al., 2018) facilitates the blurring of boundaries between mainstream and fringe, making it challenging to distinguish between reliable and unreliable sources. Research indicates a shift towards more private spaces (such as WhatsApp, WeChat) for news consumption and deliberation (N. Newman, 2019). However, little is known about the role of comparable but more fringe platforms in this matter. Initial evidence suggests that ideas born on the fringes can gain traction and make their way into more mainstream discourse (Buehling & Heft, 2023; Schulze et al., 2022). This fuels a worry that malicious actors, whether state-sponsored or independent, can exploit the interconnected nature of the contemporary media system to spread propaganda, sow discord, and influence public debate (Lewandowsky, Jetter, & Ecker, 2020; Zannettou, Sirivianos, et al., 2019). The consequences of these dynamics would be significant. The intensification of conflicts, the erosion of trust in mainstream (media) institutions, and the polarization of public discourse are suggested to be major outcomes (see e.g., Bakker et al., 2020; Knüpfer et al., 2022; Schulze et al., 2022).

Yet, empirical evidence supporting these worries is limited to a set of case studies. First, evidence regarding *what* do people discuss on the fringes is scarce and mostly limited to research around far-right movements in Germany (Buehling & Heft, 2023; Schulze et al., 2022). Hence, there is a significant gap with respect to understanding the narratives that dominate the fringes. Second, we still do not know enough about the extent to which, and under what conditions can information born on the fringes shape public debate and threaten democracy. There is some evidence that once fringe narratives enter the mainstream, they have the potential to reach a broader audience (Buehling & Heft, 2023; Schulze et al., 2022; Tahmasbi et al., 2021). The existing evidence on

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these phenomena is predominantly centered around their influence in contentious situations like the COVID-19 pandemic (see e.g., Buehling & Heft, 2023; Tahmasbi et al., 2021). However, it is unclear whether this influence extends beyond major world events and crises to shape opinions regarding democratic processes and institutions. In other words, do we see more episodic, event-based influence from the darker corners of the web, or is this influence more constant and all encompassing regarding socially and politically relevant topics? A comprehensive understanding of the contemporary media landscape requires the introduction of new theory as well as innovative methodologies capable of explaining the complexities inherent to the dynamic and multilayered information ecosystem that surrounds the contemporary media system.

I began this dissertation with one overarching research question: *How do dark platforms interact with information flows in the broader media system, and how can we study these dynamics?* This question seeks substantial, theoretical as well as methodological solutions to a highly complex phenomenon that relates to myriad topics within as well as outside of the discipline of communication science. Although the scope and aim of the empirical chapters differ, they have one important aspect in common: using novel and exploratory approaches to take us a few steps closer to advancing our understanding of information flows that spread within the contemporary media system (Starbird et al., 2018).

The first two empirical chapters provided novel (exploratory) insights about the role of dark platforms in the contemporary media system regarding information flows in the context of two highly relevant case studies: The COVID-19 pandemic as well as the Russian invasion of Ukraine. In these chapters I have not only provided substantial insights concerning information flows from dark platforms and beyond by using advanced methodology, but also discussed some important theoretical and conceptual implications that must be taken into account in future research. Throughout the process of conducting the studies described in Chapter 2 and Chapter 3, I have encountered several methodological challenges that stemmed from the complexity of information flows. I found that tracing information flows in the contemporary media system is complex and highly contingent on (1) researchers' definition and conceptualization of information flows, (2) the level of analysis (i.e., between, within platforms, or entities), (3) the research context (i.e., importance of world events, or country), and (4) the methodology used. The aforementioned factors already give a good indication about the difficulties regarding a common understanding of how to trace information flows. Not only is the tracing of these flows difficult, validating them is even more complex. Against this backdrop, Chapter 4 took a purely methodological approach to explore to what extent can LLMs be used to advance the validation of dynamic, flow-based methods such as the automated tracing of information flows. In this chapter I argued that the vast knowledge basis of LLMs provide unique opportunities

that may solve some of the inconsistencies and unclarity surrounding the understanding and validation of information flow-based approaches.

The final chapter of this dissertation consists of five main parts. First, I outline the most important findings and conclusions of each empirical chapter. Then, I discuss theoretical, methodological and practical implications that follow from the empirical chapters. Finally, I provide some concluding remarks and recommendations.

## **Key findings and conclusions**

### **Studying information flows inside dark platforms**

**Chapter 2** investigated how have information flows impacted the community structure of a single dark platform, Telegram, over time. Using state-of-the-art content analysis approaches combined with insights from social network analysis on a unique dataset of over two million Dutch-language Telegram messages collected from 174 news-related public group chats and channels, I examined the Dutch Telegramsphere as an information sharing ecosystem of current affairs by reflecting on the evolution of the community structure of this low-moderated and easily accessible novel platform over the course of four years (2017-03-18 – 2021-01-20). Since the publication of the study outlined in Chapter 2, more and more scholars have begun studying the increasingly popular Telegramsphere. At least three valuable insights have emerged from this exploratory study.

First, the Dutch Telegramsphere of current affairs is dominated by right leaning and conspiratorial group chats and channels. This has already become clear during the data collections process that when searching for groups with keywords related to current affairs (i.e., news and politics). As such, Telegram's affordances and features appear to align better with the agendas of the far-right (Peeters & Willaert, 2022). This corroborates earlier findings that showed that far-right actors' hostility towards the mainstream media, makes them more likely to turn to novel, alternative platforms, such as Telegram for mobilization and information dissemination purposes (Mudde, 2019; Schroeder, 2018). Moreover, the lax moderation policies of Telegram also enables far-right groups to disseminate more extremists views by bypassing gatekeepers of more mainstream (social) media platforms and outlets (Schroeder, 2018). To illustrate, the far-right, party, FvD, appeared to have a strong presence on the Dutch Telegramsphere of current affairs during the investigated time period. This is unsurprising as FvD's "digital pandemic populism" (Vieten, 2020) calling for the freedom of those oppressed by government-imposed COVID-19 combating measures and "fake news" surrounding the origins of the pandemic aligns perfectly with Telegram's content liberation and exile congregation features. Furthermore, findings also revealed that this digital pandemic populism likely

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contributed to the fusion of far-right groups and channels with conspiracy groups (Peeters & Willaert, 2022).

Second, the communities within the Dutch Telegramsphere of current affairs have gradually become dominated by more extremist and conspiratorial narratives. Neural topic modeling revealed that over time content sharing in the identified communities has been predominantly driven by chats and channels that disseminated topics related to conspiracy theories, anti-establishment and anti-covid narratives. The increasing prevalence of extremist narratives at the cusp of the pandemic fuels a concern that users who initially chose to follow more moderate chats or channels that aligned with their beliefs may have, over time, embraced more radical perspectives as extremist narratives infiltrated their discussions they were exposed to.

