

Inoculating an Infodemic: An Ecological Approach to Understanding Engagement With COVID-19 Online Information

American Behavioral Scientist
2021, Vol. 0(0) 1–24
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DOI: 10.1177/00027642211050903

journals.sagepub.com/home/abs



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Abstract

As the global COVID-19 pandemic has been concurrently labelled an “infodemic,” researchers have sought to improve how the general public engages with information that is relevant, timely, and accurate. In this study, we provide an overview of the reasons why people engage and disengage with COVID-19 information. We use context-rich semi-structured interviews which invited participants to discuss online COVID-19-related content they encountered. This qualitative approach allows us to uncover subtle but important details of influences that drive online engagement. Participants both engaged and disengaged with content for individual and social reasons, with seven themes emerging connected to their engagement including actions in response to information, reasoning for engagement, content, motivating concerns, frequency of engagement with information, site of exposure, and given reason for not engaging. Many of these themes intersected and informed each other. Our findings suggest that researchers and public health communicators should approach engagement as an ecology of intersecting influences, both human and algorithmic, which

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change over time. This information could be potentially helpful to public health communicators who are trying to engage the public with the best information to keep them safe during the pandemic.

Keywords

COVID-19, misinformation, online engagement, information seeking, socio-ecological model

Introduction

The COVID-19 “infodemic”—the creation and sharing of immense amounts of information pertaining to the novel coronavirus—endangers worldwide efforts to stem the pandemic. Social media and digital communication platforms have been inundated with COVID-19 misinformation (Brennen et al., 2020; Cuan-Baltazar et al., 2020; Hernández-García & Giménez-Júlvez, 2020; Kouzy et al., 2020; Pulido et al., 2020; Rodríguez et al., 2020), and such misinformation has had serious impacts on public health. In the context of public health, misinformation has been linked to delayed and improper adoption of preventive behaviors (Bursztyl et al., 2020). In the context of individual health, misinformation has led to thousands of hospitalizations and deaths caused by unverified cures and treatments (Love et al., 2020). Importantly, accompanying the infodemic is a dilution of information and reputable sources, leading to a disintegration of certainty in both, and thereby leading to “erosion of public trust and a sense of helplessness, the perfect conditions for the spread of harmful misinformation that begins a vicious circle” (The Lancet Infectious Diseases, 2020, p. 875). To contribute to the amelioration of the infodemic, in this paper, we focus on one aspect of it—engagement with COVID-19 information. We do so by exploring how and why individuals engage with COVID-19 information and propose a relational approach to understanding COVID-19 engagement. We argue that by understanding the relationship between factors that shape engagement (a) experts can provide guidance to citizens who are navigating the COVID-19 infodemic, and (b) researchers, health authorities, and designers may be aided in their efforts to reduce the impact of misinformation. In other words, by developing a more nuanced picture of the way people engage with COVID-19 information online, interventions can work better with people’s motivations and concerns and perhaps be more effective.

Literature Review

Widespread dissemination and belief in misinformation about COVID-19 is a major public health issue (Islam et al., 2020), but it is not an issue that can be improved with the provision of more “good” information under a deficit model of science communication alone. There is much more correct than incorrect COVID-19 information

online, and correct information is engaged with more often than incorrect information (Ahmed et al., 2020; Marchal et al., 2020; Pulido et al., 2020; Rovetta & Bhagavathula, 2020). Fact-checking and myth-busting are certainly important, but they do not address the underlying factors that drive engagement and belief in misinformation, and various strategies to complement fact-checking and myth-busting have been promoted. For example, belief in COVID-19 misinformation has been linked to distrust in science and government sources, and so trust-building has been a recurrent theme (Han et al., 2021; Soveri et al., 2021). Belief and dissemination of misinformation has also been linked to a lack of critical thinking around COVID-19 information, and so raising scientific, news, and digital literacy has also been emphasized (Barua et al., 2020; Montagni et al., 2021). Combined with fact-checking and myth-busting, raising trust and critical literacy promise a more holistic solution to COVID-19 misinformation. However, such strategies often take for granted that people engage with COVID-19 information simply to make personal health decisions when, in reality, people engage with information on a daily basis for a wide range of reasons. Before we can actualize these strategies, we need a clearer understanding of how and why individuals engage with COVID-19 information.

