PART I

PART 1: GLOBAL PUBLIC HEALTH
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EMERGENT COVID-19 AND SARS-COV-2 IN SOCIAL IMAGERY AND SOCIAL VIDEO: INITIAL THREE MONTHS OF VIRAL DISPERSION

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Abstract

The pandemic potential of emergent SARS-CoV-2, a zoonotic virus which causes COVID-19, has captured the world’s attention, through formal mass media and informal social media (esp. social imagery and social video). This work explores multiple social imagesets (thousands of images) from Google Images (captured from various seeding terms related to the outbreak) and social video transcripts from Google’s YouTube platform to infer focuses of mass human attention in terms of (1) messaging and information sourcing, (2) meta-messaging and subtexts, and (3) invisibilities (what is not expressed). This compares the imageset messaging against mass media articles from the same time frame. This work has implications for a mass-scale social response to an unfolding global biosafety/biosecurity risk based on learning from more organic and emergent social communications.

Key Words

Novel Coronavirus, 2019-nCoV, COVID-19 disease, SARS-CoV-2, Severe Acute Respiratory Illness, Community Spread, Self-Quarantine, Quarantine, Social Distancing, Chains of Infection, Contact Tracing
Introduction

“Assume this virus is everywhere. This is a global influenza pandemic caused by a coronavirus.”
— Michael Osterholm in Peter Bergen’s “The disease expert who warned us” in CNN (March 10, 2020)

COVID-19, the disease outbreak caused by the novel zoonotic virus termed SARS-CoV-2 (and prior, 2019-nCoV), is a major threat to human health in part because people do not have a natural immunity to this pathogen, which spreads quickly and invisibly. At this moment, World Health Organization experts suggest that COVID-19 has an estimated fatality rate of 2 – 4%+ in Wuhan (and 0.7% elsewhere) based on current available information and limited testing (Winsor & Schumaker, Feb. 24, 2020), as compared to 0.1% mortality rate for the common flu. [The “case fatality rate” is higher across all the age ranges than the common flu. Of those who progress to the actual COVID-19 disease, the case fatality rate is estimated to be 1% at present
from known data in China and S. Korea (Gottlieb, as cited in “Former FDA chief warns...,” Mar. 8, 2020). At present, there are not any known antivirals or other drugs that may be used against SARS-CoV-2 available commercially. This virus emerged from an unknown animal host and intermediate host to infect people in Wuhan, Hubei Province, in the People’s Republic of China, in December 2019, and by the end of February 2020, had spread to over 88,000 in 67 countries and territories, with over 3,000 deaths and 45,100 recovered. [More recent press accounts suggest that the viral outbreak started in November 2019 but was not detected by Chinese health officials until later and that there was a delay in notifying the world about the novel coronavirus outbreak.] Some 33,000 have recovered from infection by this respiratory virus but with the caveat that they may be re-infected based on reported health cases (Bacon, Feb. 19, 2020). The mechanics of the human bodies’ defenses and their “relapses” or reinfections (Kline, n.d., as cited in Begley, Feb. 4, 2020, p. 7) are not yet fully clear except that the protective antibodies seem to lose potency over time. The infections have occurred even in the presence of government defenses, mass quarantines, external (and internal) border controls, broad RNA-based testing in some regions, epidemiological work to map infections (through contact tracing and other work), mandatory house stays, mass sanitation efforts, and other interventions. At both the micro (individual) and macro (societal) levels, at the present moment, the defenses are few and only somewhat effective at slowing the viral spread. Buying time enables people to better control the load on their healthcare systems and to enable time to hopefully develop an effective vaccine (Evans, Feb. 23, 2020, p. 2). There have been negative byproducts of the various responses, including social stereotyping, stigmatizing and harassment (including violent assaults) of particular groups (and individuals); heavy-handed trampling of civil rights (forcible detentions and quarantines, privacy compromises, door-to-door police visits, and other challenges); and others. Three months in, there are still
many questions about the pandemic potential of SARS-CoV-2 and its capabilities.

Beyond the direct first-order effects of COVID-19 (illnesses and death), many second-order and third-order ones have occurred (affecting industries, politics, trade, and other spaces). Given the scale of the outbreak and the integration of countries in globalization, the possibility space is enormous. There have been follow-on repercussions on various health systems, economics systems, political systems, industries, tourism, and others—both in highly public ways and in much quieter ones.