Third, the Dutch Telegramsphere of current affairs has become an important medium for collective sensemaking (Weick, 1995) and collective action (Bakker et al., 2020) upon the outbreak of the COVID-19 pandemic. Findings regarding the information flows that characterized this space revealed that users of seemingly unrelated group chat and channels (e.g., farmers, conspiracy thinkers, and the far-right) came together to decipher how to best respond to the threat at hand. The constellation of diverse groups united by their resistance towards government-imposed pandemic control measures formed a digital counter public (Buehling & Heft, 2023). A similar phenomenon was observed in other European countries such as Germany (Buehling & Heft, 2023; Schulze et al., 2022). Anecdotal evidence suggest that this digital counter-public has adopted pro-Putin views upon the outbreak of the Russian invasion of Ukraine<sup>68</sup>. This is in line with research on “*fringe fluidity*” that posits that prior involvement with extremism represent a pathway to radicalization (Gartenstein-Ross & Blackman, 2019). Therefore, the digital counter-public formed around the pandemic has continued its activities by simply adopting a different issue.

### Studying information flows from darkness to light

After revealing valuable insights regarding information flows within a single and novel dark platform, **Chapter 3** expands the scope of the dissertation by zooming in on discursive information flows across multiple contributors to the communication space in order to obtain a more granular understanding of these dynamics. In this chapter, the concept of discursive information flows is introduced, with the primary objective of expanding the existing framework of (intermedia) agenda-setting theory as outlined by McCombs (2015) and McCombs and Shaw (1972). The intention is to broaden the analytical scope of agenda-setting while simultaneously narrow down the scope of information flows by offering a more granular

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<sup>68</sup><https://www.nrc.nl/nieuws/2022/03/03/ik-begrijp-wel-wat-poetin-doet-a4096731>

understanding influence dynamics with respect to public discourse.

I study discursive information flow dynamics on an aggregate level between (1) the dark platform agenda (i.e., 4chan/pol), (2) the social media agenda of politicians (G7 + Zelensky), (3) the social media agenda of the public (largest news and Ukraine related subreddits), and (4) the traditional media agenda (The New York Times, and The Kyiv Independent). Then I go deeper to study the impact of individual entities (i.e., subreddits, Twitter accounts, individual newspapers) in shaping the discursive information flows between the studied agendas.

The case under study that enabled the investigation of these complex dynamics was the Russian invasion of Ukraine. Similar to the preceding chapter, Chapter 3 employs neural topic modeling, as well as several other automated content analysis methods and advanced over-time analyses using Hawkes processes (Hawkes, 1971; S. Linderman & Adams, 2014) to study information flows. This research was carried out on a unique, multi-platform, and primarily English-language dataset ( $N_{texts} = 1,545,813$ ) covering the first six months of the Russian invasion of Ukraine (17.01.2022 – 17.06.2022). Taken together this chapter offers three core insights regarding information flows across as well as within a multitude of agendas in the contemporary media system.

First, despite concerns regarding the dangers that the influence of information flows from dark platforms pose to the mainstream media (Zannettou, Caulfield, Setzer, et al., 2019) and the public (Lewandowsky, Smilie, et al., 2020), Chapter 3 showed that the influence of the dark platform agenda on more mainstream agendas was negligible in the context of the Russian invasion of Ukraine. The most influential topics emanating from the dark platform agenda seemed innocuous at a glance. For instance they referred to rescuing animals, refugees, or donations. Further examination revealed that the language of the texts that comprised these topics was significantly more harmful than those on the studied mainstream agendas. The most influential topics on the dark platform agenda scored significantly higher on their toxicity rate, profanity rate, identity attack rate, and insult rate compared to the studied mainstream agendas. The harmful language rates uncovered were arguably much higher than one would expect when thinking about topics such as rescuing animals. Therefore, I suspect that the seemingly innocent topics on the dark platform agenda may refer to harmful metaphors, and memes as “floating signifiers” (Tuters & Hagen, 2020) used inside the darker corners of the web to spread hateful messages. This aligns well with recent work that details the antagonistic reactionary subculture on 4chan/pol (Hagen & Venturini, 2023; Tuters & Hagen, 2020).

Second, traditional media remains highly effective in influencing the rest of the contributors to the political communication space, demonstrating the continued agenda-setting importance

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of legacy media (Langer & Gruber, 2021), at least in the context of discursive information flows surrounding the Russian invasion of Ukraine. The traditional media agenda has a considerable influence on the dark platform agenda.

Third, findings in Chapter 3 indicated that dark platforms are very much connected to the rest of the contributors to the political communication landscape (Zannettou, 2019) in the context of discursive information flows surrounding the Russian invasion of Ukraine. In this chapter, I argue that rather than generating novel and potentially harmful narratives that can transcend dark platforms, users on 4chan/pol predominantly respond to existing topics and narratives from mainstream agendas. In the same vein, given the platform's significant self-influence, I posit that topics originating on 4chan/pol tend to remain within the confines of dark platforms, gaining momentum over time and spilling over into more mainstream platforms. This observation underscores the reactionary character of 4chan/pol (Hagen & Venturini, 2023), such that may encompass both an innocuous “creative vernacular sense” (Rogers & Giorgi, 2023, p. 1) as well as a potentially detrimental participatory behavior (Nagle, 2017).

Fourth, fine-grained analyses and within-agenda information flows can reveal interesting patterns that would get lost on the aggregate level. The concept of discursive information flows also aids this process. Findings on the aggregate agenda-level revealed that the traditional media agenda appears to be the most influential agenda setters amongst the studied agendas. However, after unraveling the agendas into the individual entities that made these agendas up we found that President Zelensky's Twitter account was by far the most influential in introducing new topics in the communication space surrounding the Russian Invasion of Ukraine. Furthermore, topic-level information flows may be too coarse, and thus sidestep some important nuances that are crucial to understand the content of information flows. Chapter 3 showed that it is important to conduct additional analyses in order to delve deeper into language properties that reveal a more detailed story about the information flows that dominate a certain communicative space.

### **Validating methods tracing information flows**

Following a series of important and novel empirical insights with respect to the role of dark platforms in shaping information flows in the contemporary media system, it has become clear that a validation scheme for automated computational methods that trace information flows is so far absent from the literature. Despite access to advanced computation methods to trace information flows, meaningful methodological progress is held back by the absence of rigorous validation approaches for this task. This is partly due to the challenges posed by tracing



dynamic, flow-based relationships that are more complex than identifying static concepts. Therefore, **Chapter 4** took a methodological turn to take a step towards optimizing the ways in which methods that trace information flows are validated. More specifically, Chapter 4 proposed a novel LLM-assisted human validation scheme for complex, flow-based approaches.

