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Human Cognition and Online Behavior During the First Social Media Pandemic

Breaking Down the Psychology of Online Information Consumption
in the Context of the COVID-19 Pandemic

Philipp Lorenz-Spreen



Facing up to the
Infodemic: Promoting
a Fact-Based Public
Discourse in Times of Crisis

Policy Paper Series by
the Israel Public Policy
Institute (IPPI)

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About this Paper

This policy paper is part of the paper series *“Facing up to the Infodemic: Promoting a Fact-Based Public Discourse in Times of Crisis.”*

Against the backdrop of the COVID-19 crisis, this paper series explores some of the key challenges facing democratic societies as a result of misinformation in the digital public sphere. It features a unique mosaic of perspectives and insights by experts from Israel and Germany that shed light on different facets of the phenomenon of online misinformation, with the aim of invigorating a societal debate on the issue as well as offering concrete ideas about how to address it.

The series *“Facing up to the Infodemic: Promoting a Fact-Based Public Discourse in Times of Crisis”* was generously supported by the German Embassy in Tel Aviv. The content and opinions expressed in the papers are solely of the authors and do not necessarily reflect the views of the German government and/or of the Israel Public Policy Institute.

About the Project

This paper series is part of the broader project “Fostering Democratic Resilience in the Digital Age,” conceptualized and executed by the Israel Public Policy Institute (IPPI) in collaboration with the Heinrich Böll Foundation, Tel Aviv.

The objective of the project is to promote dialogue, exchange of knowledge and collaboration between researchers and practitioners from Israel and abroad to enhance democratic resilience in the context of the changing media and information landscape in the digital age.

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Executive Summary

The COVID-19 crisis is the first pandemic covered not only by broadcasters and official public health authorities but also by the relatively novel and complex ecosystem of search engines, messenger-apps and social media platforms, with their various users, influencers and groups. These platforms provide filtering, curation and pre-selection in an information-rich world. The exponential growth of information processing capacities has led to a plethora of sources and a rapid news cycle that exceeds the attention capacity of individuals.

This paper analyzes how the growing pressure to select, trust and share information interacts with the structure and design of social media platforms, with their self-organizing nature and with the psychology of a global crisis. Three consequences of this interplay are examined: (1) Information consumers depend on algorithmic curation, which is exploited to serve the engagement-driven business model that drives almost all major online platforms, creating an opaque, asymmetrical relationship between users and platforms. (2) As in other crises, the pandemic has created a need for information that is partly met by social media, despite relative mistrust in their reliability. This can be interpreted as a thirst for social information – a selection strategy used in high pressure situations, in which people seek answers among in-group peers and experts in their social environment. (3) Two networking patterns in social media represent these tendencies: communities of well-connected individuals, and hubs or influencers. Both are potentially vulnerable in a fact-based information ecosystem, as communities can easily become breeding grounds for confirmatory beliefs such as conspiracy theories and influencers can be very effective at disseminating low-quality information if they are not experts themselves.

The policy recommendations presented here address these interplays by explicitly taking into account human psychology in the context of online environments, in the throes of a crisis and beyond. They aim to improve the decision-making environment of every individual who needs to evaluate information and decide whether to share it by improving context, social information and choice architecture. More specifically, regulations should target several platform features and introduce transparency requirements, as follows:

- **Labelling influencers** (based on a metric such as number of followers) and demanding they provide more source transparency and meet journalistic standards (as well as, potentially, be experts on the subject).
- **Improving social signals and metrics on social media** that can put factual claims into perspective, thereby precluding effects such as the 'majority illusion' (e.g., showing likes based on the number of people who saw the post).
- **Requiring the design of a social media feed include cues for evaluating information.** Examples are clearly classifying posts (e.g., news, opinions, advertisement or friends – as is the case in newspapers and TV) or marking the quality of a piece of information (e.g., number and origins of sources cited, name of publisher, or number of other sources reporting the story).
- **Promoting media literacy as a skill** via small but efficient interventions that can be rolled out on social media or as browser add-ons, and will teach people simple strategies for evaluating online information in real time (e.g., a checklist to bear in mind when reading an online article).

These interventions aim to standardize and regulate the online environments in which individual decisions are made, in order to promote informed decision making. The underlying goal is to empower users by acknowledging facets of human psychology such as cognitive bias. This approach can foster social resilience to floods of information, to radicalization trends and to

manipulation attempts, as it does not depend on the regulator directly combating specific fake news items or malicious actors. Rather, it aligns platform structure and design with the goals of quality information, thereby building a resilient collective of online users that can decide for themselves whether to trust what they read.

1. Introduction

Human cognition and behavior are accompanied by rules and mechanisms that are very sensitive to the environment in which decisions are made.¹ Such decisions can pertain to information: whether to trust it, learn from it and share it. The decision-making environment includes all factors taken into account from the outside world, i.e. the information itself, how and where it is displayed, its source, how it is delivered and what others are doing with it. A useful way to think about this interaction is Brunswick's lens model.² In this model, the decision-maker learns indirectly about the environment through a series of cues that are then integrated into the decision-making process. For instance, raindrops on the window help you decide which jacket to put on, or the fact that a restaurant is crowded guides your choice of where to eat. Figure 1 shows an adaptation of the model to the online world, where virtual platforms provide these cues and shape the perceived state of the environment. Examples include a sunny photo of a hotel you want to book, or the number of "likes" by friends or other users for a news story on your social media feed.