While various experts—epidemiologists, coronavirus experts, physicians, economists, policymakers, and others—have shared their knowledge in this space, common folk have also been sharing information. After all, they are witnesses to mass-scale city shutdowns, experiencers of cruise ship quarantines, survivors of the novel coronavirus, and others who have amateur knowledge in this unprecedented time. They not only share microblogging messages in text, imagery, and video, but they also share longer blog entries, interviews, and other information content. This less formal sharing may be studied for insights about digital services in times of crisis, with this study occurring in the moment, three months into the global epidemic (and without any benefit/harm of hindsight to the research).

This work involves the capture of multiple social imagesets with different seeding terms from Google Images and the capture of social video transcripts from Google’s YouTube…and their manual analysis for understandings of mass human attention in a real-time crisis:

1. messaging and information sourcing,
2. meta-messaging and subtexts, and
3. invisibilities (what is not expressed)
The coding is compared against the reportage of some 669 online articles related to the outbreak in the same time frame (February 2020). These articles are all in English and from over a dozen different sources: CNN, Reuters, Associated Press, Forbes, New York Times, New York Post, KOMO, KIRO, KING5, Seattle Times, ABC, NBC, CBS, CNBC, FoxNews, The Telegraph, The Guardian, The Washington Post, Foreign Policy, South China Morning Post, Time Magazine, Business Insider, Bloomberg News, Newsweek, USA Today, The Hill, My Northwest, and various local media outlets. The idea was to sample broadly and in an “agnostic” way in terms of politics. This work has implications for a mass-scale social response to an unfolding global biosafety/biosecurity risk based on learning from more organic and emergent social communications through social media platforms that are public.

The work was conducted as described in Figure 1. The visual suggests linear work, but this may be better understood as recursive, moving forwards and backwards.
This flowchart shows the research sequence of this chapter.

Figure 1: General COVID – 19 and SARS-CoV-2 Social Imagery and Social Video Research Sequence

More specifics will follow. The image coding was done in a bottom-up way. The computational text analysis was conducted
using NVivo 12 Plus. Data were collected from the following online social media sources: Google Images and Flickr.

**Review of the Literature**

In a more pure science sense, it should not be a surprise when viruses cross over from one species to another, given the probabilities alone. Some scientists have discussed generational out-breaks, with the idea that such high-risk mutations are expected given the natural context and human actions of high-trade and high-travel globally. Human lifestyles requiring incursions into different animal habitats also enable higher chances of interactions, with different pathogenic effects possible. One science writer explains:

> The virosphere and the biosphere exist together and interpenetrate each other, like milk in tea, like mist in air. Everything that lives gets infected with viruses. As far as anyone knows, viruses replicate in the cells of all species of living things, all of them, from bacteria to blue whales. The virosphere permeates the earth’s atmosphere, which is filled with viruses blowing in the wind. Around ten million virus particles land on every square meter of the earth each day, drifting down from the air. Viruses saturate the soil and the sea. A liter of seawater contains more virus particles than any other form of life. Viruses exist in vast numbers in the human gut, infecting all of the four thousand different kinds of bacterial that live naturally in a person’s intestines. Viruses can sometimes infect other viruses. (Preston, 2019, p. 34)

When crossovers occur, humanity benefits when their surveillance is able to detect this, for the sake of **biosafety** (the protection of human, animal, and environment from the unintentional exposure of disease-causing microorganisms and biological hazards) and **biosecurity** (the guarding of human, animal, and envi-
ronment from the intentional release of pathogenic microorganisms and biohazards).