Advances in computational text analysis methods have contributed to a plethora of novel insights in the field of computational communication science. Thanks to these increasingly sophisticated NLP approaches scholars have been able to teach computers to identify latent concepts in natural language with a series of more or less advanced approaches. Despite significant advancements with respect to NLP approaches that now enable the studying of more complex phenomena, innovation regarding the validation of these novel approaches has been lagging behind (Birkenmaier et al., 2023). This gap is especially pronounced regarding the validation of more dynamic and flow-based approaches that require even more focus and work from the human annotators who normally perform validation tasks. Research showed significant issues with respect to the reliability of human validation even for more static, and less complex annotation tasks (Menchen-Trevino et al., 2023; van Hoof et al., 2023). Flow-based annotation tasks present even more difficulties for annotators. This task does not only depend on identifying static representations of information (e.g., topics), annotators must also link these across documents to assess whether a flow exists between hundreds, and thousands of text-pair combinations. This arguably highly cognitively taxing task inevitably leads to errors due to fatigue and limited attention span (Grimmer & Stewart, 2013), eroding the quality of much needed “gold standard” data for information flows.

Against this backdrop, Chapter 4 tested whether using recently emerged LLMs could contribute to optimizing the validation procedure of flow-based methods. Harnessing the knowledge basis of two light-weight and self-hosted LLMs (LLaMA 7B-chat, and LLaMA 13B-chat) we proposed and tested an validation scheme for information flow-based methods. The proposed scheme makes use of LLMs, human annotators as well as an expert annotator whose role is to verify the annotation of human coders on the one hand and on the other hand to set up the LLMs. We applied this scheme to a corpus of news article pairs surrounding the 2021 Dutch general elections. Several important insights have emerged from this study.

First, the LLMs tested in Chapter 4 fell short in annotation quality regarding the topic-level as well as the news event-level matching task across the tested document pairs. Extensive error analyses showed some recurring errors that the two models have suffered from. For instance, both LLaMA 7B-chat’s and LLaMA 13B-chat’s most common shortcomings were related to the incorrect identification of topics and news events which subsequently led to incorrect evaluation

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and incorrect labels assigned. Nevertheless, one could argue that the fact that the models were able to provide logical answers based on their preliminary topic or event identification, should be considered a positive sign that LLMs can follow sequential instructions rather reliably. While LLaMA 13B-chat appeared to follow this pattern, the more condensed LLaMA 7B-chat appeared to show signs of internal inconsistency. In some cases the model's preliminary topic identification did not match its subsequent evaluation and or final label assignment answer. All in all, the LLMs tested did not perform well enough in following strict instructions. In fact, compared to human annotators, the LLMs performed extremely badly in the task of identifying topic-level and news-event-level information flows across document pairs. Therefore, I suspect that the LLMs tested were not potent enough on the one hand to follow detailed instructions regarding theoretically-based definitions of information flows. On the other hand, upon closer inspection the answers provided by especially LLaMA 13B-chat could make logical sense were it not for the strict definition provided to the models especially regarding the identification of the main topic. Hence, I argue that testing LLMs ability to discern the topic of texts without prior definitions could provided some interesting additional insights.

Second, despite the low performance of LLMs in the proposed validation scheme, partial assistance, in the form of highlighted keywords, provided to human annotators appears to be the most beneficial with respect to increasing the speed of the annotation procedure without impacting the quality of annotations in any direction. Naturally, there are less sophisticated ways to obtain keywords then asking LLMs to highlight them for us. Nevertheless, subtle assistance in annotations could prove useful for especially such tasks where reading a substantial amount of text represents an integral part of the annotation task.

Third, the human factor remains crucial in the validation of flow-based methods. As argued above, LLMs to date are not reliable enough yet to be trusted with performing more complex, flow-based tasks such as assessing whether information flows exist across a series of document pairs. However, LLMs have been shown to be useful in discerning some more static features in text (Gilardi et al., 2023; Pangakis et al., 2023). Hence, LLMs could be used to identify concepts but their ability to discern dynamic relationships remains problematic. Regardless of the complexity of the task at hand however, LLMs should be used with caution given a series of biases and shortcomings that underlie their decisions (McGee, 2023; Törnberg, 2022).

Fourth, the introduction of an expert annotator can play an important role in ensuring the generation of a high-quality gold standard dataset. As shown by Chapter 4, despite high inter-coder reliability calculated on an overlap sample, the quality of annotator performance tends to decline as the number of tasks increase, especially for more difficult annotation tasks such as

the news-event-level matching task. This is where the expert annotator can and arguably should intervene. The final gold standard dataset should be verified by an expert annotator. Of course, checking every single annotation task across thousands of documents would be unfeasible, but inserting an option where annotators can flag cases where they were unsure could result in a subset that must be double checked by an expert before a fold standard dataset is considered good enough.

Finally, the conceptual unclarity of the definition of information flows negatively impacts methods that aim to trace or validate the existence of information flows across documents. In the literature a series of definitions exist for concepts that relate to studying information flows. To illustrate, although scholars agree that news topics are “ thematic news areas [...] which receive repeated coverage but which naturally encompass multiple events, and whose time span is much longer” (p. 44, Nicholls & Bright, 2019), a common understanding of how fine-grained or coarse the operationalization of topics should be is so far absent from the literature.

## **Theoretical implications**

This dissertation demonstrated that the information flows surrounding the contemporary information landscape are complex, dynamic and difficult to trace. A multitude of information sources and communications spaces lead to a plethora of different information flow dynamics. There is no “one size fits all” to explain the information flows that shape people’s attitudes and beliefs. As such, set of predefined issues, across a set of aggregate contributors to the communication spaces as proposed by agenda-setting theory no longer match reality.

Albeit, third-level agenda-setting (network agenda-setting) (Guo & McCombs, 2011) comes closer to explaining the process of information flows in the contemporary media system by acknowledging the role of novel information sources as well as the complex interplay between issues and their attributes in influencing the public debate. Yet, this framework still sidesteps the dynamic, and multilayered nature of information flows as well as the role of so far unknown issues propagating across information sources that operate beyond the confines of existing media structures. Furthermore, I argue, that in today’s media landscape it is not only difficult to categorize novel media sources, but new sources of information in general that do not necessarily have predefined “agendas” that they must get across to the public. Thanks to social media and other similar digital outlets, anyone can become an information source in the contemporary media system. The lines between curator and consumer of information have blurred to a great extent.

Does an influential person’s social media account that discusses current affairs belong to the

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media agenda or is it rather a reflection of a member of the public agenda? One could think of arguments supporting both of these options. In Chapter 3 for instance I considered posts from subreddits as the reflections of the social media agenda of the public, yet one could argue that the constellations of opinions on certain news related subreddits should not be aggregated into a single idea of agenda. Just like different newspapers have different issues that they aim to get across to their audience, different subreddits are characterized by different moderation rules, tones, stances, and styles of language which impact who speaks up on these forums. This is the reason why Chapter 3 also looked into information flows on the level of subreddits next to their aggregate influence on the agenda level.

