

## Using Syndemic Theory as a Framework for Understanding and Addressing Polarization and Other Antisocial Behavior on Social Media

Jaigris Hodson, Ph.D.  
Royal Roads University  
[Jaigris.Hodson@royalroads.ca](mailto:Jaigris.Hodson@royalroads.ca)

Esteban Morales, Ph.D.  
University of Groningen  
[E.morales.velasquez@rug.nl](mailto:E.morales.velasquez@rug.nl)

Joan Owen  
Royal Roads University  
[j3owen@royalroads.ca](mailto:j3owen@royalroads.ca)

### Abstract

*Digital information and communication platforms like social media are implicated in the spread of digital polarization, mis- and dis-information, and other types of antisocial online behavior. These problems are complex and cannot be addressed simply via content-based or platform-design changes; however, if information system scholars and practitioners cannot address them, they threaten the very fabric of democratic communication. In this paper, we adopt an epidemiological and social determinants of health model, drawing on the concept of syndemic from the public health literature. We suggest that problems like polarization, misinformation, or online abuse can be best understood as information syndemics, and then we demonstrate how the syndemic framework is a useful theoretical contribution to enhance the understanding of the relationships between structural and technological issues, misinformation, online antisocial behavior, and polarization.*

**Keywords:** Information Systems, Misinformation, Online Antisocial Behavior, Polarization, Social Determinants of Health, Syndemic.

### 1. Polarization as an antisocial online behavior

Information systems can either support the flow of evidence based democratic communication, or impede it (Bernacer et al., 2021; Bisiada, 2022). Unfortunately, there has been recent growth in the spread of misinformation, online and offline polarization, and online harassment and abuse. In this paper, we argue that systems researchers should consider a social determinants of health framework to understand and address problematic online behavior like polarization on digital platforms.

Together, misinformation, harassment, and abuse that occurs in digital spaces like social media can be broadly understood as online antisocial behavior. Online antisocial behavior has been defined as “any

interaction between two or more users that is hateful, harmful, or contrary to the norms of an online community or platform... [and includes] cyberbullying, hate speech, trolling, doxing, and the spreading of disinformation” (Gruzd et. al., 2023 p. 4). These toxic online behaviors can arise as a result of polarization—a social phenomenon whereby citizens are resistant to alternate worldviews, “inhibiting social linkage with others perceived as holding opposing views, and often [creating] negative affect against the outgroup” (Arora et al., 2022, p. 1) For example, Marwick (2021) showed that gender-based online harassment can arise as a result of social polarization when it is used to reinforce and illustrate membership to a specific (non-feminist) social group. Similarly, Jenke’s (2024) work shows that highly polarized individuals are more likely to believe in misinformation. Alternately, Au, Ho and Chu (2022) have shown that misinformation can drive people to become more polarized. For these reasons, extreme polarization can be considered both as a cause, and a result of, other antisocial online behaviors.

Au, Ho, and Chiu’s (2022) process model for understanding the relationship between online polarization and misinformation shows that economic, legal, technological, and psychological factors lead both to the spread of misinformation and then also to polarization. Including other antisocial online behaviors like online harassment in this model means considering structural forces like economics, law, and platform design to understand how polarization is related to other antisocial online phenomena. As such, systems scholars need to consider new ways to conceptualize the linkages between technological environments, human psychological and social vulnerability, the material conditions that are linked to online antisocial behavior, and other structural forces like cultures, legal frameworks, and stereotypes. Such a framework represents a departure from a linear model in which, for example, we see misinformation causing polarization or online harassment driving polarization (or vice-versa). In fact, a comprehensive understanding of online

antisocial behavior requires scholars to think both of the relationships between these such phenomena as misinformation, polarization and harassment PLUS the conditions that contribute to or exacerbate all of them. To that end, we adapt the concept of syndemic theory from the health literature and apply it to information systems. Information syndemic theory offers a framework for understanding the relationships between online harassment, polarization, and misinformation as well as the relationship of all three to structural, behavioral, social, and technological forces. We start by detailing the relationship between online antisocial behaviors, polarization and the technological, social and cultural influences that give rise to them, then we introduce syndemic theory, and adapt it to information systems. Finally, we use the case of polarization to illustrate how the an information syndemic framework could work in practice.

## **2. Technological, social, and cultural drivers of polarization and online antisocial behaviors**

The August 2024 news concerning the riots in London, UK shows how anti-social online behavior, polarization, and technological, social, and structural factors come together. The riots began when a Muslim man was incorrectly identified on Facebook as a killer of three young girls. This misinformation led to what Reuters (2024) called “violent anti-muslim riots.” The London riots are related to the convergence of at least four factors, including 1) technological affordances leading to misinformation spread, 2) cultural stereotypes and biases towards the Muslim community, and 3) the material and physical circumstances that gave rise to the crime in the first place, coming together in 4) a polarized and polarizing offline event. This is one example of many recent events illustrating the convergence of social, technical, behavioral, and structural forces that give rise to misinformation, antisocial behavior, and group polarization.