One side of this equation has not changed much over the last 30 years: human psychology, which follows relatively stable rules and principles.³

The other side of the equation, however, has changed dramatically: the capacity to distribute information and communicate globally, which has grown exponentially.⁴ This has created a new, complex ecosystem of platforms, publishers and individuals. The global pandemic flooded these relatively new channels with an unprecedented amount of information, magnifying their importance.⁵

The exponential growth of the capacity to distribute information has created a new, complex ecosystem of platforms, publishers and individuals. The global pandemic flooded these relatively new channels with an unprecedented amount of information, magnifying their importance.

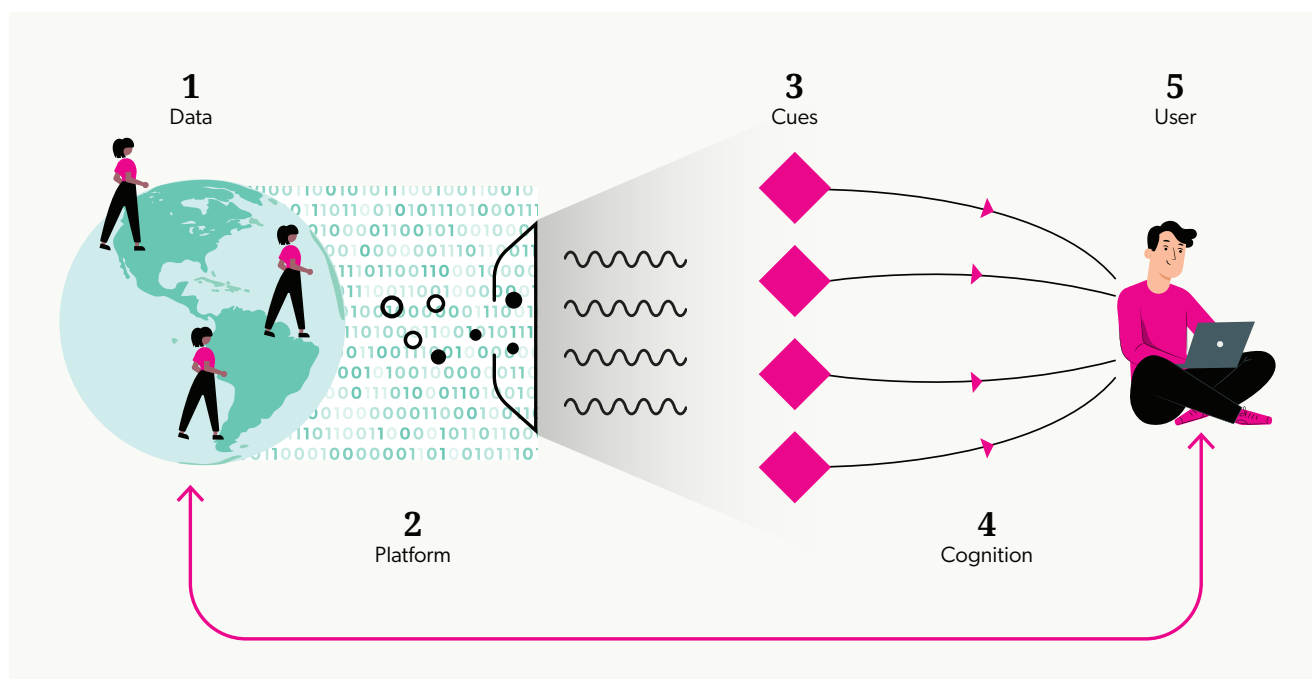
The combination of these three factors (human cognition and behavior, the online information ecosystem and the global pandemic), along with a lack of substantial oversight or accountability, is volatile. This report reviews the scientific literature

on what is known about the interaction between these factors and the unfolding consequences during the COVID-19 pandemic. This includes recent data we collected about information consumption and sharing behavior during the global crisis. After a review and discussion, this paper recommends ways to actively design

platforms that take this interaction between people and information into account. In particular, this paper explains how to increase resilience to misinformation and manipulation in response to crises, and the flood of information they engender.

Figure 1.

Human Cognition and the Online Environment



Schematic representation of the interaction between the online environment provided by platforms and human cognition, depending on available cues.

2. Psychology of Online Information Consumption

Attention is an important cognitive process, in the context of information consumption (others include memory and perception). Attention is defined as "a state in which cognitive resources are focused on certain aspects of the environment."⁶ This cognitive process does not change nearly as fast as technological developments – if at all – as it is limited by our cognitive resources (e.g., working memory⁷), which change on evolutionary timescales. In

other words, it is very unlikely that people will suddenly learn to process information simultaneously, because our brains do not have the capacity and will take many generations to develop it.⁸ Yet attention governs a large part of the interaction between people and information: as our time is limited, so is the attention we can pay to a piece of information. When the amount of information grows quickly while our capacity to process it does not, this creates a growing imbalance. Described by Herbert Simon as a resource allocation problem,⁹ it is also sometimes called information overload. In a world of

abundant information, we are forced to decide which information to attend to, for how long, and which sources to trust. This information selection ideally occurs early on in the process, so as to not waste time (and attention) on the evaluation itself.