### **Towards a new theoretical model to study information flows**

Conceptualizations of the media, the public, and politics can take many offline and online shapes and forms. Given the blurring boundaries between curators and consumers of information, perhaps we should no longer try to force information sources into predefined, aggregate-level boxes and instead study them as separate entities across any number of topics, and news events of interest. Hence, the relatively high-level of aggregation used in agenda-setting studies does not do justice to the complex nature of today's dynamic media landscape. The theory of discursive power (Jungherr, Posegga, & An, 2019) comes closer to this level of abstraction needed to understand contemporary information flows. However, it does not provide us with a clear model that could be used to translate complex information flows into relatively easily interpretable phenomena.

Therefore, in Chapter 3 I have introduced the concept of discursive information flows that relied on both agenda-setting theory (McCombs, 2014; McCombs & Shaw, 1972) as well as the idea of discursive power (Jungherr, Posegga, & An, 2019). The aim of this concept was to expand the scope of agenda-setting research by more fine-grained insights and at the same time narrow down the scope of the broad framework of information flows and discursive power to offer a more granular understanding of influence dynamics that surround public discourse in the contemporary media system. The concept of discursive information flows is useful to study influence dynamics that shape public discourse around specific events and issues. It considers power dynamics on multiple levels while still adding to the literature on agenda-setting theory. However, after nearly three years of research, I have come to realise that the most useful theoretical framework to study information flow dynamics must be more flexible in order to stand the test of time and technological advancements.

Instead of constructing more levels on top of agenda-setting theory, the answer to understanding information flows in the contemporary media system is to deconstruct them in such a way that could be applied to a plethora of cases, contexts and time. Unlike with

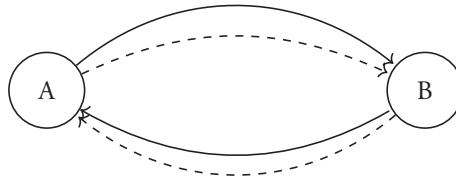
agenda-setting theory, this novel framework should not necessarily depend on logical and pre-defined patterns of agendas and gatekeeping, but it should rather embrace the complexity of the contemporary information landscape.

How can we deconstruct a complex phenomenon like information flows? Going back the fundamental definition of information flows provides us with a good starting point. The transfer of information from A to B, represents the foundation of this new proposed, deconstructed model. As we have seen in the empirical chapters, it is uncommon for information flows to be completely one-sided. For instance, findings in Chapter 3 indicated a reciprocal relationship between several subreddits through the topics they shared. Topics that first appeared on “r/news” stimulated the appearance of new topics of “r/politics” and vice-versa. On the aggregate level, the findings of Chapter 3 illustrated a reciprocal relationship between the dark platform agenda and the social media agenda of the public, the social media agenda of the public and the traditional media agenda, and the social media agenda of the public and the social media agenda of politicians. It appears that such feedback loops can occur both on the aggregate as well as on more fine-grained levels. Hence, what goes around, comes around, if you will. As illustrated by Figure 23, the information that first gets transmitted from A to B (solid line) may come back to A in a slightly different form (dashed line). In the same vein B can also transfer information to A (solid line), which once again can come back to B (dashed line).

Of course, this model of a feedback loop represents only a single link within the interwoven, and multilevel, contemporary information environment. There are arguably many more such “communicative feedback loops” (Trilling, 2023) operating across a multitude of information sources and communicative spaces dynamically.

The beauty of the proposed model is that it can be applied to virtually any level of abstraction across any number of and type of entities of interest. Depending on the level of analysis conducted, the proposed, single feedback loop can be expanded to multiple interwoven loops across as well as within any number of information sources and communicative spaces. To illustrate if one is interested in understanding information flows concerning a particular election, they might first identify relevant information sources involved in the coverage and discourse surrounding the election. Then, using the feedback loop model they can investigate these flows both on a coarse level, across the identified contributors to the discourse, as well as on a more fine-grained level by also zooming in on feedback loops that characterize each of the more coarse information sources investigated. Such practice may help break down the amplifiers of information to the very smallest entity such as the feedback loops that define the individual thoughts and attitudes of a single citizens, who posts something election-related in a Telegram

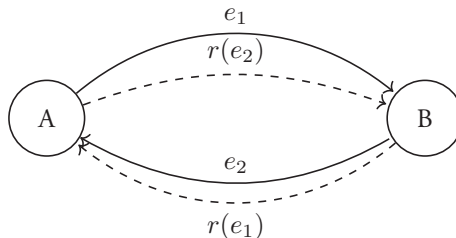
group dedicated to conspiracy thinking.



*Note:* Solid lines represent information, dashed lines represent reaction (i.e., feedback)

**Figure 23:** Basic feedback loop between A and B

The assumption about a set of agenda points or issues being transmitted by different contributors to the communication space no longer holds. Based on the empirical chapters we have seen that information flows are very much contingent on world events such as the outbreak of the pandemic or Russia’s war in Ukraine. A multitude of topics, and issues can surround these events. A news event is picked up by one entity then this information gets transmitted to another entity in a reactionary fashion. Figure 24 aims to depict that the feedback loops that define the contemporary information ecosystem are contingent on world events ( $e_1$ , and  $e_2$ ) and the subsequent reactions  $r(e_1)$ , and  $r(e_2)$  to these events across A and B.

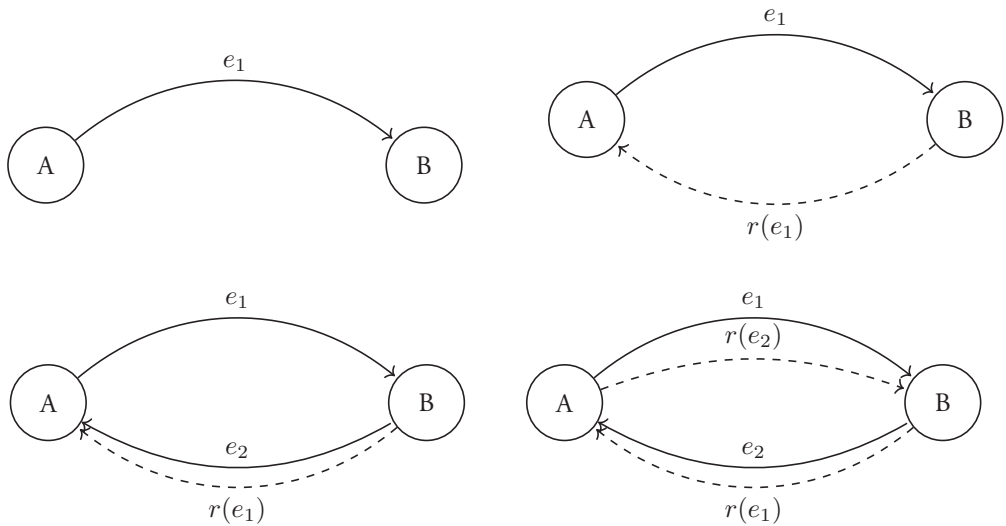


*Note:* Solid lines represent information, dashed lines represent reaction (i.e., feedback)

**Figure 24:** Event-driven feedback loop between A and B

In addition, we observed in Chapter 2 that with the passage of time the influence of certain information flows decline while others may gain power. Chapter 3 further contributed to the exploration of over-time information flows and suggested that the dynamics of these time-dependent information flows are nonlinear and happen in continuous time. The dynamic

over-time amplification of certain narratives can happen both within as well as across entities on multiple levels. Figure 25 illustrates the evolution of such a dynamic, and event-driven feedback loop. The different stages of the dynamic feedback loop model are a representation of the passage of time. Notably, these stages are meant to be perceived as continuous and non-linear processes.