As seen in the London example, social media could be considered one important component in the spread of both antisocial online behaviors and online polarization (Munn, 2020). Social media algorithms prioritize dramatic content in user feeds which, under the right social, economic, and cultural circumstances can create divisiveness and polarization (Bisiada, 2022; Darius & Urquhart, 2021; Gupta et al., 2021; Jungkunz, 2021). At the same time, it has become more difficult to verify the reliability of information on digital platforms. As such, misinformation—understood as incorrect or misleading information, often created with the intent to deceive (Au et al., 2022)—now reaches a wider audience more

effectively and efficiently than ever before (Azzimonti & Fernandes, 2023).

According to Van Bavel et al. (2021), “the relationship between social media and polarization ... [] ... depend[s] on the features of the different social media platforms” (p. 914). Such features include resharing buttons, the existence of groups and pages, ‘like buttons’, and emojis (González-Bailón & Leikes, 2023). These features can result in negative, divisive, and antisocial content going viral more rapidly than positive or pro-social posts (Rathje et al., 2021). While engagement algorithms can bring people together in generative communities, they also tend to feed people information that confirms existing beliefs and values (Dubois & Blank, 2018; Flaxman et al., 2016; Levy, 2021). This process influences what information and sources people are willing to trust.

In addition to spreading misinformation and exacerbating polarization, platform affordances as well as broader cultural messaging can promote hatred or digital violence (Walther, 2022). Enabled by toxic disinhibition and emboldened by the anonymity of social media (Lapidot-Lefler & Barak, 2012), out-group animosity can lead to online harassment (Rathje et al., 2021), or even offline violence.

Importantly, content moderation strategies alone do not address the more fundamental problem of how the combination of the technological affordances of digital platforms with broader social and structural forces can exacerbate the spread of extreme polarization, misinformation, and harassment (Crystal, 2023). However, there is a small but growing part of the literature that is beginning to examine these problems holistically. For example, Németh (2023) recommended more interdisciplinary and applied work for researching digital polarization, and promising research is also coming from outside the systems sciences field. Here we detail one such approach, drawing from public health and philosophy.

## **3. An epidemiological approach**

In one holistic approach to online antisocial behavior, philosopher Tirell (2017), recommended an epidemiological model. Borrowing from the World Health Organization (WHO), Tirell showed how an expansive definition of health should take into account citizens’ social and technological health, not just the presence or absence of disease (WHO, 2010). Expanding on this work, we provide a concept of individual and collective information health, which considers links between online antisocial media and polarization.

The WHO defines “social determinants of health” as non-medical factors that influence health outcomes

(2010). Similarly, and taking Tirell's (2017; 2021) suggestion to heart, we aim to build a framework that recognizes a myriad of technical and non-technical factors that influence our individual, social, and democratic health. We have thus adapted syndemic theory from the health literature and applied it to online anti-social behavior and polarization.

#### 4. Syndemic theory

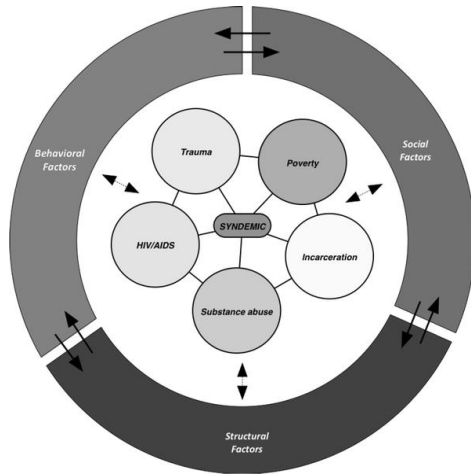
A promising way that medical researchers are linking the biological, structural, and social mechanisms of disease can be found in syndemic theory. According to an article published in the *Lancet*, syndemic refers to the "population-level clustering of social and health problems" (Singer et al., 2017, n.p.). It includes contextual and social factors that create the conditions for health threats to cluster and shows how some health problems do not simply co-occur, but together exacerbate each other, and make treatment more challenging (Singer et al., 2017). The concept of syndemic is now widely used in public health because it identifies how contexts (environmental, economic, psychological, and social factors) create the conditions that increase the risks for complex illnesses like the AIDS virus or heart disease, and lead to the clustering and negative impacts of multiple related illnesses beyond simple comorbidity (Mendenhall, Newfield, & Tsai, 2022).

In medical terms, syndemics are identified through the following: 1) detailed accounting of the disease(s) and other related health conditions; 2) examining how the diseases/conditions interact; 3) uncovering the social, political, environmental, economic, and other contextual factors driving the noted health conditions; 4) tracing how the social context impacts the health conditions progression and patient outcomes; 5) and finally, collecting evidence that the social context and disease-disease interactions are resulting in an increased medical burden (that is, faster spread, more aggressive progression, higher rates of morbidity, etc.) (Singer et al., 2020). Importantly, syndemics tend to decrease the effectiveness of medical treatments for the impacted population and increase the cost of delivering effective medical treatments for the impacted population. See Table 1 for key syndemic definitions.