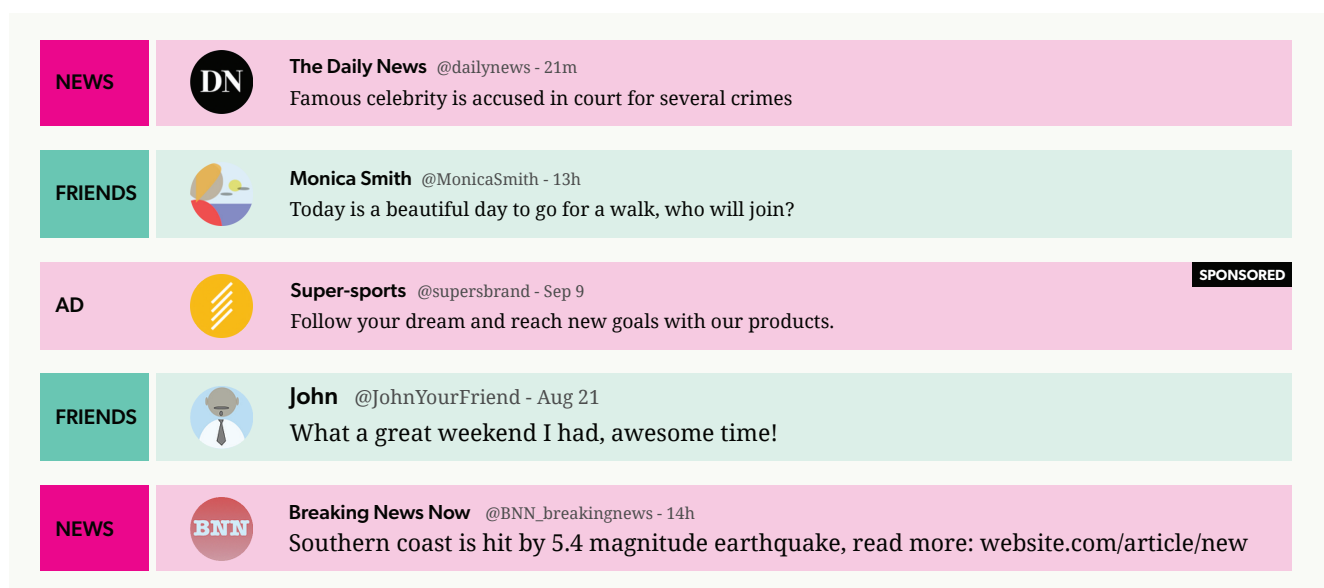
The imbalance between the information available to us and the attention we can devote to it leads to selection pressure, which has significant but underappreciated psychological and sociological consequences.

The imbalance between the information available to us and the attention we can devote to it leads to selection pressure. This has significant but underappreciated psychological and sociological consequences. For example, the discussion shifts much more quickly today. In 2013, a hashtag on Twitter remained among the 50 most popular hashtag for an average of 17.5 hours; by 2016,

this had fallen to 11.9 hours. This means shorter attention cycles for specific issues. The same decreasing half-life has been observed in the duration of popular Google searches or of ticket sales for a particular movie.¹⁰ For the individual news consumer, long-term offline decisions such as which newspaper to subscribe to have evolved into a multitude of online micro-decisions that require us to evaluate individual content from a range of scattered sources. The more sources flood the market, the less attention can be paid to any one piece of information, and the more difficult it becomes to assess its trustworthiness – especially given the decline in traditional quality indicators¹¹ (e.g., name recognition, reputation, print quality, price). To make matters worse, different types of information (such as the opinions of friends, news and advertisements) are mixed in with social media news feeds, which offer few cues to help us make the distinction¹². Clear labelling as indicated in Fig. 2 could help (see also chapter 3).

Figure 2.

Illustration of a Social Media News Feed



Representation of a prominent choice architecture online, the news feed. Ideally different types of content could be clearly distinguished here (figure adapted from Lorenz-Spreen et al. 2020).

2.1. Dependence on Algorithmic Curation

This situation inevitably places our decisions under forces of selection. On one hand, there is our own cognitive selection, characterized among other things by belief-consistent selection (preferring information that is consistent with our previous beliefs, also known as confirmation bias)¹³ or by social selection (preferring information from people who are close to us).¹⁴ These tendencies are amplified, the more selection pressure is introduced through oversupply of information.¹⁵ On the other hand, there is pre-selection by others, such as publishers or platforms (cf. Fig. 1), a process also known as curation. With the explosion of available information, this process is increasingly becoming automatic, particularly on platforms that use algorithmic curation for their news feeds or search engines. These two types of selection put together, lead to depending on algorithmic curation for pre-selection, with the role of social and confirmatory selection amplified.

Depending on pre-selection creates an asymmetrical relationship between online platforms and their users. In addition, the attention economy's goal of increasing user engagement, which drives the agenda of these platforms, amplifies the human tendency to prefer confirmatory and social selection.