**Figure 25:** Evolution of a dynamic, event-driven feedback loop between A and B

Taken together the proposed, deconstructed feedback-loop model, aims to capture information flows across any number of or type of information sources and communicative spaces within a dynamic and multi-layered information ecosystem. This model reinforces the need for fine-grained insights regarding the spread of information in the contemporary media system. I argue that when tracing information flows, scholars should move beyond classical typologies for information sources and instead focus their research around specific events, topics, and issues over time in specific contexts. One size does not fit all. This rule is especially true for information flows that are shaped by a multitude of forces. Below, I propose some hypotheses for future research in order to study information flow in the multi-layered, and dynamic information ecosystem.

First, the findings of Chapter 2 indicated increased activity from fringe actors and a subsequent increase in more extremist narratives in the ecosystem of current affairs within the Dutch Telegramsphere amid the COVID-19 pandemic. Topic-modeling over-time highlighted

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that the as stricter government-imposed measures were introduced to combat the pandemic, the more user activity could be observed in the Dutch Telegramsphere. This heightened activity manifested itself as a series of episodic peaks across several months. Furthermore, the topics that emerged during the enforcement of these stricter measures were also more extreme. This suggests that a crisis situation can act as a catalyst, amplifying both the volume of (extremist) information flows, as well as the level of extremism in narratives related to information flows about socially and politically relevant issues.

Second, findings from Chapter 3 suggest that despite widespread worry about the role of dark platforms in manipulating public debate, the darker corners of the web may not be as successful in introducing new potentially harmful narratives into the public debate, but they may instead take on a primarily reactionary role that reflect on topics already existing on mainstream outlets and information sources. Nevertheless, as previous studies indicated, the darker corners of the web have been compared to laboratories of extremist narratives (Lewandowsky, Smilie, et al., 2020) such as “pizzagate”, a conspiracy theory that became viral during the 2016 US presidential election campaign (Tuters et al., 2018). Although pizzagate is just one example of a fringe narrative that was born on the darker corners of the web and became mainstream overtime, the timing of this conspiracy theory once again suggests a feedback loop between major world events such as a presidential election, which serve as amplifiers that can elevate fringe narratives from obscurity into the mainstream. Therefore I propose the following hypotheses:

**H1:** *Crisis situations and major world event lead to an episodic increase in information flows from fringe information sources.*

**H2:** *Crisis situations lead to an increase in the extremism of the content of information flows from fringe information sources.*

**H3:** *Users continuously exposed to extremist content will score higher on extremist attitudes over time.*

**H4:** *Dark platforms generally play a reactionary role regarding the information flows that characterize the contemporary media system.*

Third, the dynamic, event-driven feedback loop model can also be used to understand the relationship between platform affordances and the level of extremism exhibited by information on communicative spaces. Recent research has found that the interplay between platform affordances and the information ecosystem can influence the formation of counter-public movements on Telegram (Buehling & Heft, 2023). In the same vein, I argue that the interplay between platform affordances and the information ecosystem can not only influence the structure of (counter)public



movements but also the speed with which information moves through communicative spaces. To illustrate, the ease of creating and joining groups on Telegram, coupled with the IM app's content liberation policies and encryption, enables for the rapid formation of communities around specific (extremist) narratives or movements. This rapid group formation accelerates the dissemination of information within the broader Telegramsphere across group chats and channels, fostering an information ecosystem where ideas can gain momentum quickly.

**H5:** *Platform affordances that enable content liberation – anonymity, low moderation, encryption, instant messaging function, and limitless group size – amplify the distribution speed of fringe narratives.*

**H6:** *Platform affordances that enable content liberation – anonymity, low moderation, encryption, instant messaging function, and limitless group size – lead to a higher level of extremism of the content shared on communicative spaces.*

Finally, the findings of this dissertation also suggest that information flows take place on many levels, across myriad entities that neither fit the mold of existing typologies of information sources nor possess predefined “agendas” that they must transfer to the public debate at all costs. To truly understand the forces that shape information flows in the dynamic and multilayered information ecosystem, scholars must embrace the complexity of the task at hand and strive to trace information flows dynamically, and on multiple levels by adopting the proposed feedback-loop model. More specifically, instead of assuming a linear relationship between a set of aggregate information source types over time, future research should model information flows by conceptualizing them as dynamic feedback loops that take place between, as well as within entities such as newspapers, various social networking sites, political parties, or individuals.

**H7:** *Information flows in the contemporary media system consist of a series of dynamic feedback loops.*

To illustrate, during a press conference, Politician A declares their candidacy for the upcoming elections, drawing coverage from newspapers A and B. However, Newspaper C, absent at the event, picks up information from A and B's reports and crafts a biased, negative narrative. Reddit user X shares Newspaper C's article on a news-related subreddit, leading to a contentious discussion with comments linking to the articles by Newspaper A and B. Moderators intervene by removing toxic comments. This prompts one user to post a link to a public Telegram group where users can express their opinions without moderation concerns.

Meanwhile, on 4chan/pol, anonymous users begin “shitposting” and creating memes and conspiracy theories about the upcoming elections in response to Politician A's announcement.

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Some of these memes and theories find their way into the Telegramsphere, reaching individuals in public group chats and channels who may not have encountered such content on other mainstream platforms. Telegram users who encounter the theory and find it shareworthy, may further propagate it to others both offline and online, which prompts further coverage of the conspiracy theory by obscure blogs and forums.

In response to the initial outbreak and spread of the conspiracy theory surrounding Politician A, the campaign manager of the opposition candidate B seizes the opportunity, and incorporates elements of this narrative into their campaign strategy. As soon as Candidate B starts hinting at the conspiracy theory, this lends legitimacy to it, making it more convincing to a broader electorate. Those members of the electorate who already possessed some level of affinity towards the narrative amplified by Politician B, may over-time shape their beliefs regarding parties and candidates which may ultimately impact their voting behavior.

The example above represents a simplified version of the complex web of information flows that can surround a single event. It must be noted that this example as well as the entirety of my dissertation does not consider the role of algorithms in shaping information flows. The proposed feedback loop model however can easily be used to hypothesize about the amplifying or dampening role of algorithms regarding information flows given that these recommender systems are largely based on the reinforcing users' existing preferences. Furthermore, although this dissertation does not tap into user characteristics, I argue that the feedback loop model would also help scholars reconcile the relationship between individual differences in news diets, personality traits, and behavior. The relationship between these aspects is also dynamic in nature. Individuals' pre-existing beliefs, values and distinctive personalities influence their information consumption choices (Festinger, 1957). Algorithms in turn use this data to provide tailored recommendations, which can reinforce existing beliefs (Loeberbach & Trilling, 2020).