There is an extensive scholarship dedicated to understanding why people engage with online information, which highlights internal influences such as communication, performativity, and education (Chin et al., 2015; Li et al., 2016; Shin & Thorson, 2017) and external influences including algorithmic filters, social barriers, and cultural norms (Bucher, 2012; Kitayama et al., 2009; Levitan & Wronski, 2014). However, it is unclear whether these influences operate in the same way during high-stress infodemic situations like that of COVID-19. For instance, multiple studies have found that during high-risk situations, people do not always engage with the sources that they trust the most (Burger et al., 2013; Cataldi et al., 2016; Hesse et al., 2005; Prior et al., 2014; Smith, 2011). In the specific instance of COVID-19, individuals commonly engage with information without considering its accuracy or the source's credibility, in some cases due to the inconvenience and time required to consider credibility (Dunwoody, 2020; Pennycook et al., 2020). If people are not engaging with online COVID-19 information strictly to gain accurate information, then the basic assumption of the above anti-misinformation strategies is flawed and we need a better understanding of what drives engagement during the COVID-19 infodemic. To date, most studies on engagement with COVID-19 information have used quantitative techniques to identify the types of information with which individuals are most interested in engaging. For instance, the use of Google Trends has been a particularly rich source used to identify the most searched COVID-related topics and how COVID-related engagement has changed over time (Effenberger et al., 2020; Husnayain et al., 2020; Rovetta & Bhagavathula, 2020; Springer et al., 2020). While these quantitative studies are valuable for discussing macro-scale trends in engagement, they can be enriched by examining the underlying and concomitant factors of engagement (see, for example, Authors, 2020).

Theoretical Framework

Given the complexity of ways in which people engage with information online during an infodemic, understanding such phenomena requires a framework that accounts for multiple factors including motivations, actions, and environmental impacts. One such model has been developed by [McCay-Peet and Quan-Haase \(2016\)](#) as a way to explain why people engage with particular content on social media, and which elaborates upon the well-established Uses and Gratifications theory of social media engagement ([Ruggiero, 2000](#)). In this six-step model, the authors examine social media engagement as being shaped by desires to fill particular needs and satisfactions through a combination of specific uses and gratifications, positive (or lack of) experiences, the presentation of self, usage and activity, and social context as informing content engagement. *Action and participation* refers to behaviors enabled by social media affordances, for example, whether a social site allows a user to share a post easily with others. *Positive experiences* describe the ways that flow, emotion, and serendipity drive a positive association and further engagement with social media. *Usage and activity counts* are numbers that are presented to users showing, for example, how popular a post is, which can drive engagement because they signal what content is worth paying attention to. *Social context* refers to the ways individuals are driven to engage with different content differently due to social interactions. This overlaps somewhat with uses and gratifications, but goes beyond social gratifications to help understand how engagement can vary between social media sites and even within groups on social media sites. Finally, *the presentation of self* refers to the ways that social media platforms allow users to craft and to a certain extent broadcast an identity to others ([McCay-Peet & Quan-Haase, 2016](#)). All six elements of the model can reinforce each other. For example, uses and gratifications via usage and activity counts specific to a platform can inform the social context which can influence positive experience, and in turn influence participation via specific presentations of self. Or as an example, if I see that a selfie I posted to Instagram is getting many likes with a popular friend group, I will probably feel good, and this feeling will encourage me to post similar content in the future. While, as our data show, this model is helpful as a preliminary guidance towards understanding engagement with COVID-19 information online, it is inadequate for capturing the complexity of the phenomena as it does not effectively account for things such as changes in engagement over time and the broader impacts of algorithms, for example.

One means to address these gaps is Brofenbrenner's (1979) socio-ecological model, the use of which has precedent in online media engagement studies ([Liu et al., 2018](#)). In this model, individual behaviors and attitudes are understood to be situated within a range of systems alongside other agents, all operating in a relational and reciprocal way at varying degrees of distance. The level of the microsystem is the level of the individual, which includes a person's thoughts and feelings, and relationships with friends and family. At the level of the mesosystem are community, organizational, and sectoral factors, with elements such as cultural values, social norms, and laws operating

at the level of the macrosystem. Lastly is the chronosystem, which accounts for the role of time in an individual's behavior. The socio-ecological model has been utilized across disciplines such as in children and youth studies (MacKenzie et al., 2011), media studies (Hodson et al., 2018), and education studies (Rania et al., 2014). What this model makes legible is the centrality of behavior being relationally organized, which is to say, as not being reducible to factors operating from any one location, in any one direction, or with a singular motivation. However, the risk in such a model is that its structure overstates the distinctions between levels of the model such that the appearance of influences and factors are rendered discrete from each other when the very fact of relationality means that all systems are porous and all factors are inseparably enmeshed with other factors to greater and lesser degree.