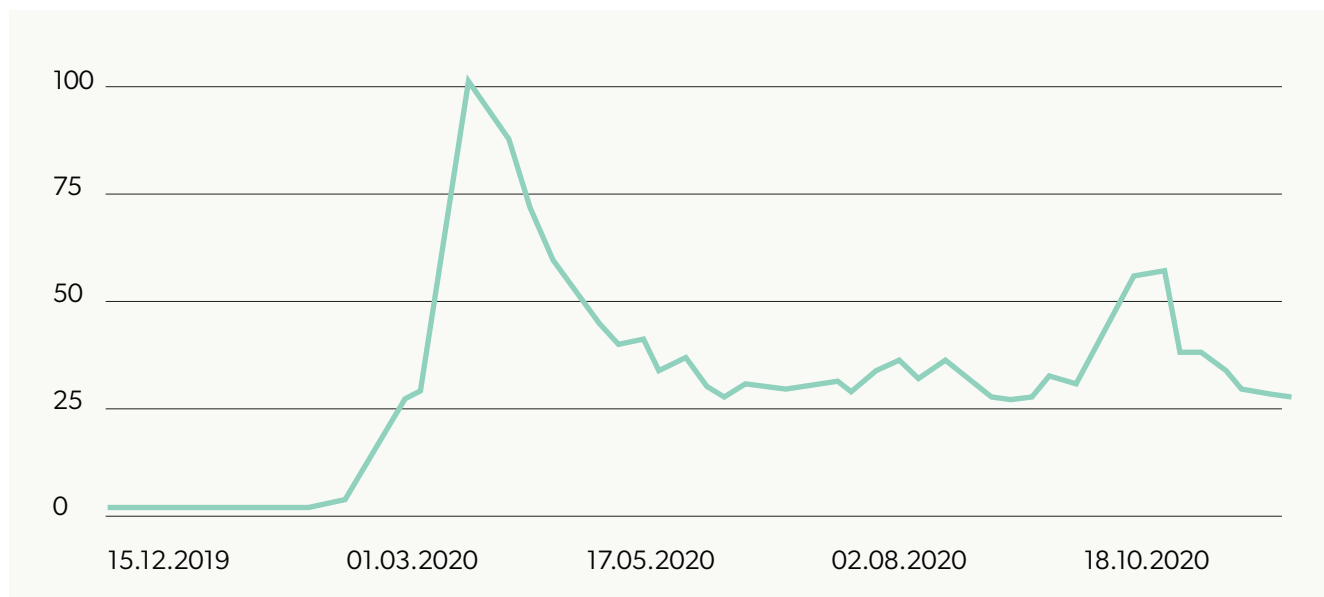
As curation criteria are usually not known to the public and the algorithms are not transparent, depending on pre-selection creates an asymmetrical relationship between online

platforms and their users. In addition, the attention economy's goal of increasing user engagement, which drives the agenda of these platforms, amplifies the human tendency to prefer confirmatory and social selection, supporting the dissemination of low quality or partisan information.¹⁶

2.2. The Pandemic and Other Crises

The global pandemic, with its uncertainty, fear and quickly-evolving events, has contributed to this mixture in both positive and negative ways: from increased trust in experts and authorities in some cases¹⁷ to growing belief in conspiracy theories in others.^{18,19} In addition to the general trends described above, the COVID-19 crisis has led to an unprecedented amount of information received and distributed by the public.²⁰ Much like a virus, the spread of misinformation can be amplified by modern infrastructure that allows it to travel around the globe at ever-increasing speed.²¹

Waves and spikes of collective attention on social media have become a typical response to natural disasters.²² Specific reaction patterns to such external events can be clearly measured.²³ This raises the question: what were the reactions of these systems to the COVID-19 pandemic? What are the underlying psychological and sociological mechanisms that, in the interplay with modern communication systems such as social media, drive these patterns of information-sharing during a global health crisis? Many studies have examined that question in recent months, and scientific debate on the matter is far from settled. In this paper, we discuss several results that showcase two specific reactions to the crisis in terms of information-seeking behavior: increased desire for factual information and increased desire for community.

Figure 3.**Google Searches for COVID-19 in Germany**

The graph shows a steep increase in COVID-19-related searches at the beginning of the pandemic and a second peak during the second wave of infections around October (source: Google trends).

Fig. 3 shows a very simple yet illustrative example of this interaction – the rise and fall in Google searches of “COVID-19”, closely resembling the number of infections in Germany over time. This connection was also established in studies that found peaks of information-seeking whenever the first cases were announced in various US states.²⁴ Notably, in Fig. 3, interest peaks when the first cases are reported and “wears off” for subsequent cases.²⁵ This spiking thirst for information is, of course, fed by various sources. Many people turn to established news sources for answers, but a growing – and especially young – segment of the world population is turning to social media to follow news about COVID-19.²⁶

Notwithstanding these findings, a recent survey across Germany found that although people turn to social media, they do not trust the information there: 73% of respondents named social media as a source of misinformation. Respondents also supported more fact-checking on social media.²⁷ There seems to be an interesting contradiction in the German sample, which sheds light on the strange relationship of dependence and distrust between platforms and users. In the same study, respondents also reported that they saw major news agencies as sources of false information more than social contacts such as friends, family or neighbors – to whom they also turned frequently for information about the

pandemic. We confirmed these patterns in two of our own studies in Germany: lack of trust in social media as a news source (only 38% said they have at least some trust in social media as a source of COVID-19 information), even though a majority (64%) indicated using social media to get information on the pandemic, at least some of the time.²⁸ This data reflects, on the one hand, a demand for information from social media (perhaps due to the speed and the personal nature in which it is delivered), and on the other hand, an understanding that social media is not made for that purpose, especially given its lack of transparency.