**Table 1. Syndemic definitions (Singer et al., 2017)**

<b>Syndemic</b>	Population-level clustering of social and health problems. The criteria of a syndemic are: (1) two (or more) diseases or health conditions cluster within a specific population; (2) contextual and social factors create the conditions in which two (or more) diseases or health conditions cluster; and (3) the clustering of diseases results in adverse disease interaction, either biological or social or behavioral, increasing the health burden of affected populations.
<b>Syndemic vulnerability</b>	Integration of epidemiological and experiential levels of analysis of multiple, overlapping social and health problems that increase morbidity and mortality as a result of syndemic clustering of social and health conditions within a certain context.
<b>Syndemic interaction</b>	The co-occurrence of social and health conditions, including social–psychological, social–biological, and psychological–biological interactions, which worsen the condition of the person or population afflicted.
<b>Syndemic risk factors</b>	Social, political, economic, and environmental factors that increase the risk for clustering of two or more diseases.
<b>Syndemogenesis</b>	The processes, pathways, and stages of syndemics development involving a disease–social context and disease–disease interactions.
<b>Iatrogenic syndemic</b>	A syndemic interaction caused or exacerbated by medical treatment.[...]or, medical treatment for one disease is weakened by the actions of another disease.

Figure 1, from Wilson et. al. (2016) offers a visual representation of the HIV syndemic. Substance use disorder, domestic violence, and AIDS tend to interact synergistically and allow for other diseases or health conditions to proliferate, including mental health conditions that can in turn contribute to the issue (Gilbert et al., 2023). A syndemic framework allows researchers to assess the way different health conditions exacerbate the risk for both infection with the AIDS virus and morbidity from the virus. Also, syndemic theory prompts health professionals to consider the structural, behavioral, and social conditions that can cause certain populations to be more at risk from contracting AIDS and dying of it.



**Figure 1: Conceptual model of a syndemic (Wilson et. al., 2014)**

Like syndemic medical conditions, structural, social, and behavioral, in addition to technological forces are leading to problems in the health of our information systems, of which the symptoms are phenomena like online antisocial behavior (including misinformation) and polarization. Social, structural, and technological factors have also made the cost for addressing these information problems greater. For this reason, polarization, online antisocial behavior, and misinformation are what we call information syndemics. These issues tend to interact synergistically and allow for other problems (misinformation types, or multiple types of online or offline antisocial behaviors, as well as democratic decline) to proliferate.

## 5. Understanding information syndemics: The case of polarization

We have adapted syndemic theory as a way to understand how intersecting online harms like misinformation, polarization, and online antisocial behavior, as well as the structural, behavioral, social and technological influences that put people at risk of negative outcomes. Our information syndemic framework provides a mechanism of understanding antisocial online behavior in order to help illuminate the structural (political, cultural, and economic), behavioral (psychological, and behavioral economic), technological (affordances, nudges, and engagement algorithms) and social (social capital, social ties) that worsen or enable the breakdown of democratic or pro-social communication, particularly on digital platforms. Drawing from and adapting Singer et al. (2017), information syndemics are best described as population-level clustering of different types of online antisocial behaviors. An information syndemic can be identified when: (1) two or more distinct types of misinformation,

or the combination of misinformation, polarization, and/or online harassment clusters within a specific population; (2) contextual, technological, economic, political, psychological, and social factors create the conditions in which two (or more) manifestations of online misinformation or online antisocial media cluster; and (3) the clustering of online antisocial media results in adverse social, democratic, or behavioral (sometimes all three) consequences for affected populations.

Using online polarization as an example of information system condition, we conducted an extensive review of the literature on polarization to understand if an information syndemic framework can indeed provide a useful model to better understand this phenomenon. First, we themed the literature to understand what, if any, other antisocial online behaviors can be found clustered with polarization, and whether these co-occurring phenomena are creating adverse outcomes. Next, we looked at what conditions seem to give rise to online polarization, as per the literature, and finally, we looked at the risk factors and solutions to online polarization to determine if they would fit into a syndemic framework. Notably, we did not initially theme the data according to the syndemic definitions, as we did not want to accidentally jam a square peg into a round hole. Instead, we compared our independent themes to Singer et al.'s (2017) syndemic frame to see if we could find alignment. This allowed us to test the strength of extending Tirell's (2017; 2021) epidemiological model and the syndemic concept to online information systems.

### 5.1. Problem clustering

Our review of the online polarization literature reveals different types of antisocial online behavior clustered with polarization. Digital misinformation remains a key issue. For example, Van Bavel et al. (2024) recommend addressing polarization by correcting false beliefs, Pilch et al. (2023) suggest a link between conspiracy theories and polarization, and Spears (2021) notes the connection between algorithmic influence, problematic content, and polarization.

Harassment, abuse, bias, and bullying are also clustered with polarization in some of the literature. For example, Denning and Hodges (2021) point to the relationship between harmful stereotypes and online polarization. Hartman et al. (2022) identify negative thoughts and behaviors relative to perceived outgroups. Finally, Balinhas (2023) recommends increased contact between majoritarian and subaltern or minority groups, as a solution to polarization, while also noting that a

contact-based strategy can backfire and exacerbate harassment or abuse if not handled with care.

In each of these studies, we can see the clustering of different antisocial online behaviors with polarization. But in order to assess if this clustering can be considered syndemic in nature, there must be contextual or social factors in which this clustering occurs, and the clustering must lead to adverse social, democratic, or other consequences.

## 5.2. Conditions creating vulnerability

The literature shows complex and intersecting influences that make certain communities vulnerable to polarization. Individual psychological characteristics and political beliefs contribute to the issue of polarization (Grünhage & Reuter, 2021). Social media engagement algorithms contribute to the problem by spreading polarizing content further and faster than it would otherwise spread (Metzler & Garcia, 2023). Paywalled information, like academic journal articles, is implicated in the spread of misinformation leading to polarization according to Stevens, Jussim, and Honeycutt (2020). Lack of access to education can exacerbate polarization (Kozyreva, Lewandowsky & Hertwig, 2020). Other types of social or economic inequality also make people more vulnerable to polarization (Siltala, 2020). Finally, the lack of government regulation of media and social media companies can make polarization worse (Arora et al., 2022).