A review of the mass media reportage from late January 2020 through the end of February 2020 (with an extra day for leap year) finds some early published works by science writers who have taken on the role of sentinels providing early warning, such as Laurie Garrett [Pulitzer Prize-winning author of *The Coming Plague* (1994), *Betrayal of Trust* (2000), and *Ebola: Story of an Outbreak* (2014)]. In one early work, several weeks after the Chinese government was said to have become aware of a cluster of illnesses in Wuhan, Garrett wrote a prescient piece titled, “Just in time for Lunar New Year, another SARS-like epidemic is brewing in China: Scores of people in Wuhan and Hong Kong have been sent to hospitals because of a mysterious respiratory ailment—and true to form, China is trying to keep it quiet” (Garrett, Jan. 8, 2020, p. 1). It was written in part as a goad to encourage an apparently reticent Chinese government into increased transparency. She cites a red alert posted on the website of the Medical Administration of Wuhan Municipal Health Committee on Dec. 30 announcing a “pneumonia of unknown cause” (Garrett, Jan. 8, 2020, p. 3). On New Year’s Day, other information was released with identification that the outbreak was “caused by the SARS virus, which is a member of the coronavirus family,” and shortly thereafter, temperature screenings ensued at airports and train stations in China, HK, Singapore, and Taiwan (Garrett, Jan. 8, 2020, p. 3). [The name “coronavirus” comes from the Latin word “corona,” referring to a “crown” or “halo.” Electronic microscope images of the very small virus—about 27 – 34 kilobases (“Coronavirus,” Feb. 29, 2020)—shows a virus that “looks like a solar corona” (Gibbons, Jan. 24, 2020). Coronaviruses are “in the subfamily *Orthocoronavirinae* in the family *Coronaviridae* and in the order of *Nidovirales*.

Other news started leaking from others that the genetic profile did not fit SARS and that a novel pathogen was likely. There
is reference to a report of two people with pneumonic plague in November, with a two-week delay of reportage to the WHO: “A number of mysteries about the illness remain outstanding, including its connection to a nearby rat infestation, reported plague cases in Mongolia, and its ultimate resolution. After a flurry of coverage in Chinese media, the story died out, government officials issued no further statements, and it isn’t known how extensive the problem may have grown” (Garrett, Jan. 8, 2020, p. 5). It is unclear whether the illnesses are related, but there seems to be a possibility that the issue may have been around for longer than is known currently. Garrett makes the case that more information is needed before the mass travels of the Lunar New Year (Garrett, Jan. 8, 2020, p. 7), but that did not happen, and the mass movement of peoples with no defenses and no knowledge of the outbreak points to a massive missed opportunity to try to contain the virus. The meta-narrative of the country with the largest population and the world’s second largest economy hiding its realities is a recurrent theme. The coronavirus story is seen as “too big...to spin” (Zhao, Feb. 14, 2020). [If not for the public and a few whistleblowers holding their government to account, the story may have been delayed even longer. Those inside and outside China monitor social media channels in order to make sure not to get left behind from the unfolding news, including information shared outside of official channels.]

In a snarkily-titled work, she labels the coronavirus outbreak to be a “belt and road pandemic,” in reference to Chinese president Xi Jinping’s political agenda (“a multitrillion-dollar program to expand Chinese trade and infrastructure around the world—the centerpiece of his foreign and economic policy”) (Garrett, Jan. 24, 2020, p. 1). The deeper integrations of people and places, across vast distances, also means that animal- and human-borne infections may travel along and wreak havoc. She writes: “It’s hard to look at the new routes built with Chinese aid over Siberia and the Himalayas and as far as Africa without seeing potential routes for
disease that could carry contagion to every corner of the world” (Garrett, Jan. 24, 2020, p. 4).

A work later that month focused on ways to stay healthy, involving wearing gloves outside the home, keeping her hands from touching her face, assigning towels to household members and washing them twice a week, using elbows or shoulders to open and close doors (because of the contaminants on hand-touched and handheld objects), using serving spoons for shared dishes, not consuming any “live animal or fish until it is known what species was the source of the virus,” ventilating rooms in a home when the weather allows, and wearing a tight-fitting mask if caring for a sick relative (Garrett, Jan. 25, 2020, pp. 2-3), among others. Of towels, she writes: “Damp towels provide terrific homes for viruses, like common colds, flues, and yes, coronaviruses” (Garrett, Jan. 25, 2020, p. 2). Gaining control over people’s unconscious hand movements requires retraining, mindfulness, and self-control.