For this reason, rather than using the socio-ecological *model*, which can create the appearance of hierarchy, we emphasize an ecological *approach* that centers relationality as the key mechanism for understanding engagement behaviors. In other words, the key analytic strategy is to understand the relationship between behaviors and processes rather than a primary focus on where the elements of those relationships might land in the model. An ecological approach goes beyond the application of a specific model, and asks us to look at online interactions as a complex web of interconnected relationships that extend from the specific communicative context and encompass other relationships and sources of feedback independent of the content or platform under study. We thus borrow from and extend work by Philips and Milner (2021) and seek to understand COVID-19 engagement choices as part of an ecology of different interactions both on and offline. This permits inclusion and expansion upon the categories outlined in both uses and gratifications as well as the more extensive McKay-Peet and Quan-Haase model by incorporating additional salient factors, while more clearly attending to the interactivity between factors. In practice, this ecological approach means that there are two significant relational orientations from which people operate regardless of tools, content, or location. These are at the level of individual needs, concerns, and preferences, and at the level of social needs, which reflect concerns and responsibilities for others, including friends, family, community, and even nation. Our data analysis thus helps to reveal the multidimensional interactions between a person who engages with COVID-19-related information, the tools they use, the people or websites they interact with, their motivations for the engagement, and how these things can change over time.

Methods

Our goal in this paper is to identify, describe, and make sense of the factors that influence the kinds of online COVID-19 information with which people engage. We define engagement as any type of interaction with online content, such as reading an article, listening to an audio file, or watching a video or sharing, commenting on, or linking to social media content. These activities are aligned with the way engagement is described in both the social media communication and marketing literature (see, for

example, McCay-Peet & Quan-Haase, 2016; Men & Tsai, 2013; van Asperen et al., 2018). Specifically, we ask:

1. What factors influence why people engage with information related to COVID-19 online?
2. What factors influence why people disengage with information related to COVID-19 online?

Participants

Potential participants were Canadians who were at least 18 years old at the time of the interview and who had engaged with COVID-19 information online prior to the launch of the study. To incentivize participation, we offered potential participants the option to either receive a \$25 gift certificate or donate the same amount to Food Banks Canada. We directed potential participants to an invitation to take part in this research via three means in order to recruit a broad and diverse group of participants: first, we emailed all tenured and tenure-track faculty members at the authors' institution, recruiting two participants. Next, we emailed all individuals subscribed to a newsletter focusing on COVID-19 misinformation [URL redacted for peer-review purposes] an invitation to participate, thereby recruiting three more individuals. Next, we posted a research recruitment advertisement on Facebook that ran for 10 days, aimed at any Canadian aged 18 and older. More than 250 individuals responded to this call, and 18 individuals were eventually interviewed for this particular study.

We interviewed these 18 individuals in an iterative manner. We started by interviewing five individuals and continued interviewing people until we felt that we had reached *saturation*—the point at which we were confident that we could answer our research questions with the data we gathered—which is a common methodological step in qualitative research (Baker & Edwards, 2012). The pre-interview invitation to participate consisted of a short demographic questionnaire. We used responses to the questionnaire to guide our selection of who to invite for interviews in order to recruit a diverse sample (e.g., varied ages, education, genders, and technology use).

Pseudonymous participants are listed in Table 1 in alphabetical order. Eleven participants resided in BC, and one of each participants resided in AB, NB, NL, NS, ON, QB, and SK. Participants' age ranges were 18–29 (3), 30 to 45 (6), 46 to 59 (6), and 60+ (3). Twelve self-identified as women and six as men, and nearly all of them had some college-level education. With respect to their use of online communication platforms, nearly all used Facebook, Facebook Messenger, and email multiple times a day; more than half never used Reddit, and the rest used it infrequently; and they used Instagram more often than they used WhatsApp, which they used more often than they used Twitter, though in general they used all three of these platforms relatively infrequently.

Table 1. Participants.

<i>Pseudonym</i>	<i>Province</i>	<i>Age</i>	<i>Gender</i>	<i>Highest level of education completed</i>
Ali	Quebec	18 to 29	Male	Bachelor's degree
Carla	British Columbia	30 to 45	Female	Master's degree
Dana	New Brunswick	18 to 29	Female	Some college
Debra	British Columbia	46 to 59	Female	Doctoral degree
Elaine	British Columbia	30 to 45	Female	Master's degree
Gus	British Columbia	46 to 59	Male	Master's degree
Henry	British Columbia	46 to 59	Male	Professional degree
Jerry	Ontario	18 to 29	Male	Bachelor's degree
Joshua	Alberta	60 or older	Male	Master's degree
Kathy	British Columbia	46 to 59	Female	Master's degree
Leah	British Columbia	60 or older	Female	Some college
Lee-Anne	Newfoundland	30 to 45	Female	Bachelor's degree
Lisa	British Columbia	46 to 59	Female	Master's degree
Melanie	Nova Scotia	30 to 45	Female	Graduated from high school or GED
Mia	British Columbia	30 to 45	Female	Master's degree
Rose	Saskatchewan	46 to 59	Female	Bachelor's degree
Sherri	British Columbia	60 or older	Female	Associate degree
Tyler	British Columbia	30 to 45	Male	Associate degree