Taken together, it is clear that digital polarization arises out of the intersection of behavioral, technological, social, and structural forces that lead to the clustering of problems identified above. Additionally, there are interactions between the factors and the problems that make some people more likely to experience the adverse impacts of an information syndemic than others.

## 5.3. Adverse consequences

The adverse consequences of digital polarization, according to the literature, include threats to democratic communication (Bridgman, n.d.), radicalization (Bjornsgaard & Dukić, 2023), the amplification of outrage (Van Bavel et al., 2023), the breakdown of international order (Walther, 2022), decaying trust in government and scientific authorities (Gunderson et al., 2022), the erosion of social cohesion (González-Bailón & Lelkes, 2023), and even online and offline violence (Arora et al., 2022). These consequences can be understood as detrimental for individuals, communities, and society as a whole and they increase in severity

when two or more elements of an information syndemic occur concurrently (like in a polarized environment rich in misinformation, such as illustrated by the London riots).

## 5.4. Conditions countering the problem

The literature suggests strategies to counter polarization that not only target individual behavioral vulnerabilities, but also the different systems, technologies, and social conditions contribute to the problem. For example, the literature notes that addressing misinformation or fake news can help counter growing polarization (Van Bavel et al., 2023). Ethical algorithmic design (Iandoli et al., 2021) and policies that encourage ethical algorithmic design (Arora et al., 2022) are also important for addressing polarization. Some studies mention the suboptimal incentive structures that make polarizing content (Jones et al., 2022) politically or economically valuable to produce (González-Bailón & Lelkes, 2023). Others discuss education (Johansson, Biglan & Embry, 2020) or other community social needs (Bliuc, Bouguettaya & Felise, 2021), and how fulfilling these can mitigate growing polarization. Finally, addressing economic inequality (Siltala, 2020) is also raised as a solution to polarization. Thus, the literature on polarization can fit a syndemic model in which structural, behavioral, social and technological forces can be addressed as ways to counter the problem.

## 6. Information syndemics

Using online polarization as an example of an information syndemic, we can adapt Singer et al.'s (2017) definitions of syndemic. Table 2, below, provides a working definition of information syndemic, accounting for the complex interactions present in many current online information systems.

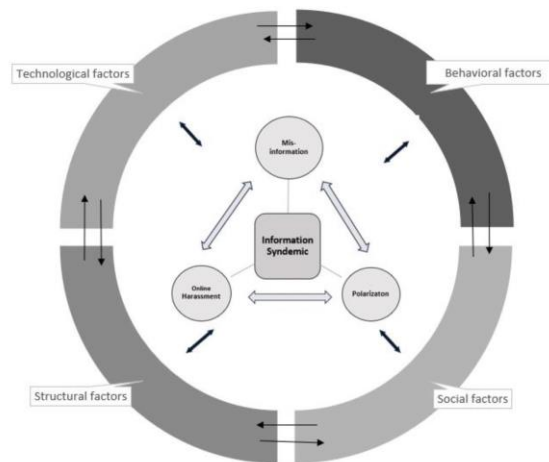
**Table 2. Information syndemic definitions (adapted from Singer et al., 2017)**

<p><b>Information syndemic</b> Population-level clustering of information-based social problems. The criteria for an information syndemic are: (1) two or more distinct types of misinformation, or the combination of misinformation, affective polarization and/or online harassment clustering within a specific population; (2) contextual and social factors create the conditions in which two (or more) manifestations of online misinformation, polarization, or online antisocial media cluster; and (3) the clustering of these different issues results in adverse social, democratic, or behavioral (sometimes all three) consequences for affected populations</p>
<p><b>Information syndemic vulnerability</b> Interaction of individual, organization, community, content/platform, and system analysis of multiple types of online antisocial behaviors that currently threaten social cohesion and democratic communication for certain populations or within specific contexts.</p>
<p><b>Information syndemic interaction</b> The co-occurrence of technological, psycho-social, and cultural interactions that make a person more vulnerable to experiencing harm from unhealthy information systems.</p>
<p><b>Information syndemic risk factors</b> Social, political, economic, technological, and environmental factors that increase the risk for clustering of two or more types of misinformation or the clustering of misinformation, polarization, and online antisocial behavior(s).</p>
<p><b>Information syndemogenesis</b> The processes, pathways, and stages of falling into a misinformation, polarization, or antisocial rabbit hole involving information-social context and interactions between different types of misinformation or online antisocial media.</p>
<p><b>Iatrogenic information syndemic</b> An information syndemic interaction caused or exacerbated by the steps taken to prevent online antisocial behavior (i.e. government censorship).</p>

With Table 2’s definitions as a starting point, we can conceptualize how we might identify information syndemics. Information syndemics occur when there are adverse interactions between different types of problematic or antisocial online behavior. In the example we previously discussed, the adverse interactions of the 2024 London riots are seen in both online hate against the Muslim community and online

misinformation about the perpetrator of the original attack. In a syndemic model, these adverse interactions are most likely to emerge under particular technological, social, behavioral, and structural conditions, and can be related to poverty, stress, structural violence stigma, media availability, economic incentives, education, and technological affordances. Again, using the London riots as an example, the socio-economic and technological conditions are thus an important part of the anger bubbling over to the point of violent rioting, contributing to people’s susceptibility to believing the misinformation in the first place.