### Methodological implications

Much can be uncovered about information flows across different platforms, actors, and entities using a wealth of computational text analysis approaches and millions of data points. Given the easy access to novel, and vast amounts of digital data, scholars argued that we must update computational communication science methodology for automated text analysis approaches (Kroon et al., 2023). At the same time, innovation with respect to the validation of automated methods is crucial (Grimmer & Stewart, 2013). Yet, the validation of computational text analysis methods is difficult (Baden et al., 2021) due to the absence of adequate methodological guidance as well as a unified framework for validating computational text-based measures (Birkenmaier et al., 2023) which likely explains inconsistent findings across empirical

studies aiming to measure similar concepts (van Atteveldt et al., 2021). To address these gaps, in this dissertation I apply a series of state-of-the-art, predominantly open-source computational methods on large corpora to uncover patterns and trends regarding the dynamics of information flows in the contemporary media system. Moreover, addressing the need for innovation with respect to the validation of novel computational text analysis methods, I propose and test an LLM-assisted human validation scheme, which offers important guidance both regarding the validation of flow-based computational text analysis methods, as well as regarding the current state of light-weight and self-hosted LLMs in aiding the validation procedure of complex computational text analysis methods.

First, advanced methodology can offer fine-grained insights about the dynamic and interwoven nature of the contemporary media system. In this dissertation I employed state-of-the-art computational text analysis methods to provide a more nuanced understanding of the key features that influence how information propagates in the contemporary media system. In Chapter 2 I have demonstrated that applying BERTopic, neural topic modeling approach (Grootendorst, 2022) combined with social network analysis techniques can reveal interesting patterns with respect to the role of information flows in shaping the community structure of the Dutch Telegramsphere of current affairs.

After discovering that examining over-time dynamics of information propagation can provide fruitful insights about the role of world events in shaping information flows, in Chapter 3 I have embarked on disentangling the role of dark platforms in sharpening information flows in the broader media system by studying these in continuous time using Hawkes processes. This method originates from neuroscience and information science and it enabled the studying of influence dynamics across any number of entities in continuous time. Combined with neural topic modeling and toxicity analysis, Hawkes processes proved to be a useful tool to reveal complex influence dynamics across the contemporary media system.

The aim of Chapter 4 was to leverage the unique opportunity provided by LLMs in optimizing the ways in which the validation of flow-based automated approaches is conducted. Based on the findings of Chapter 4, humans remain crucial parts of any annotation and validation process. I argue that with innovation and much needed democratization of LLMs, the role of human annotators may over time change to verification. However, regardless of the performance of new AI models, the control over what is considered to be true and correct should always remain with humans. The currently available LLMs are great for exploring new perspectives and discovering aspects that have not been considered before, but we cannot forget the importance of the human factor. Moreover, the added value of LLMs for more complex,

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and flow-based approaches such as the validation of information flows remains questionable to date. However, the guidance provided in Chapter 4 regarding the advantages and disadvantages of two widely accessible models offer important lessons to scholars who wish to explore new ways in which LLMs can potentially optimize other NLP tasks. This dissertation has not only presented innovative theoretical and methodological insights into the dynamics of information flows within the contemporary media system but has also generated valuable datasets and useful analysis scripts along the way. These datasets and scripts serve as a resource for future research, enabling the training of new models and the validation of existing ones. By making both the datasets and analysis scripts accessible to other scholars, this work contributes significantly to the advancement of our understanding of information flow dynamics. The section below outlines future directions for computational communication scientists.

### Looking ahead for computational communication scientists

Novel methods can offer novel insights or confirm existing knowledge. Countless approaches and models exist for the purpose of automated content analyses. Having this vast array of choices, it has become increasingly difficult to navigate this terrain. It is no longer an issue to find models, and sophisticated methods to analyze vast amounts of data. The challenge is finding the right models and applying these correctly. Leading scholars in the field of media effects research and computational communication recently highlighted the need for more interdisciplinary collaborations between theoretical experts and methodologists to optimize the investigation of content-based effects in the contemporary media system (Pouwels et al., 2023). Moreover, even if one possesses a vast theoretical knowledge and is able to conduct sophisticated analysis with advanced methods, it is still difficult to navigate the current, ever-changing media system where not only the phenomena we aim to study represent a moving target but also the tools we use to study them are continuously in need of upgrading. How can then computational communication scientists navigate this ever-changing field?

Take the rise of LLMs as an example. These powerful models seem to offer new opportunities to tackle complex issues that so far were extremely difficult to decipher using conventional approaches. Although LLMs may seem like the ultimate answer to all outstanding NLP issues, their real contribution at present is at best questionable due to issues regarding transparency, computational costs, as well as ethical concerns related to built-in biases (Bartl et al., 2020; McGee, 2023). Despite some interesting initial findings regarding the usage of some LLMs for NLP tasks, many scholars have serious doubts about the usage of LLMs in academic research (Ahmed et al., 2023). One thing is clear, to keep up with the ever-connected and ever-changing information landscape, the field of computational communication science will inevitably keep

moving towards even more automation. Some argue that as technology advances, we will be moving towards multi-modal foundation models that are no longer specialized on a single task such as classification of political texts, but rather multi-modal general-purpose assistants that are capable of performing a plethora of vision-language tasks (Li et al., 2023).

The movement towards more automation is a double-edged sword, however. As long as LLMs and other generative AI that are useful for research purposes are controlled by commercial entities, researchers must be cautious about how they intend to use these technologies. In line with Liesenfeld et al. (2023), I argue that scholars must always consider the safer, more open, and most ethical alternatives as opposed to choosing models with the best possible performance. The commercial success and striking capabilities of OpenAI's ChatGPT or GPT-4 represent a feature that has swayed several scholars as indicated by a significant number of studies related to LLMs (see e.g., Törnberg, 2023a, 2023b). Some of these studies lead us to believe that by using these commercial models we can simply replace humans in the process of data annotation, classification or validation tasks traditionally performed by humans (see e.g., Gilardi et al., 2023; Törnberg, 2023a). Although the encouraging findings of these studies point towards a future where we can potentially leverage generative AI to optimize tasks by reducing labour costs, and improving annotation/classification quality and speed (Pangakis et al., 2023), at present, there are still a series of issues and risks surrounding commercial LLMs that must be acknowledged and evaluated by the academic community.

The growing influence of commercial entities on academic research is in and of itself a huge concern (Ahmed et al., 2023). It leads to several risks that need to be acknowledged. Although it is great that for a small sum of money anyone can use OpenAI's proprietary models for a plethora of NLP tasks, the company may at any point decide to either discontinue their API or significantly increase the costs related to the usage of their services. Such decisions are entirely outside of the control of the academic community.