Data Collection

Two data sources informed this study: interview transcripts and examples of online artifacts related to COVID-19 that each participant was asked to bring to the interview. Using a semi-structured interview protocol, we interviewed participants via a video-conferencing application between June 8 and 26, 2020. Using this protocol, we asked participants to describe their engagement with online information related to COVID-19, and explore what information they find credible, appealing, and relevant, and the reasons why. We asked participants to arrive at the interview prepared to share with us three examples of recent COVID-19 content they had engaged with online. Using these artifacts, we probed participants to describe to us how they engaged with this information and why, and inquired into the reasons they selected to share these artifacts with us. Interviews lasted between 45 and 90 minutes. The interviews were recorded and transcribed verbatim. While the interview protocol covered various aspects of the participants' engagement with their artifacts, this paper focuses solely on issues of engagement.

Data Analysis

Five researchers analyzed the interviews using an iterative process. We began our analysis by independently reading all interviews to gain a broad understanding of the

data. Next, three researchers read two interviews and wrote open codes to describe the information that people engage with and find credible. We used an open coding process partly due to a lack of research focusing on the COVID-19 and partly because this process allowed us to remain open to facets of the experience that emerged from the raw data without the predetermined categories that are applied in cases of using a pre-existing codebook. This process involved the constant comparative approach (Glaser & Strauss, 1967). Each researcher read each piece of data and gave it a code relevant to the research question. From there, as each new piece of data was assessed, it was compared to previously generated codes to verify if it captured the new information. If it did not, a new code was assigned; if it did, it was assigned to the already established codes. The process of constantly comparing emergent codes and established codes produced a code list covering all of the data.

After the initial round of independent coding, the three researchers met to discuss the emerging categories seen in the data; as many unique codes were still emerging, another three interviews were independently coded by each researcher. Upon review of the second round of coding, we identified two main emerging and recurring areas: engagement and credibility. To answer our research question, we focused on engagement. The codes that fell under engagement were then examined, interrogated, and categorized into themes. The remaining interviews were then iteratively coded by one of the three initial researchers, and categorized according to the generated themes.

Rigor and Trustworthiness

Several steps were taken to reduce the incidence of bias in our analysis. First, members of the research team coded interview transcripts independently to avoid exerting any one person's biases on the findings. Next, we discussed emerging codes, inconsistencies, individual findings, and differences in the interpretation of the phenomenon. Once this step was concluded, we conducted a collaborative analysis that aimed at mitigating individual biases. Finally, we provide "thick descriptions" of the results in order to make it possible for readers to assess the applicability of the findings to their own experiences and contexts (Merriam, 1995).

Results

Codes were divided into themes determined by the lead authors that captured their broader meaning. In total, seven themes emerged from organization of the subcategories, which served to capture reasons or motivations for engagement and disengagement, engagement behaviors (i.e., type of engagement), and location and frequency of engagement (see Table 2).

The largest theme, *action*, captured the varying ways in which people actively engaged with or responded to information they encountered online, and included information-related behaviors (e.g., verifying the accuracy of something they read), relational or social behaviors (e.g., correcting misinformation in people's posts online),

Table 2. Themes.

<i>Theme</i>	<i>Description</i>	<i>Examples</i>
<i>Actions in response to information</i>		
Information-related behavior	Actions oriented to assessing information	Following up on information; fact-checking; source checking
Relational or social behaviors	Engagement with others in response to seen information	Debunking myths; posting only reliable information; discussing with others
Social media affordance behavior	Behaviors tied to platform affordances	Liking; sharing; commented
<i>Reason for engagement</i>		
Content qualities	Specific aesthetic qualities or information cues	Headlines; style of writing; scientific in appearance
Desire to learn or understand further	Engagement driven by interest in learning more	Gain insight; awareness of other perspectives
Driven by emotion, e.g., curiosity	Engagement said to be shaped by emotional responses or needs	Curiosity; anxiety; provides relief
Member of a network, e.g., following a page or group	Engagement as a result network affiliations or memberships	Membership in a Facebook group; subscribed to a newsletter
Source of humor	Desire to engage with funny content	Memes; funny quizzes
Personally relevant	Relevant to own life	Relevant to profession; relevant to family
Reasons for sharing	Explanations for why participant did or did not share information online	Felt others should know for own good; felt others would be interested
Source qualities	Engaged due to specific qualities in source of information	Source provided evidence; source was a doctor; Canadian news source
<i>Content</i>		
New information	Information that was new to participant	
Broad impact of pandemic	Information tied to the wider impacts of and vulnerabilities stemming from the pandemic	Wealth inequality; international travel; border closures
COVID data	Information related to COVID data in terms of numbers	Case counts; death counts
Disease-related information	Information related to COVID as a disease	Cures; treatments; vaccines
Medium of content	Format of content	Articles; videos; memes; comments