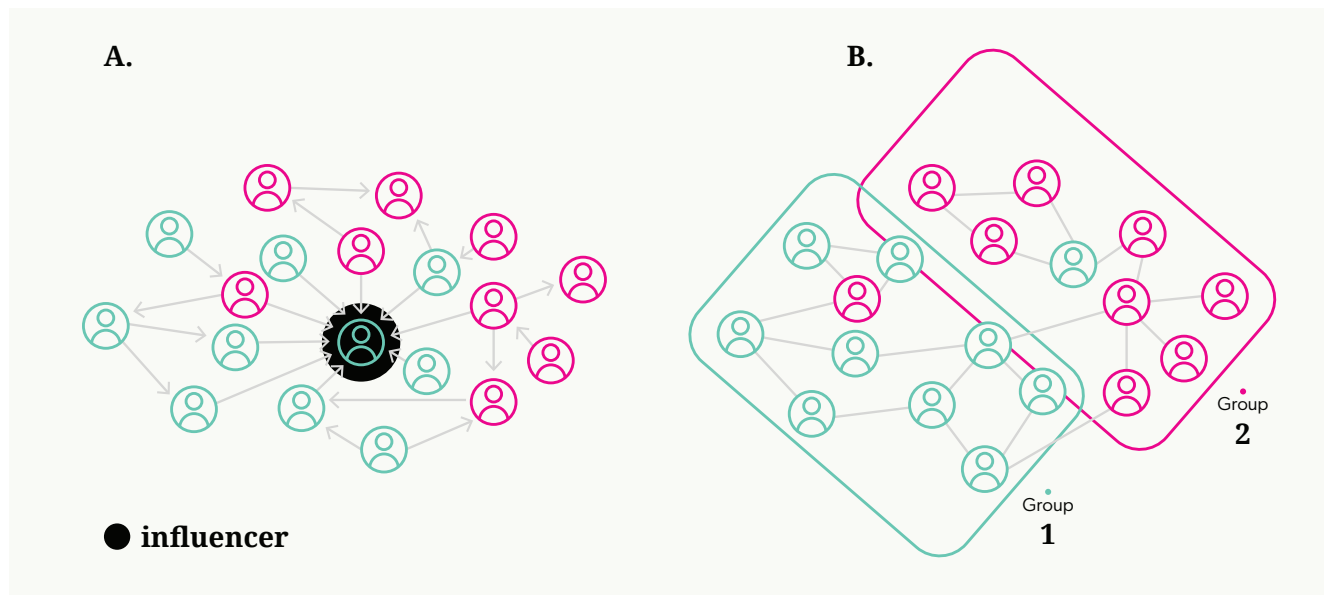
While only a minority of our respondents (38%) said they trust social media as a source of information on COVID-19, the majority (64%) indicated using social media to get information on the pandemic, at least some of the time.

This causes an ambivalent relationship and motivates improvement. In another study conducted by our group, we scraped the German Twittersphere for several weeks early on in the pandemic and found increased in-group information seeking. Retweets among members of the same community increased by almost 40% compared to the baseline.²⁹

2.3. Network Effects on Information Consumption

On social media, increased demand due to the crisis has met with the complex dynamics of information-spreading on social networks, governed by human psychology and the platforms' ecosystem described in 2.1. Social media platforms enable people to form complex networks of pairwise relations, such as "friends" on Facebook or "followers" on Twitter. Information and viruses have similar, yet distinct, characteristics in the way they spread through social networks.³⁰ While viruses do not care about psychology or social setting, these are important factors that drive the spread of information. For example, a need for expert knowledge can help messages from influential individuals spread, irrespective of the content or of social selection that allows an in-group opinion to circulate unhindered within a community. In other words, in contrast to a virus, the propagation of information depends heavily on who else around me is talking about it.³¹ Two prominent network motives (hubs and communities, see Fig. 4), their origins and their effects are examples of the crucial role of these connections.

Figure 4.
Illustration of Prominent Network Motives



The figure shows two prominent network motives: a) Hubs are individuals with many connections, often “followers” in a directed network, who are known as “influencers” b) Communities form in most social networks and are defined as groups that have more connections within the group than to the outside (figure adapted from Lerman et al. 2016).

The way a social media platform enables users to connect, greatly influences the shape of the emerging network structures. On a platform such as Twitter, where followers can accumulate in high numbers, influencers adopt the role of broadcasters – without journalistic responsibilities or transparency requirements. They become gatekeepers and tipping points for large information cascades.³²

On a platform such as Twitter, where followers can accumulate in high numbers, influencers adopt the role of broadcasters – without journalistic responsibilities or transparency requirements.

The platforms, which build the backbone of the network and deliver the content, have a great interest in maintaining influencers and

growing their follower base. In the pandemic, influencers play an important role, whether as experts actively engaging with the public or as pseudo-experts feeding the demand for information. According to one report, influencers are responsible for 69% of the misinformation spread concerning the pandemic.³³ Public figures have also been heavily involved in spreading false hopes, such as being cured by hydroxychloroquine.³⁴ On platforms with directed network structures (i.e., when a connection does not need to be reciprocal, which is known as a follower-connection), individuals with many followers play a crucial role in the dissemination of information. Therefore, they represent potential vulnerability that should be taken into account in future interventions aimed at designing a resilient information ecosystem. As in other networks, controlling hubs means controlling large parts of the population.

Since influencers do not need to follow any journalistic standards and are potentially easy to persuade or sponsor, they are a good target for manipulation attempts.

On other platforms, such as Facebook, connections are reciprocal. These platforms do not exhibit extreme hubs, since it requires cognitive capacity to maintain a large number of friends.³⁵ Under such selection pressure, this gives rise to communities – strongly connected subgroups in a network which often share an ideology, location or interests.³⁶ As trusted social networks, these subgroups exert strong social influence³⁷ and can lead to effects such as the ‘majority illusion’, forming a breeding ground for radicalization and conspiracy theories.³⁸ Fig. 3 illustrates the situation of two communities that are largely similar in some attribute (color coded).