Not only would such decisions affect the reproducibility of hundreds if not thousands of studies, but research software built on Open AI's proprietary models would become virtually obsolete. Alternatively, if the models prove to be extremely lucrative, and the company decides to increase the price of usage, then scholars may get locked into increasingly costly contracts with commercial entities whose future is difficult to predict. To illustrate, recently the academic community has been affected greatly by the shutdown of Twitter's academic API that has enabled countless researchers to conduct myriad studies on a plethora of topics free of charge. Twitter used to be the go-to-source to "take the pulse of the internet" (Calma, 2023). Since the takeover of Elon Musk, and Musk's crusade to monetize Twitter usage, researchers who relied of

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Twitter for data collection for the past decade, were suddenly left without an alternative. In fact, the Twitter data collected for the purpose of Chapter 3 would not be possible to replicate due to this development. Although the shutdown of the once accessible Twitter API is arguably different from the potential shutdown of OpenAI's services, it still provides a good lesson to the academic community: Relying heavily on commercial entities be it for data collection or data analysis, can severely undermine one's research.

In addition, and circling back to LLMs, the usage of commercial LLMs in academic research exacerbates the “compute divide” (Ahmed et al., 2023) that fosters the increasing “de-democratization of AI” (Liesenfeld et al., 2023, p. 2). Scholars argued that despite a decades-long equilibrium between AI in academia and in the field, the balance has recently shifted in favour of the industry that now seems to dominate in terms of compute power, models, data, and highly skilled researchers (Ahmed et al., 2023). This shift fosters more academic research that incorporates industry-set benchmarks, models, and publications. The rising influence of the industry fuels a concern that the need for AI-tools built with the interest of the public at heart, rather than for profit, is decreasing, which may jeopardise future endeavours to decolonize computational sciences that suffer from significant biases (Birhane & Guest, 2021), and to regulate the corporations that have so much control over AI-research in terms of transparency, accountability, and unethical labour practices (Gebru et al., 2023).

In fact, transparency, openness, accountability, and ethics represent the most fundamental premises of academic research. These properties have enabled scientific progress in several disciplines over the past millennia. With the rise of LLMs such as ChatGPT we have entered an era where large AI corporations have enticed millions of people worldwide to get on board with using their closed-source and freemium models with striking capabilities. The shiny features of these closed-source models divert attention from the underlying issues related to these commercial models such as lack of openness, major copyright violations related to data theft, biases, and increasing inequality due to power concentration in the hands of a few, for-profit corporations (Gebru et al., 2023). Discussing and acknowledging these issues in the academic work that aims to test commercial models should not come as an afterthought.

While I agree that testing new models is crucial to advance scientific progress, scholars should by no means become complicit in advertising closed-source models as *the* solution. Instead, we must strive for openness to the best of our abilities with respect to model choice as well as regarding the publication of research materials, data, and error analyses. Following this mantra we can foster the widespread understanding of the technology behind closed-source models that will eventually enable the generation of more open-source tools, open data, and reproducible

workflows by academics, for academics (Liesenfeld et al., 2023).

Finally, although this dissertation showed that much can be uncovered about the forces that shape contemporary information flows by using state-of-the-art computational text analysis on large textual corpora, much also remains hidden without zooming in on the interplay between individual differences in humans and algorithmic recommendations. Although it can be highly insightful to map information flows within and beyond dark platforms to obtain a good understanding of narratives that shape these spaces, highlighting the individual experience of users in being part of these more obscure spaces would reveal much needed nuance with respect to the motivations of citizens in seeking information outside of the boundaries of the mainstream media. Pioneering studies in the field of communication science have begun working with such individual-level data via data-donations, browser histories and digital traces to understand citizens' news diets, attitudes, and behavior related to socially and politically relevant issues (see e.g., Ohme et al., 2020; van Hoof et al., 2023). Albeit, studying the individual experiences of citizens who have grievances against the establishment, or are suspicious about science in general represents a highly challenging task. Nevertheless, we must move beyond studying the broad strokes of information flows in order to clarify the role of individual differences in the complex interwoven information ecosystem.

## **Practical implications**

### **Implications for policy makers**

This dissertation demonstrated that using platforms such as Telegram may put citizens who wish to get informed about socially and politically relevant topics in harms way. Telegram may not be as successful in introducing new narratives, or planting new ideas in users' heads. However, based on the findings in Chapter 2, it appears to be successful in drawing the attention of those who are uncertain, and have grievances against the establishment for one reason or another especially during a crisis. This vulnerable population should be protected by policy makers.

A person who is initially doubting the legitimacy of the mainstream media may gradually adopt more radical views if continuously exposed to extremist narratives. This phenomenon can be explained by a series of "communicative feedback loops" (Trilling, 2023): within-human (i.e., human behavior influences human opinion which affects behavior), between-human feedback loops (i.e., behaviour of human(s) affecting the behavior of other human(s)), and algorithmic feedback loops (i.e., between human and algorithm). The interactions of these feedback loops can lead to an amplification effect such that may explain the fluidity of the fringes whereby prior involvement with extremist views foster one's pathway down the

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radicalization rabbit-hole (Gartenstein-Ross & Blackman, 2019). Crisis situations provide fertile ground for rising extremism and radicalization (Funke et al., 2016) and dark platforms such as Telegram can exacerbate this effect by enabling political outsiders such as the far-right exploit crisis situations and spread their poisonous, alternative narratives and mobilize their followers (Schulze et al., 2022).

In the same vein, scholars argued that “decreasing trust may reduce governmental and institutional capacity, contributing to cycles of distrust where low trust hinders positive change [...]” (van Antwerpen et al., 2023, p. 2298). Research found that citizens who distrust mainstream news media, are more likely to seek out alternative news outlets that promote anti-establishment attitudes and views (Hameleers et al., 2022).

Hence, it appears that the key to protecting vulnerable populations, would be to restore their trust in the fourth estate. This, of course is easier said than done. As shown by Chapter 2, long-term exposure to alternative narratives on obscure spaces such as Telegram can expose users to more radicalized views over time. Seemingly innocent communicative spaces may morph into full-blown anti-establishment platforms that actively promote ways to erode the structures of the establishment. Research also showed that “fringe fluidity” represents a radicalization pathway whereby those already harbouring extremist attitudes and beliefs towards one issue, will likely adopt extremist views regarding other issues (Gartenstein-Ross & Blackman, 2019).

What can policy makers do to increase trust in the media to simultaneously increase trust in the establishment? Banning dark platforms would arguably represent a Sisyphean task. As soon as the door to one dark platform closes another, unknown door emerges towards a potentially even darker platform. Not to mention that if the establishment cracks down on alternative news sources it would amplify the narrative that has contributed to eroding the trust in mainstream media in the first place. Hence, banning platforms is arguably futile.