(continued)

Table 2. (continued)

<i>Theme</i>	<i>Description</i>	<i>Examples</i>
Measures and guidelines	Content tied to government health protocols and responses	Measures taken by state; health and safety guidelines
Comparison data	Information on different case loads and fatalities across different jurisdictions	Comparing local situation and elsewhere; comparing national situation to other nations
Positive content	Content that shared information about positive events	Happy things; positive coping mechanisms
<i>Motivating concerns</i>		
General concerns	Concern for broad impacts or factors	Misinformation; American situation
Concern for others, e.g., concerns about friends or family	Concerns for safety and well-being of friends and family	Emotional impact
Personal concerns	Concerns for safety and well-being of self	Career changes; personal disability
Privacy concerns	Concerns about technology and the pandemic	Apps; contact tracing
Local information	Concerns about local community	Children and schooling; elderly and care homes
<i>Frequency of engagement with information</i>		
Change in frequency over time	Indication of increased or decreased engagement	Daily engagement declines since March
Frequency of engagement with information, e.g., habit	Mentions of engagement	Habit; daily; every morning
<i>Site of exposure</i>		
Site of exposure	Range of media and platforms	Facebook; news media; email
<i>Given reason for not engaging</i>		
Given reason for not engaging	Stated understanding for not engaging or disengaging with information	Content or source not trustworthy; tone; information fatigue

and social media affordance behaviors (e.g., sharing or liking a post). In other words, this theme captures engagement as a consequence of encountering something online. For example, any reference to engagement that took the form of following up on information the participant was exposed to was grouped into “information-related behavior,” or as Debra described it, as going “deeper.” Relatedly, engagement with information that expanded beyond the initial encounter into discussion of some type

with others was categorized as a social or relational behavior, and included everything from being very cautious about triggering people, as Lisa described her online sharing, to sharing it with friends or in their network, as Leah indicated she did. The categories were then organized within the larger theme of actions in response to information, which also included behaviors tied to social media affordance behaviors, such as clicking and liking a post, as these too were actions in response to information.

Reason for engagement captured the reasons why people understood themselves to be engaging with information excluding type of content, with the subcategories being content qualities (e.g., headlines attracting engagement), desire to learn more, driven by emotion (e.g., curiosity), member of a network (e.g., following a page), personally relevant (e.g., relevant to career), and source qualities (e.g., source provided evidence). Another major theme, *content*, captured mentions of the kinds of information people actively sought and chose to engage. While *content* can be understood as a subcategory of *reason for engagement*, the volume and specificity of it meant that further categorization of its component codes yielded valuable information about engagement behaviors. This included content about the broad impact of the pandemic, such as increasing wealth inequality, which Carla cited as “frustrating,” and economic instability, about which both Dana and Elaine were concerned. Other categories included COVID-19 data (e.g., case counts and deaths), and disease-related information (e.g., cures and treatments), with almost half of participants ($n=8$) mentioning interest in treatments, including vaccines. Also included was interest in specific mediums (e.g., videos and articles), measures and guidelines (e.g., contact tracing), humorous content, and misinformation. Humorous content, for example, might include watching satirical media, an interest in “graveyard humor,” or as one participant, Lee-Anne used it, as a way to engage “my friends no matter where they are in the word.” For her, humor served the dual purposes of providing a bit of levity, or as Tyler described “a semi-poking fun at,” but also as a route to social connection and relationship with others on a wider scale, underscoring the complexity of motivations for engagement as not being exclusively localized in one category.

Similar to *content*, *motivating concerns* were reasons for engagement, but with a specific orientation to anxieties associated with the pandemic. This included the subcategories of concerns about larger structural threats such as privacy, which Melanie remarked upon in relation to tracing apps, and concerns about misinformation, which five people mentioned, with Kathy noting that “we’re not just fighting the epidemic, we’re fighting the infodemic.” Further concerns included concerns for self, and interest in local information as a means to understand whether the local environment was safe, as Sherri noted.

The subsequent themes shifted away from stated reasons for engagement to include more environmental and temporal factors, as well as reasons for disengaging. *Frequency of engagement* reflected codes for mentions of how often participants engaged with COVID-19 information online, with changes in frequency being especially notable as a subcategory. Joshua, for example, noted that “there’s a kind of fatigue” that had set in for him, and so he no longer watched the news. *Site of exposure* captured the

location at which engagement was understood to have begun, such as the appearance of information in their Facebook feed or in an email newsletter. The final category, *given reason for not engaging*, while not large in terms of frequency, is valuable because it provides insight into some of the factors that drive people away from engaging with COVID-19 information online. These included things like tone and aversion to conflict, which we discuss further next.