In late January, several articles show hallway images from Wuhan hospitals. One shows a walk-through of the hallway with dead bodies covered in quilts and sheets. Another one shows a coronavirus patient convulsing on a cart (Adedokun, Jan. 27, 2020). [At the time of the writing of this work, some of the videos had been taken offline.] Near the end of January, the Chinese government pledged to build a 1,000-bed hospital for those with coronavirus and succeeded in 10 days, taking in its first patients by Feb. 3 (McDonald, Feb. 3, 2020); they completed a second one, a 1,600-bed hospital, shortly thereafter (Wang, Zhu, & Umlauf, Feb. 6, 2020). The bravura feat of government messaged a commitment to care for its peoples and to gain control of the outbreak.

And yet, as time passes, there are reports of health workers coming down with the infection and some dying, given the shortage of safety equipment, gear, and personal protective clothing (Saio, Feb. 11, 2020; Quinn, Feb. 14, 2020) and the lack of training
for handling such pathogenic agents, according to multiple articles. There are several stories of heroic doctors wearing diapers to make it through “long shifts” (Steinbuch, “Doctors battling...,” Feb. 13, 2020, p. 1) and nurses shaving their hair to avoid cross-contamination (Saio, “Nurses fighting coronavirus...,” Feb. 13, 2020), which smack of propagandistic storylines. There are questions of relief measures and resources for those on the front lines, given their critical skills and knowledge. Other stories emerge about treatment types, such as using plasma from recovered patients to treat those severely ill to try to boost an immune response (Young, Feb. 14, 2020), and to concentrate antibodies. Indeed, the hospitals seem overwhelmed by the refocus on those with COVID-19, displacing others who are critically ill from other causes (Feng & Change, Feb. 25, 2020). Different reports show varying levels of supportive care for those with COVID-19.

The government set up edicts to lock down cities of people and to control for the movement of its citizenry, and they enforced these with police and military. They forbade work for weeks at a time. They closed schools through April, provisionally, until the coronavirus passes the typical flu season, in order to lessen the impact of illness and fatalities.

The Chinese government ramped up RNA testing (through PCR testing or “polymerase chain reaction” analysis), based on mucus samples from noses and throats) for the coronavirus and shared their findings globally. They sent out patrols to enforce the uses of facemasks in public. They tested people’s temperatures on the streets, in cars, and in their homes, and forcibly removed those with fever or other symptoms of coronavirus infection into isolation or quarantine units (some of which looked like mass gymnasiums with cots), for “social distancing”. [Ideally, people who are infected would be housed in units with negative air pressure to contain the circulating air and particles, so that there is not spread. However, with the scope of the infections, it can be hard to provide that sort of approach.] Citizens (who may or may
not have the infection) were asked to self-quarantine at home to prevent human mixing and the spread of the virus. At the same time, various governments arranged flights for their citizenry to return home to quarantines in their own homes or in military bases. All the while, some level of triage was occurring in order to provide higher levels of care for those in more serious condition (such as those needing intensive care) and showing less priority for those with milder symptoms. News reports show emptied streets, some strewn with garbage. There are stores emptying of food and other staples as well as cleaning supplies.

**Some of the Initial Science**

The unfolding of a disease outbreak may be seems to spark fear and anxieties right away once the news starts to move through the respective formal mass media channels. Many of the initial focuses have been on symptomology: coughing, shortness of breath, fever, or other similar symptoms similar to those from the flu; some have also experienced aches, running nose, nasal congestion, sore throat, diarrhea, gastrointestinal challenges, tiredness, suppressed appetite, and others. [It is said that many of the most dangerous illnesses in people start with the same symptoms as the common cold or flu, so the symptoms alone are not indicative of the ultimate effects on the ill person.] Further into the outbreaks, others suggest that the “loss of smell and taste” could be symptoms (Gupta, Mar. 23, 2020).

Some have described uncontrollable fits of coughing anecdotally. There have been questions about how long the viral **incubation period** (how long a person may be infected but not show symptoms) may be. Initial thinking was that most showed symptoms within 3 days of infection and up to 14 days, depending on the individual, but some research suggests that the incubation period might be as long as “24 days” (Saio, “Coronavirus incubation period...,” Feb. 13, 2020). People were infectious even before they showed signs of being ill. Some people have mild cases of the
infection and were asymptomatic but could still pass the virus on to others.