Subgroups exert strong social influence and can lead to effects such as the ‘majority illusion’, forming a breeding ground for radicalization and conspiracy theories.

If others are only visible through the connections they form, most members in each group almost only see others of their color. This creates the ‘majority illusion’, whereby everyone thinks they are part of a majority even if that is not the case.³⁹ Again, the business model of the platforms amplifies these natural tendencies, as they have an interest in cultivating groups with clear shared attributes because it makes them easy to target for specific advertising, and because the sense of belonging binds the users to the platform.

These two examples show just how significant the simple differences in the options to connect with

others on social media are, both in terms of how they affect the sort of information that is shared, as well as the way it spreads on a particular platform. Emergent phenomena such as social movements kicked off by a handful of influencers are hard to predict. Understanding them better is crucial to designing platforms that can convey reliable information and remain robust when faced with external shocks such as a global crisis.

3. How to Build a Resilient Online Information Ecosystem

Finding ways to tackle these challenges and to create resilient social network structures on such platforms in the long run, while preserving their important connective and informational features, is an important task – for current and future crises, as well as for a functioning democracy.

Improving infrastructure and environments for decision-making and equipping individuals with the skills to recognize and avoid misinformation, while keeping an eye on the structural features of social networks, are promising ways forward.

Improving infrastructure and environments for decision-making and equipping individuals with the skills to recognize and avoid misinformation, while keeping an eye on the structural features of social networks, are promising ways forward. In a recent paper,⁴⁰ we outlined practical directions for interventions, self-regulation and policymaking that are informed by behavioral science. Examples for potential interventions

include: (1) Recognizing the crucial role of influencers by demanding increased transparency for their content (e.g., labeling, journalistic standards), if they exceed a measure of influence (such as a certain number of followers). This means treating them more like broadcasters than private persons, and generally adding cues to help assess the quality of a piece of information or of an influential individual. (2) Avoiding ‘majority illusion’ effects in well-connected communities by providing social information that reaches beyond the innermost circle. This can be achieved by providing more cues about the path a piece of information took before it reached an individual, and about the state of the overall discussion of the topic on the entire platform, rather than only in the direct “neighborhood”. Both interventions demand more transparency, mainly from the platforms’ interface – both source transparency and network transparency.

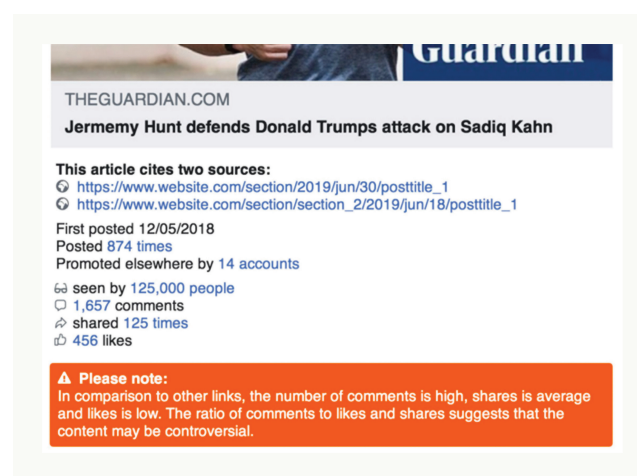
Transparency, however, is not a self-explanatory solution. As our discussion in Chapter 1 shows, it is important to think about the exact structure of the environment the user is placed in. Transparency can be defined by the set of cues readily available for making a decision. The online world has many more cues to offer than are currently provided, as platform design is limited by the business models of the current providers of these interfaces. We classify these cues as endogenous or exogenous. Endogenous cues are pieces of information about the content of a story, i.e. the actions being reported on, or the names of the actors and relations between them. When considering only these cues, it can be difficult to distinguish between facts and opinions or to detect irony, humor and sarcasm, as that often requires not only knowing what was said or done, but also the exact context,

i.e. who said what and in what way. A more general shortcoming of endogenous cues is that evaluating them requires judging the value of the content itself, which makes them potentially prone to abuse by censorship.

In contrast, exogenous cues, such as the source of information, writing style or references cited, are easier to harness as indicators of content quality, in particular by showing how an article is embedded within the existing corpus of knowledge and public discourse. This relates to making clear what external references or evidence the article is based on, and even to the objectivity of its style, which are signs of journalistic quality. Social information – who else is talking about the article, who shared it in the past, or how many people saw it but did not read – can mitigate ‘majority illusion’ effects.

Fig. 5 is an illustration of a social media post that includes a selection of potential cues that could be added to a social media environment to provide guidance and context to the users.