After sorting data into the major themes and sub-themes, we noted a trend in both engagement and disengagement factors as dividing along codes oriented to the *individual*, as in individual preference, interest, and habit, for example, and codes oriented to the *social*, meaning, engagement being driven by relational factors such as concern for others including friends, family, people within the participant's society, and larger structures like the province in which they reside, the state, and the world. Table 3 shows the themes and their subcategories broken down along these lines, with both engagement and disengagement being divided between individual and social motivations. Totals correspond to the number of references coded for each subcategory, with 390 total coded references to engagement as driven by social factors, and only six coded references reflected in socially motivated disengagement (see Table 3).

In contrast, 893 total engagement references were driven by individual factors, compared to 89 for individually driven disengagement factors. What these numbers suggest is that people appear to be far more motivated to engage with COVID-19 information for social reasons, though such motivations rarely impact disengagement, with *aversion to conflict with others* being the dominant cited factor. Tyler, for example, avoided certain controversial discussions, stating that they were not going to be "the hill I'm going to die on," and Joshua preferred not to bother engaging, noting "you never changed anybody's mind." In contrast to social motivations, individual motivations such as preference around aesthetics and tone drive both engagement and disengagement, with participants disengaging because information was found to be boring, aggressive, or irrelevant, for example, and engaging for reasons such as finding things personally relevant, of general interest, or aesthetically appealing. Jerry cited the appeal of infographics and data visualizations, for example, and Joshua noted the appeal in graphs, with further factors including things such as length of messages, simplicity of information, and the style of writing.

Discussion and Implications

The COVID-19 pandemic is a time of great personal and public stress when people are using digital communication technologies to stay informed and connected. As a result, it is not surprising that the framework of uses and gratifications provides at least a partial explanation for why people engage with specific types of COVID-19 information on social media. Our findings support previous research noting that people engage with online information and misinformation to address concerns and knowledge gaps related to personal and community health, concerns about loved ones, and as a result of emotional reactions like anxiety or even humor (Du et al., 2020; Dunwoody,

Table 3. Engagement and Disengagement.

<i>Engagement</i>	<i>Engagement individual</i>	<i>Engagement social</i>	<i>Disengagement individual</i>	<i>Disengagement social</i>
<i>Actions in response to information</i>				
Information-related behavior (e.g., verifying accuracy)	142	1	22	0
Relational or social behaviors (e.g., correcting people online)	6	39	1	0
Social media affordance behavior (e.g., shared, liked, and clicked)	30	93	2	0
<i>Reason for engagement</i>				
Content qualities (e.g., headlines)	109	0	0	0
Desire to learn or understand further (e.g., looking for more information)	29	8	0	0
Driven by emotion (e.g., curiosity)	45	0	0	0
Member of a network (e.g., following a page or group)	17	0	0	0
Source of humor	25	0	0	0
Personally relevant (e.g., relevant to own life)	63	1	0	0
Reasons for sharing (e.g., others should know for their own good)	0	60	0	0
Source qualities (e.g., source provided evidence)	72	0	0	0
<i>Nature of content</i>				
New information	6	0	0	0
Broad impact of pandemic (e.g., wealth inequality)	3	11	0	0
COVID data (e.g., case counts, and deaths)	0	53	0	0

(continued)

Table 3. (continued)

<i>Engagement</i>	<i>Engagement individual</i>	<i>Engagement social</i>	<i>Disengagement individual</i>	<i>Disengagement social</i>
Disease-related information (e.g., cures and treatments)	40	24	0	0
Medium of content (e.g., articles)	17	2	0	0
Measures and guidelines (e.g., contact tracing)	32	8	0	0
Comparison data (e.g., between local situation and elsewhere)	6	6	0	0
Positive content	5	0	0	0
<i>Explicit motivating concerns</i>				
Motivating concerns (e.g., concerns about misinformation)	45	39	0	0
Concern for others (e.g., concerns about friends and family)	8	41	0	0
Personal concerns	4	0	0	0
Privacy concerns	4	4	0	0
Local information	24	0	0	0
<i>Frequency of engagement with information</i>	0	0	0	0
Change in frequency over time	0	0	23	0
Frequency of engagement with information (e.g., habit)	30	0	23	0
<i>Site of exposure</i>				
Site of exposure (e.g., Facebook)	113	0	0	0
<i>Given reason for not engaging</i>				
Given reason for not engaging	0	0	18	6
Total	893	390	89	6