Using our literature review as a starting point. We have adapted Wilson et al.’s (2014) conceptual syndemic model to illustrate information syndemics. Our model shows the ways that misinformation, online harassment, and polarization exacerbate one another. It also illustrates the roles of structural, behavioral, social, and technological factors and how these factors can influence and be influenced by the information syndemic conditions. Finally, it shows the multidirectional nature of the entire system, and thus illustrates a need to think holistically and systemically about the problems of online antisocial behavior and polarization (See figure 2).



**Figure 2: Conceptual model of an information syndemic. (adapted from Wilson et al., 2014)**

Just as syndemics like AIDS tend to increase healthcare costs and reduce the effectiveness of treatments, information syndemics tend to both cost communities’ money and also reduce the effectiveness of democratic communication. For example, in our case study of polarization, we can see that digital polarization reduces a community’s ability to engage in democratic dialogue (Gunderson et al., 2022), and also can increase the cost of government or community action (Bridgman, n.d.).

Returning to Figure 2, we suggest that people are most vulnerable to an information syndemic under specific contextual circumstances. For example, a person who is anxious about vaccines, has limited access to a trusted healthcare provider, spends a lot of time on social media, and lives in a socially or economically disadvantaged area is probably more at risk for online health misinformation than someone who is economically secure, well educated in health and science, and has exposure to a wide variety of points of view on and offline. Similarly, if a person is already at risk and is part of social groups that also hold similar views, they will be even more likely to believe dangerous misinformation on social media and are also more likely to experience online polarization relative to the issue of vaccines (see for example: Jakovljevic et al., (2020). This process most likely occurs over time as a person's exposure to misinformation and polarized communities increases and, as the world witnessed during COVID-19, often government efforts to address this issue without taking a systemic approach (such as via mandatory vaccinations) can easily backfire, which can lead to greater information syndemic spread.

The information syndemic framework helps to illuminate the complexity of problems like online polarization and online antisocial behavior(s) including digital misinformation because it moves beyond current approaches to mitigating problematic online content such as platform monitoring, censorship, or other band-aid solutions. Because it begins to conceptualize these problems within a social determinants framework, and because it includes accounts of both online and offline contextual factors, it offers researchers tackling these issues a toolkit for thinking beyond individual solutions to online problems. It also allows for additional opportunities to 'multi-solve' complex issues like polarization and misinformation. Furthermore, an understanding of how iatrogenic information syndemics (see Table 2) can result in unintended negative consequences, gives researchers a framework for managing the interactions between clustered online issues in order to design better systems.

## **7. Identifying and mitigating information syndemics**

### **7.1. Identifying information syndemics**

Not only are information syndemics difficult and expensive to address, but they also impact the ability for communities impacted by them to engage in democratic communication. As such, they are a disease of the social body, just as AIDS or heart disease are diseases of the physical body. The identification and description of

information syndemics for scholars involves the following five elements:

1. A detailed account of the different types of problematic online behaviors and content that are operating in different situations (for example, a detailed account of communities spreading misinformation in the London riots, analyzing content and community dynamics, including network mapping and qualitative content analysis. Netnography would be a particularly useful tool here).
2. An examination of the mechanisms by which different types of problematic online content and behavior work together and reinforce each other (for example, relationships between political polarization and racism that helped lead to the 2024 London riots).
3. A clear description of the socio-psychological, socio-environmental, socio-economic, and socio-technical conditions that contribute to people sharing problematic content, participating in problematic communities, or engaging in other online antisocial behavior (for example, an account of how different economic circumstances, different behavioral traits or different platforms contributed to the information syndemic during the 2024 London riots).
4. An examination of the pathways of effect that starts at the social-psychological, social, economic, technological, and environmental conditions and shows how they contribute to specific manifestations of online antisocial behaviors (for example, using qualitative methods to understand what makes people most vulnerable to acting on misinformation, becoming polarized or engaging in harassment related to the 2024 London riots).
5. Provide evidence of threats to pro-social or democratic communication because of the interactions described in points three and four, above (for example, connecting the tools above to a syndemic event like the 2024 London riots).

Information syndemics can be identified by mapping the connections – first between different online problems (like types of misinformation, misinformation and polarization, harassment and polarization, or misinformation and harassment), and second between the identified problems and the greater structures that enable them. Importantly, it's not enough that different kinds of online antisocial behavior impact an individual, but that entire online communities are impacted in a sort of information epidemic or infodemic as has been

described by the WHO (2024) in relation to COVID-19. Just like a social determinants of health approach recognizes that not all people are at the same risk of illness, the strength of an information syndemic frame lies in mapping the precise conditions out of which susceptibility to various online harms increases. Once they are mapped out and the connections understood, then scholars and practitioners can employ different sets of tools to solve these problems.