Figure 5.
Example of Possible Exogenous Cues in a Social Media Post



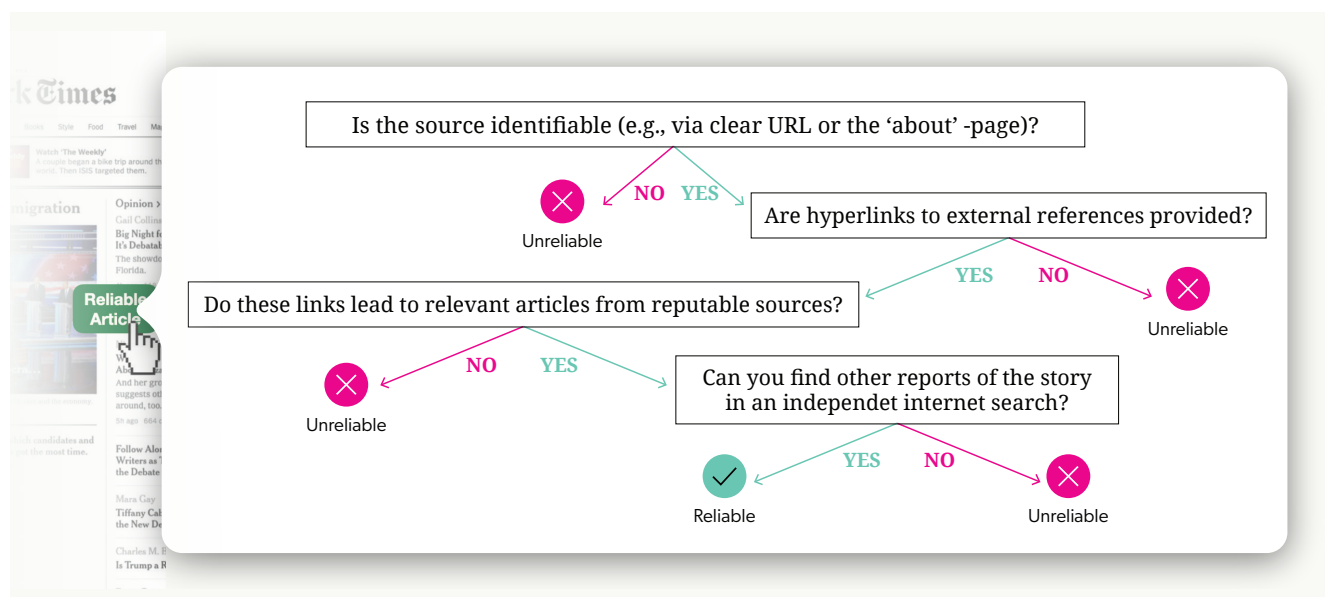
Behavioral interventions can enlist exogenous cues by integrating them into a social media platform, namely by nudging⁴¹ and boosting.⁴² Nudging interventions shape behavior primarily through designing choice architecture, and typically require little active user engagement. A classic example of a nudge is the placement of food items in a cafeteria buffet: if you put the tomatoes at the front, more people will buy them than if they are somewhere in the back. Boosting interventions, in contrast, focus on creating and promoting user competence to make crucial decisions. They require some level of user engagement and motivation.

Fig. 6 shows a ‘fast and frugal’ decision tree as an example of boosting in online information. As a pop-up, the tree could encourage users to systematically follow a series of steps to check for quality cues in order to evaluate online content. These steps could be internalized in the long run, promoting online media literacy. Both nudging and boosting have been shown to be

effective in various domains, including health and finance.⁴³ Recent empirical findings on the ability to detect false news indicate that information literacy can also be boosted.⁴⁴ Initial results on the effectiveness of simple nudges that remind people to consider accuracy before sharing content,⁴⁵ as well as apparently successful friction interventions that Twitter recently rolled out,⁴⁶ suggest that such interventions can be effective in the online domain. However, more evidence must be gathered and organized to reliably inform concrete design decisions. A recent effort in this direction is the prosocial design network (<https://www.prosocialdesign.org/>). Through online behavioral experiments and agent-based simulations, these important effects are being tested further. Their large-scale effects can and need to be estimated, too. Enhanced access to data from the platforms for independent research could greatly accelerate this process.

Figure 6.

Illustration of a Boosting Intervention



A boosting intervention could help users internalize a systematic rule for checking a piece of information with the help of a pop-up, which is ideally no longer needed after a period of use (figure adapted from Lorenz-Spreen et al. 2020).

4. Conclusions

Understanding the interplay of information ecosystems and human behavior is crucial for formulating recommendations to actively shape the online world and make it more resilient – both in times of a crisis and as the foundation of a functioning democracy. The pandemic has highlighted weak spots in the current, largely unregulated, self-organized online ecosystem. This may trigger new discussions about ways to advance the positive potential of our globally connected world.

This paper recommends interventions that focus explicitly on human decision making and its interplay with the online environment. Specifically, it argues that a potentially sustainable and robust way to achieve resilience is a bottom-up process: leaving judgments about the validity of content to the user. Users have to be enabled to make an informed decision, such as being shown whether an influencer has the relevant background on a subject or whether a certain view is just a niche opinion. Given that a large portion of the problems addressed in this paper are self-organized in nature, the solutions

should be designed in this way, too. The online environment will have to facilitate such processes of collective intelligence. This will require centralized standardization and regulation that will enable the de-centralized and self-organized fact-checking and discourse. Regulations that are agnostic about the human factor are prone to circumvention by platforms that are very aware of their users' behavior, or to entering an arms race with upcoming technology. The stability of human cognition offers the possibility of more sustainable regulation based on its rules.

The pandemic has shown that while human behavior is a key factor in the exponential spread of the virus, it is also key in breaking the chain of infections. Much like wearing a mask to avoid spreading a virus, it is imaginable that small interventions that prevent individuals from becoming disseminators of misinformation can have a major collective impact, and even protect people who have not taken up the intervention themselves – thereby creating collective resilience against misinformation and conspiracy theories.