2020; Jacobson et al., 2020; Krause et al., 2020; Lwin et al., 2020). Our interviews also support the idea that people engage with information that allows them to perform their identity to others, or to develop social relationships (Chen et al., 2015; Chin et al., 2015; Herrero et al., 2017; Kim & Yang, 2017; de la Peña & Quintanilla, 2015). In the case of

our research, uses and gratifications overlaps with other engagement factors and provides a solid understanding of why people both engage with some content and disengage with others. However, given the complexity of the intersection of today's broader information environment, an emergent infectious disease event like the COVID-19 pandemic, and the shifting orientations to and management of online information at the level of the individual, the platform, and society more generally, this is only a starting point. Thus, we expand our analytical frame to include additional factors from [McCay-Peet and Quan-Haase's \(2016\)](#) six-step engagement model, as well as additional considerations beyond the model, while situating all of these factors within an ecological understanding of engagement as something that happens as a result of using communication processes and platforms as a way to understand oneself and others in the world.

Beyond uses and gratifications, we also see ecological explanations for further factors outlined in McKay-Peet and Quan-Haase's work. The factors of action and participation come into play when our participants indicate, for example, that they engage with information that comes from a page that they subscribe to or follow, reflecting a relationship to wider social media spaces. In this case, the follow or subscribe affordance influences engagement, as one participant demonstrated in discussing her interest and reliance upon a professional newsletter as a primary source of COVID-19 information, and to which she had subscribed long before the pandemic. In other words, while her engagement was at least on the surface driven by subscription affordances, a pre-established relationship unrelated to the pandemic significantly determined this engagement, suggesting that other influences (e.g., history) remain relevant.

The positive experience factor of the six-step model is apparent when our participants described the role of, for example, humorous content in driving engagement. While our participants did not specifically note the popularity of posts as a reason for engagement, they did tend to engage with mainstream or dominant media outlets, showing that reputation of the original source of the information and knowledge of that reputation does impact engagement, with things like Canadian media and information provided by Canadian media driving engagement. This type of engagement is covered under the usage and activity factor, but again, must be understood relationally across time, including times prior to the pandemic, and within a particular information environment, such as the Canadian context.

Our data demonstrate the social context factor when we consider the degree to which social context drives engagement, which [Table 3](#) reveals in detail. Finally, the presentation of self-factor is reflected in our data when participants told us how they feel they are perceived by others as a reliably informed individual and as a result felt compelled to share specific COVID-19-related information, such as Tyler, who felt his friends "consider me a pretty good source for science things."

While the six-step model proposed by McKay-Peet and Quan-Haase is useful for understanding our interview data, it has two key limitations. First, it lacks a step which fully accounts for the role of algorithmic content curation on engagement, so it does not

adequately account for the broader information environment in which people are embedded, an environment that, given the rate of information flows and the changes of management of those flows, is constantly evolving and requires of users ongoing and changing relationships. Indeed, all participants engaged with material that came up in their social media feeds or that was sent to them via an email digest which may or may not have been impacted by algorithms, meaning the decisions (often algorithmic) driving the initial appearance of the content in their feed represented a key first step to engagement that should be accounted for. While some of the aspects of algorithmic analysis is captured by the usage and activity part of the six-step model, usage and activity tends to refer to individual engagement choices, rather than the nudge of algorithmic decision-making, which has been shown to be particularly important for COVID-19 information-related engagement (Bucher, 2012; Van Dijck et al., 2018; Gillespie et al., 2014; Webster, 2011). By complementing their model with an ecological approach that accounts for these environments, we develop a more robust understanding of engagement as described above.

Secondly, the McKay-Peet and Quan-Haase model also does not account for what we see in changing COVID-19 engagement over time, which an ecological approach also attends to, given its emphasis on time. Our participants often indicated the way their information engagement behaviors had changed since the beginning of the pandemic. Changes over time are a key factor in considering engagement with high uncertainty information subject to change, and as such is particularly important for understanding health information during an emerging pandemic. Similarly, the affordances of a social network will impact how an individual expresses their identity through engagement with online information, and the individual engaging with online information over time will “train” an algorithm to deliver new content for the individual to engage with (as described by Airoidi et al., 2016; Davidson et al., 2010; DeVito, 2017; Thorson et al., 2019).