## 7.2. Mitigating information syndemics

Once an information syndemic has been identified, we can begin to explore ways of addressing key problems of online communication that are syndemic in nature. When we have identified a certain digital communication problem as a possible syndemic, we are called upon to think about mitigation in a social, structural, technological and behavioral way, by considering how economics, politics, technological affordances, social networks, psychology, and other factors beyond platform and content contribute to the problem. Mitigating information syndemics requires scholars and practitioners to recognize that just as stopping the transmission of an AIDS virus requires social support, medical support, policy interventions, and the addressing of other related health issues (mental health, intravenous drug use, etc.), so too stopping the viral transmission of problematic online content or behaviors requires psychological support, social support, economic support, technological interventions, and addressing co-occurring information issues. To do so effectively, information systems scholars would likely benefit from interdisciplinary research to better understand the causes and consequences of unhealthy information systems. At minimum, the treatment of information syndemics requires thinking outside of a single platform or issue and attending to the complex interrelationships between syndemic risk factors.

## 8. The promise of information syndemic theory for systems research

Information syndemic theory is a useful conceptual tool in the toolkit of systems science researchers because it nests the health of information systems within other overlapping human, environmental, and technological complex systems. The explanatory potential of this framework is that it gives a new language with which to explain, quantify, and measure the interactions between policy, culture, psychology, community, and information-based social problems like online misinformation, polarization, and antisocial behavior. Theoretically, it also provides an explanatory

frame that links information-based social problems and affords researchers a systemic, contextualized, and comprehensive lens into the contemporary landscape of antisocial behavior on digital platforms.

Through all these affordances, syndemic theory could support researchers looking for lenses to better grasp the nature of anti-sociality in digital platforms beyond mere encounters with adversity. Indeed, as illustrated throughout this paper, this model can be used to better frame events such as the 2024 London riots as information syndemics. Here, researchers could move beyond simplistic narratives of criminality to contemplate, for instance, how polarization interacts with misinformation and prevailing cultural, economic, and political tensions to explain why the riots occurred in the first place. Consequently, researchers could design and reimagine paths to mitigate similar future riots. In this way, researchers can emphasize systemic and structural imbalances of power that disproportionately affect vulnerable populations—in the case of the 2024 London riots, migrants and Muslims.

While we know that misinformation, polarization, and online harassment often occur together, the concept of information syndemic encourages researchers to think about these problems as not simply co-occurring but as factors that increase the damage done by each, make each more difficult to address in isolation, and escalate the damage done by each. For problems like misinformation, online harassment, or polarization, the whole is greater than the sum of its parts, meaning that the damage done when these conditions cluster is much greater than a simple additive analysis would suggest. Information syndemic analysis considers this clustering as the outcome of a complex system, and as such, considers how all unhealthy information systems are not simply packets of multiple issues, but recombinations of issues that lead to outsized negative consequences. That online problems ‘go viral’ isn’t simply a clever metaphor. An epidemiological approach to online harms, understood via a syndemic framework, can assist researchers and designers in creating healthier digital information spaces.

## 9. References

- Arora, S. D., Singh, G. P., Chakraborty, A., & Maity, M. (2022). Polarization and social media: A systematic review and research agenda. *Technological Forecasting and Social Change*, 183, 121942.
- Au, C. H., Ho, K. K., & Chiu, D. K. (2022). The role of online misinformation and fake news in ideological polarization: barriers, catalysts, and implications. *Information Systems Frontiers*, 1-24.
- Azzimonti, M., & Fernandes, M. (2023). Social media networks, fake news, and polarization. *European Journal*