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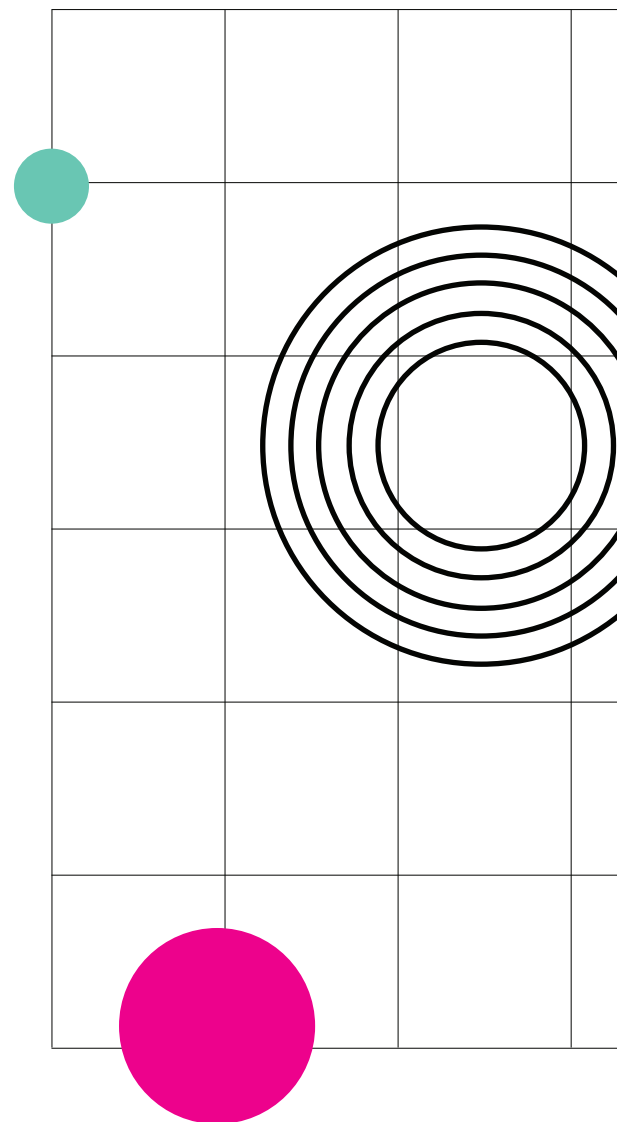
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About the Author

Dr. Philipp Lorenz-Spreen is a network scientist at the Center for Adaptive Rationality of the Max Planck Institute for Human Development, Berlin. He is interested in how and why information spreads via social media, and more generally, in the impact of modern information systems on our society and on the public domain. To that end, he analyzes large data sets from social media and other sources. This allows quantitative access to human behavior at the societal level and across large time spans.

Dr. Lorenz-Spreen's current research centers on the question of how individual choice environments can be changed to translate into positive collective effects of quality information distribution. He is experimentally testing ways to computationally extract meaningful cues for the quality of online information and make them more accessible to large numbers of users.

He completed his PhD on empirical methods and theoretical models for describing the dynamics of collective attention from online data sets at the Technische Universität Berlin. At the Ludwig-Maximilians-Universität in Munich, he studied physics, focusing on systems biophysics.



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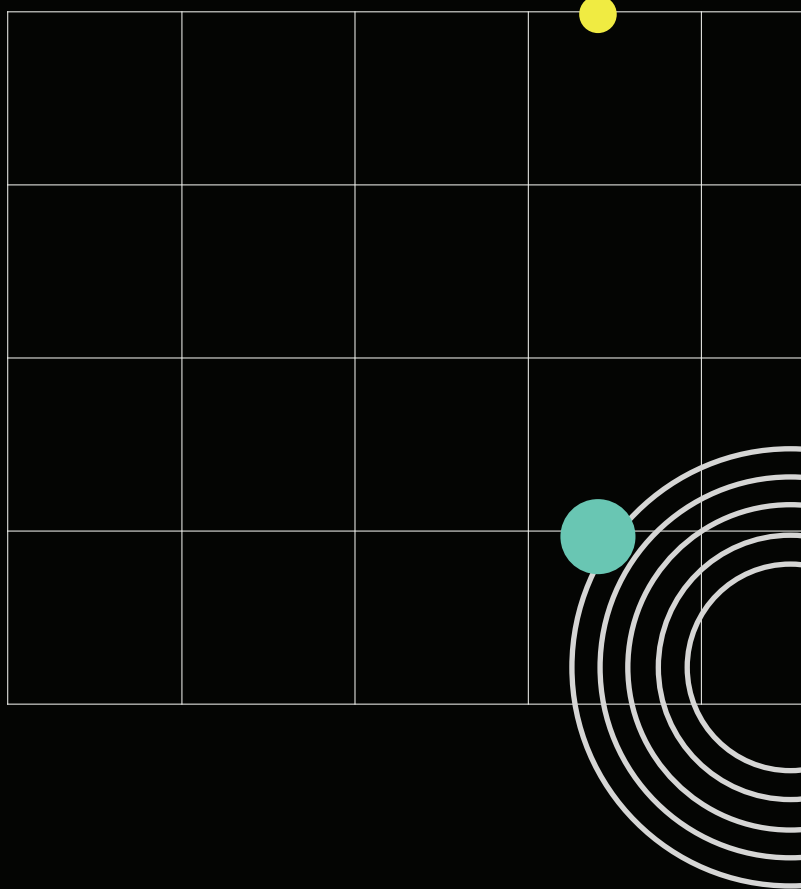
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