In our interviews, participants described the ways that their individual habits, preferences, and pleasant experiences (e.g., humor) influenced the content with which they chose to engage. They also recognized the role that social relationships played in their engagement choices. They noted how the platform affordances impacted engagement, and also suggested a desire to engage with information that was unavailable through other media sources, for example, local news relevant to COVID-19—these are all engagement factors at a level of organizational interactions with individuals. Furthermore, they told us about how they look to known experts (e.g., provincial or federal health officers) and known organizations (such as the CDC or WHO) as sources of information with which to engage. Our participants understood that they are in a broader information environment of misinformation (as described in Brennen et al., 2020; Cuan-Baltazar et al., 2020; Hernández-García & Giménez-Júlvez, 2020; Kouzy et al., 2020; Pulido et al., 2020; Rodríguez et al., 2020), and as a result, they sometimes engage by verifying the information they see in their feeds. This often helps them to engage further and sometimes prompts disengagement.

Disengagement happens over time, and as a result of a series of environmental, social and content-related reasons. Interestingly, however, when people disengage, it is more likely to be for individual reasons (e.g., tone or the irrelevance of the content) than for social reasons (e.g., not wanting to post or respond to dubious information, so it does not show up to others in their feeds). Furthermore, disengagement is likely to be something that participants indicate grows over time, showing the importance of considering changes over time. This could be a particularly salient factor for public health communicators during a pandemic, when information is subject to change frequently, and where people may be searching for information over a prolonged period of time.

Importantly, individual factors for engagement, which would fall under McKay-Peet and Quan-Haase's uses and gratifications, positive experiences, presentation of self, and action and participation cannot really be separated from social and organizational factors like social context, and usage and activity. There are not really discrete and separable reasons for engagement, but a web of reasons for engagement, which also include the passage of time, policy decisions related to the defunding of traditional media (and thus the need to engage online to, for example, find local news), and the complex dance between social media algorithms and individual preferences. Understanding this, we can consider the six-step model as part of a growing ecology of influences and decisions that drive engagement, and we can use this approach to better understand why COVID-19-related misinformation spreads.

This study is a preliminary foray into the complex motivations for engagement, and thus, it faces a few limitations. Participants were primarily selected based on an invitation on Facebook, which may impact results based on the effect of Facebook user profiles and user engagement. Furthermore, we were most interested in having participants reflect on actual content that they had recently interacted with online, meaning that participants may have selected content that they felt would cast them in the best possible light with researchers. For this reason, certain political nuances, or specific engagement with controversial types of misinformation, disinformation, or conspiracy theory may not have been captured through this analysis. Nevertheless, our approach of using content elicitation plus deep context-rich interviewing techniques is useful since it reveals important considerations driving engagement with COVID-19 information that can be useful for understanding why both credible information and misinformation travel. Additionally the use of an ecological approach to understanding reasons for engagement captures elements of engagement that have been either under-studied or only studied in isolation, while also maintaining the complexity of engagement drivers, and thus represents an important step forward for understanding why information travels online, particularly in the context of an emergent infectious disease event like the COVID-19 pandemic.

Notably, this kind of engagement may be resistant to fact-checking since it meets an identity and community need that is independent of the information sharing itself. While our interviews indicate that people engage in a type of fact-checking of COVID-19-related information, this may or may not be helpful overall since the literature notes that fact-checking can often lead people toward additional sources of misinformation (Krause et al., 2020; Zollo & Quattrociocchi, 2018). This makes sense when we

consider responses from our participants that indicate that online engagement is one way they maintained a social identity as a knowledgeable or credible individual. If people are performing a social identity and this is driving at least some engagement, then fact checking, rather than exposing the truth, could be more of a way to manage or support an existing identity. If that identity is grounded in misinformation, then it will be more resistant to change.

Conclusion

While it is too early to make concrete recommendations with respect to information about COVID-19 in online spaces, it is clear that engagement with this content is complex and needs to account for intersecting influences at the levels of the individual, community, organizations, and the broader information environment, and how these influences change over time. While previous models for engagement including uses and gratifications and McKay-Peet and Quan-Haase's six-step model have been useful in the past for conceptualizing the reasons why people engage, and the platforms on which they choose to engage, the complexity of social media platforms now and in particular the complexity of COVID-19-related information during a time of "infodemic" mean a more nuanced understanding of engagement is warranted. To achieve this, we recommend embedding the elements of the six-step model, including uses and gratifications into a broader ecological understanding of engagement which includes and accounts for the relationship between the algorithm and individual choice, as well as changes to habits, preferences and algorithms (as a result of machine learning) over time. It is not adequate to consider just what factors people perceive to be impacting their engagement activity, but research also must consider factors that include the information environments in which they participate, given that those environments are shaped not just by individual interest or choice, but by social connections, policy, culture, and broader trends. Developing an ecological approach to engagement will help researchers see why people may be likely to engage with misinformation and will also help health communicators develop different approaches to reaching people with better information. By taking into account the myriad of influences and how they change over time and interact with technology, it is possible to better understand how to reach people with compelling public health advice during a pandemic scenario in the future.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Canadian Institutes of Health Research (CIHR) grant number 440296.

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