One of the solutions against battling the dangerous narratives spreading on dark platforms would be to invest resources into reinforcing public broadcasters with more public funding that would enable higher quality, more transparency and less one-sided reporting of the news. At the same time, more funding available for quality news reporting by independent organizations could also help increase trust in the news media (Banerjee et al., 2023). Nevertheless, in countries with an existing strong public broadcaster such as The Netherlands (N. Newman et al., 2023) such measures may not result in substantial change.

Another, perhaps more generally effective measure is to enforce the regulations established in the recently adopted EU Digital Services Act (DSA)<sup>69</sup> for fringe media and for mainstream

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<sup>69</sup>[https://ec.europa.eu/commission/presscorner/detail/en/QANDA\\_20\\_2348](https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_2348)



media alike. Regulating rather than banning potentially problematic online information sources and communicative spaces would expose the issues surrounding these spaces to the wider public and in turn empower them to either keep using these services in a safe way or look for safer alternatives. Achieving a higher level of transparency and accountability would contribute to the empowerment of users of mainstream as well as more fringe media.

### **Implications for journalists**

Chapter 3 found that traditional media still appears to lead while dark platforms seem to follow from an agenda-setting perspective. While this is an encouraging finding, we must not forget that the power of dark platforms such as 4chan/pol and Telegram are not to be underestimated. As shown in Chapter 2, a crisis such as a global pandemic had the power to transform such channels and chat groups that were rather innocent at a glance into anti-establishment platforms, some of which became associated with real world violence and harm. A crisis can have a disruptive effect on society, especially on those citizens who do not feel heard and represented by the establishment. Furthermore, the social instability brought on by a crisis creates a fertile ground for the rise of or escalation of extremism (Funke et al., 2016). How can we make citizens trust the mainstream media and avoid the darker corners of the web that offer alternatives to the truth? What can journalists and mainstream media outlets do to regain trust?

This is perhaps one of the most difficult questions at present. It has become much too easy to label news organizations as spreaders of “fake news” since prominent political figures such as Donald Trump have permanently entrenched this concept into our collective vocabularies. The term has earned legitimacy, has even become term of the year in 2017 (Flood, 2017). The widespread usage of such terms as fake news undermines trust in established news organizations and journalism. Recent research argued that the key to increasing trust in journalism would be related to adopting constructive, non-sensationalised journalism (van Antwerpen et al., 2023). In a similar vein, another study found that more in-depth reporting, transparency regarding political views and standpoints, and more regional news coverage, more activity on social media, and more reporters could contribute to improving perceptions of mainstream news (Fisher et al., 2021). All in all, there does not seem to be a magic bullet that would improve trust in mainstream media and news on a global level. Yet, there are signals that increasing transparency and reducing bias in news coverage could have a positive impact of perceptions regarding mainstream media.

### **Implications for citizens**

The contemporary information landscape offers several information sources from fringe to mainstream that cater a multitude of diverse viewpoints surrounding socially and politically relevant information to citizens across the globe. Nowadays news can be found anywhere.

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People's news diets also differ to a great extent, not only based on what sources they choose to follow, but also based on the series of forces that further shape what kind of news they are ultimately exposed to. In line with previous research (Vermeer et al., 2021) this dissertation found evidence for the increased importance of messaging apps from a news consumption and deliberation perspective. Although one could argue that if citizens engage in socially and politically relevant discussions in online chat groups, this could have positive consequences for political knowledge and participation. Yet, as I have shown in Chapter 2, participating in seemingly news-related group chats on IM apps such as Telegram may over-time expose citizens to harmful narratives that can spread virtually unchecked and have the potential to spill over to mainstream discourse surrounding contentious issues.

Recent research identified teenagers, who are increasingly using IM apps and social media for news consumption (Vermeer et al., 2021), to be more susceptible to believing conspiracy claims than adults (Navarro, 2023). Another vulnerable population is older adults who are generally considered to be latecomers to the realm of social media. This population is less media literate than younger generations and may in turn struggle with identifying online misinformation such as fake news (Moore & Hancock, 2022) and fake images (Brashier & Schacter, 2020).

Digital literacy interventions represent a promising avenue to improve one's resilience to manipulation (Moore & Hancock, 2022). Therefore, to combat the looming dangers of being exposed to harmful narratives online, it would be beneficial to invest into educating vulnerable populations such as teenagers and older adults regarding the potential risks of using dark platforms such as Telegram to consume and discuss news, as well as to teach them how to recognize misinformation.

### **Final conclusion**

In sum, this dissertation has built on state-of-the-art methodological approaches and unique datasets collected around important societal issues and world events to advance our understanding of information flows in the contemporary media system. The increasingly fragmented but at the same time interwoven nature of the contemporary information landscape poses new challenges to existing theory and methodology in studying the information flows that disseminate dynamically through a multitude of information sources and communicative spaces that no longer fit the predefined definitions established by existing communication theory. Despite the growing trend towards the usage of social media and more private communication spaces, for news consumption and deliberation, empirical insights on the role of comparable but more fringe communication spaces in consuming socially and politically relevant information is not well understood. While prior research has linked these dark platforms to extremism, there is limited empirical evidence

substantiating the assertions that the obscure corners of the web are laboratories for extremist narratives and that these platforms possess the capability to influence mainstream media coverage, and public debate. This dissertation aimed to advance our knowledge about information flows in the contemporary media system by examining how dark platforms interact with information flows in the broader media system and how can we study these dynamics.

Findings showed that the influence of dark platforms is negligible compared to more mainstream information sources. However, low-moderated publicly facing communication spaces offered by dark platforms such as Telegram can pose a danger to those users who over time get exposed to more extremist narratives around contentious issues regarding socially and politically relevant topics. This dissertation also took a step towards innovating the ways in which we study and validate automated methods that trace information flows by leveraging novel computational methods. Although state-of-the-art computational methods foster more fine-grained insights regarding contemporary information flows, the validation of these approaches remains challenging. Despite the recent opportunity provided by the rise of Large Language Models to innovate not just the measurement but also the validation of complex and dynamic phenomena, the current subpar state of these LLMs regarding performance, transparency, and ethics necessitates the continued importance of retaining the human factor in validating advanced computational methods.

Taken together, this dissertation offers new avenues for theory building, and methodological innovation by exploring complex, and fine-grained information flow dynamics in the contemporary media system from fringe to mainstream. The exploratory findings of this dissertation have opened doors towards several new hypotheses that should be tested by future research that aims to understand the forces that shape the contemporary media system. Besides studying the interplay of content features and influence dynamics across platforms and time, the dynamic, event-driven feedback loop model proposed in this dissertation can foster more fine-grained research efforts into understanding the ever-evolving contemporary media system that is shaped by complex interactions between individual choices, algorithmic recommendations, platform affordances, and context. Herewith, we can shed new light on amplifying, as well as potentially dampening factors that shape information flows. Although what happens on the fringes may not (always) stay on the fringes, we must continue monitoring the role of dark platforms in the contemporary media system, not only to safeguard citizens from potentially dangerous narratives but also to understand the multifaceted forces that contribute to the (episodic) popularity of more obscure places for news consumption and deliberation.