- of *Political Economy*, 76, 102256. <https://doi.org/10.1016/j.ejpoleco.2022.102256>
- Balinhas, D. (2023). Bringing critical social psychology to the study of political polarization. *Social and Personality Psychology Compass*, 17(1), e12721.
- Baptista, J. P., & Gradim, A. (2021). “Brave new world” of fake news: How it works. *Javnost - The Public*, 28(4), 426–443. <https://doi.org/10.1080/13183222.2021.1861409>
- Bernacer, J., García-Manglano, J., Camina, E., & Güell, F. (2021). Polarization of beliefs as a consequence of the COVID-19 pandemic: The case of Spain. *PloS one*, 16(7), e0254511.
- Bisiada, M. (2022). Discourse and social cohesion in and after the COVID-19 pandemic. *Media and Communication*, 10(2), 204–213.
- Bliuc, A. M., Bouguettaya, A., & Felise, K. D. (2021). Online intergroup polarization across political fault lines: An integrative review. *Frontiers in Psychology*, 12, 641215.
- Boonprakong, N., Tag, B., & Dingler, T. (2023). Designing technologies to support critical thinking in an age of misinformation. *IEEE Pervasive Computing*, 22(3), 8–17. <https://doi.org/10.1109/MPRV.2023.3275514>.
- Bridgman, A. (n.d.). The role of social media in polarizing Canadians. McGill Centre for Media, Technology and Democracy. Available from: <https://www.mediatechdemocracy.com/all-work/the-role-of-social-media-in-polarizing-canadians>
- Crystal, C. (2023). Facebook, Telegram, and the Ongoing Struggle Against Online Hate Speech. *Carnegie Endowment for International Peace*. <https://carnegieendowment.org/2023/09/07/facebook-telegram-and-ongoing-struggle-against-online-hate-speech-pub-90468>
- Darius, P., & Urquhart, M. (2021). Disinformed social movements: A large-scale mapping of conspiracy narratives as online harms during the COVID-19 pandemic. *Online Social Networks and Media*, 26, 100174. <https://doi.org/10.1016/j.osnem.2021.100174>
- Denning, K. R., & Hodges, S. D. (2022). When polarization triggers out-group “counter-projection” across the political divide. *Personality and Social Psychology Bulletin*, 48(4), 638–656.
- Dubois, E., & Blank, G. (2018). The echo chamber is overstated: The moderating effect of political interest and diverse media. *Information, Communication & Society*, 21(5), 729–745. <https://doi.org/10.1080/1369118X.2018.1428656>
- Fernbach, P. M., & Van Boven, L. (2022). False polarization: Cognitive mechanisms and potential solutions. *Current opinion in Psychology*, 43, 1–6.
- Flaxman, S., Goel, S., & Rao, J. M. (2016). Filter bubbles, echo chambers, and online news consumption. *Public Opinion Quarterly*, 80(S1), 298–320. <https://doi.org/10.1093/poq/nfw006>
- Iandoli, L., Primario, S., & Zollo, G. (2021). The impact of group polarization on the quality of online debate in social media: A systematic literature review. *Technological Forecasting and Social Change*, 170, 120924. *Opinion Quarterly*, 80(S1), 298–320. <https://doi.org/10.1093/poq/nfw006>
- Gilbert, L., Stoicescu, C., Goddard-Eckrich, D., Dasgupta, A., Richer, A., N. Benjamin, S., ... & El-Bassel, N. (2023). Intervening on the intersecting issues of intimate partner violence, substance use, and HIV: a review of Social Intervention Group’s (SIG) syndemic-focused interventions for women. *Research on social work practice*, 33(2), 178–192.
- González-Bailón, S., & Lelkes, Y. (2023). Do social media undermine social cohesion? A critical review. *Social Issues and Policy Review*, 17(1), 155–180. <https://doi.org/10.1111/sipr.12091>
- Gravlee, C. C. (2020). Systemic racism, chronic health inequities, and COVID-19: A syndemic in the making?. *American Journal of Human Biology*, 32(5).
- Grünhage, T., & Reuter, M. (2021). Tell me who you vote for, and I’ll tell you who you are? The associations of political orientation with personality and prosocial behavior and the plausibility of evolutionary approaches. *Frontiers in Psychology*, 12, 656725.
- Gruzd, Hodson, Jacobson, Mai, O’Meara, Soares (2023). The State of Anti-Social Behaviour on Social Media. Social Media Lab Toronto Metropolitan University, Version 1. DOI: 10.6084/m9.figshare.24417271
- Gundersen, T., Alinejad, D., Branch, T. Y., Duffy, B., Hewlett, K., Holst, C., ... & Baghrarian, M. (2022). A new dark age? Truth, trust, and environmental science. *Annual Review of Environment and Resources*, 47, 5–29.
- Gupta, S., Jain, G., & Tiwari, A. A. (2021). Investigating the dynamics of polarization in online discourse during COVID -19 pandemic. In D. Dennehy, A. Griva, N. Pouloudi, Y. K. Dwivedi, I. Pappas, & M. Mäntymäki (Eds.), *Responsible AI and Analytics for an Ethical and Inclusive Digitized Society* (pp. 704–709). Springer International Publishing. [https://doi.org/10.1007/978-3-030-85447-8\\_58](https://doi.org/10.1007/978-3-030-85447-8_58)
- Hartman, R., Blakey, W., Womick, J., Bail, C., Finkel, E. J., Han, H., ... & Gray, K. (2022). Interventions to reduce partisan animosity. *Nature Human Behaviour*, 6(9), 1194–1205.
- Jakovljevic, M., Jakovljevic, I., Bjedov, S., & Mustac, F. (2020). Psychiatry for better world: COVID-19 and blame games people play from public and global mental health perspective. *Psychiatria Danubina*, 32(2), 221–228.
- Jenke, L. (2024). Affective polarization and misinformation belief. *Political Behavior*, 46(2), 825–884.
- Johansson, M., Biglan, A., & Embry, D. (2020). The PAX good behavior game: one model for evolving a more nurturing society. *Clinical child and family psychology review*, 23(4), 462–482.
- Jones, M. I., Sirianni, A. D., & Fu, F. (2022). Polarization, abstention, and the median voter theorem. *Humanities and Social Sciences Communications*, 9(1), 1–12.
- Jungkunz, S. (2021). Political polarization during the COVID -19 pandemic. *Frontiers in Political Science*, 3. <https://www.frontiersin.org/articles/10.3389/fpos.2021.622512>
- Kozyreva, A., Lewandowsky, S., & Hertwig, R. (2020). Citizens versus the internet: Confronting digital challenges with cognitive tools. *Psychological Science in the Public Interest*, 21(3), 103–156

- Lapidot-Lefler, N., & Barak, A. (2012). Effects of anonymity, invisibility, and lack of eye-contact on toxic online disinhibition. *Computers in Human Behavior*, 28(2), 434–443. <https://doi.org/10.1016/j.chb.2011.10.014>
- Levy, R. (2021). Social media, news consumption, and polarization: Evidence from a field experiment. *American Economic Review*, 111(3), 831–870. <https://doi.org/10.1257/aer.20191777>
- Marwick, A. E. (2021). Morally motivated networked harassment as normative reinforcement. *Social Media+ Society*, 7(2), 20563051211021378.
- Mendenhall, E., Newfield, T., & Tsai, A. C. (2022). syndemic theory, methods, and data. *Social Science & Medicine* (1982), 295, 114656.
- Metzler, H., & Garcia, D. (2023). Social Drivers and Algorithmic Mechanisms on Digital Media. *Perspectives on Psychological Science*, 0(0). <https://doi.org/10.1177/17456916231185057>
- Minson, J. A., & Chen, F. S. (2022). Receptiveness to opposing views: conceptualization and integrative review. *Personality and Social Psychology Review*, 26(2), 93-111.
- Munn, L. (2020). Angry by design: Toxic communication and technical architectures. *Humanities and Social Sciences Communications*, 7(1), 1–11. <https://doi.org/10.1057/s41599-020-00550-7>
- Németh, R. A scoping review on the use of natural language processing in research on political polarization: trends and research prospects. *Journal of Computational Social Science* 6, 289–313 (2023). <https://doi.org/10.1007/s42001-022-00196-2>
- Pilch, I., Turska-Kawa, A., Wardawy, P., Olszanecka-Marmola, A., & Smółkowska-Jędo, W. (2023). Contemporary trends in psychological research on conspiracy beliefs. A systematic review. *Frontiers in Psychology*, 14, 1075779.
- Ramírez-Dueñas, J. M., & Vinuesa-Tejero, M. L. (2021). How does selective exposure affect partisan polarisation? Media consumption on electoral campaigns. *The Journal of International Communication*, 27(2), 258-282.
- Rathje, S., Van Bavel, J. J., & van der Linden, S. (2021). Out-group animosity drives engagement on social media. *Proceedings of the National Academy of Sciences*, 118(26), e2024292118. <https://doi.org/10.1073/pnas.2024292118>
- Reuters. (2024). Explainer: Why are there riots in the uk and who is behind them? Retrieved August 22, 2024 from [Explainer: Why are there riots in the UK and who is behind them? | Reuters](https://www.reuters.com/explainer/why-are-there-riots-in-the-uk-and-who-is-behind-them-2024-08-22/)
- Singer, M., Bulled, N., Ostrach, B., & Mendenhall, E. (2017). syndemics and the biosocial conception of health. *The Lancet*, 389(10072), 941-950.
- Singer, M., Bulled, N., & Ostrach, B. (2020). Whither syndemics?: Trends in syndemics research, a review 2015–2019. *Global Public Health*, 15(7), 943-955.
- Siltala, J. (2020). In Search of the Missing Links Between Economic Insecurity and Political Protest: Why Does Neoliberalism Evoke Identity Politics Instead of Class Interests?. *Frontiers in Sociology*, 5, 28.
- Spears, R. (2021). Social influence and group identity. *Annual Review of Psychology*, 72, 367-390.
- Stevens, S. T., Jussim, L., & Honeycutt, N. (2020). Scholarship suppression: Theoretical perspectives and emerging trends. *Societies*, 10(4), 82.
- Stupavský, I., Dakić, P., & Vranić, V. (2023). The Impact of Fake News on Traveling and Antisocial Behavior in Online Communities: Overview. *Applied Sciences*, 13(21), 11719.
- Törnberg, P., & Uitermark, J. (2022). Tweeting ourselves to death: The cultural logic of digital capitalism. *Media, Culture & Society*, 44(3), 574–590. <https://doi.org/10.1177/01634437211053766>
- Tirrell, L. (2017). Toxic Speech: Toward an Epidemiology of Discursive Harm. *Philosophical Topics*, 45(2), 139–161.
- Tirrell, L. (2021, July). Discursive epidemiology: two models. In *Aristotelian Society Supplementary Volume* (Vol. 95, No. 1, pp. 115-142). Oxford University Press.
- Van Bavel, J. J., Rathje, S., Vlasceanu, M., & Pretus, C. (2024). Updating the Identity-based Model of Belief: From False Belief to the Spread of Misinformation. *Current Opinion in Psychology*, 101787.
- Van Bavel, J. J., Robertson, C. E., Del Rosario, K., Rasmussen, J., & Rathje, S. (2023). Social media and morality. *Annual Review of Psychology*, 75.
- Van Bavel, J. J., Rathje, S., Harris, E., Robertson, C., & Sternisko, A. (2021). How social media shapes polarization. *Trends in Cognitive Sciences*, 25(11), 913–916. <https://doi.org/10.1016/j.tics.2021.07.013>
- Walther, J. B. (2022). Social media and online hate. *Current Opinion in Psychology*, 45, 101298. <https://doi.org/10.1016/j.copsyc.2021.12.010>
- Wilson, P. A., Nanin, J., Amesty, S., Wallace, S., Cherenack, E. M., & Fullilove, R. (2014). Using syndemic Theory to Understand Vulnerability to HIV Infection among Black and Latino Men in New York City. *Journal of Urban Health*, 91(5), 983–998. <https://doi.org/10.1007/s11524-014-9895-2>
- WHO (2024). Infodemic. Available from [The COVID-19 infodemic \(who.int\)](https://www.who.int/infodemic)
- WHO (2010). Social Determinants of Health. Available from [Social determinants of health \(who.int\)](https://www.who.int/social-determinants-of-health)