Along with press reports are people wearing loose-fitting paper and cloth masks; some are improvised “masks” such as those created from empty plastic bottles (over a child’s head). [During the stories and later, there are many reports from doctors and public health professionals that such masks are ineffectual as a defense in public spaces …and because of the gaps and porosity of the masks. Those symptomatic should wear masks so as not to potentially infect others (Schiff, Feb. 9, 2020, p. 5), but mask usage has to be done effectively to be effectual: with masks “not touched once in place, changed if damp or soiled, and discarded after a single use (p. 5).]

The evolution of the zoonotic virus enabled people to be infected by the animal-borne virus, in a zoonotic spillover (the transmission of a pathogenic agent from a vertebrate animal to human). Initially, it is thought that people could only be infected by consuming infected animals (of some kind) from the Wuhan wet market (Wuhan South China Seafood Wholesale Market or Huanan Seafood Wholesale Market)...or by inhaling the viruses shred by the infected animals. One writes: “It is not clear whether any bats or pangolins, live or dead, were on sale in December at the Huanan Seafood Wholesale Market in Wuhan, where more than half of the people first identified with the virus had shopped. And it is possible that the viral leap into humans occurred somewhere else, as some early cases occurred in people with no known link to it” (Achenbach, Feb. 7, 2020, p. 2). There have been calls for increased regulation of the wild animal trade (Ellyatt, Feb. 12, 2020) and calls for its abolishment altogether. [Farmed food animals also are prone to various infections, which is why biosafety boundaries are maintained around pig farms, poultry farms, and others, to avoid viral spillovers. This boundary is to minimize human interactions with the domestic animals
as well as wildlife, all of which can expose the food animals to varied microorganisms, some of which may be pathogenic.

Then headlines emerged that there could be human-to-human transmission, such as through close personal contact (within three to six feet and over a period of time), through respiratory droplets from coughing and sneezing. One source suggested the fecal-oral transmission route, often through improper hand hygiene. One work explains: “The virus is primarily transmitted through saliva that is released when an infected individual coughs into the air, but can also be transmitted through diarrhea” (Berry, Feb. 22, 2020).

Then, there were concerns about potential fomite (“objects or materials which are likely to carry infection, such as clothes, utensils, and furniture” as defined in the Oxford English Dictionary) transmission. The viral transfer leading to infection may occur from touching contaminated surfaces and then touching the face (eyes, nose, mouth) and transferring germs (Rowan, Nov. 28, 2012). Various studies found that people touch their faces on average 3.6 times an hour (other studies suggest even more frequent facial touching). Even with frequent handwashing, the speed of recontamination is fast. Multiple observational research studies also suggest that only a small minority of people—5%—wash their hands correctly and with sufficient time for the bacteria on their hand to be killed (“Gross!...,” June 10, 2013). Disease vectors can be intermediary hosts of the pathogen or inanimate objects like fomites that enable the transmission. In this case, it is important to know how robust or fragile the viral pathogen is on contaminated surfaces (Howard, Feb. 17, 2020) in ambient temperatures. [One work comparing the viability of SARS and MERS found that these human coronaviruses persisted on inanimate surfaces “including metal, glass or plastic surfaces—for as long as nine days if that surface had not been disinfected” in research in *The Journal of Hospital Infection* recently (Howard, Feb. 17, 2020, p. 1). An update from the CDC suggests
that coronavirus survived on cruise ships for “up to 17 days after passengers left” (Feuer, Mar. 24, 2020). More recent research suggests that SAS-CoV-2 particles in the air may be viable to cause infection for up to three hours (Marchione, Mar. 11, 2020). The lab researchers also found that “viable virus could be detected up to three hours later in the air, up to four hours on copper, up to 24 hours on cardboard and up to two to three days on plastic and stainless steel” (Marchione, Mar. 11, 2020). Some coronaviruses reportedly are sensitive to heat and so are more common in the Fall and Winter seasons. The approach to SARS-CoV-2 is a One Health one, which includes consideration of humans, animals, and the environment (although there are disparate implications on each).

Based on past experiences, there are questions of whether there are “super spreaders,” individuals who are connected to a high rate of infection transfer to others (Saio, Feb. 10, 2020, pp. 1-2). In this case, this role has been assigned to a “British businessman” (Saio, Feb. 12, 2020) and a “flight attendant” (“Flight attendant…, Feb. 28, 2020), with the first credited with infecting nearly a dozen and the latter, multiple dozens. There is a female church attendee in S. Korea tied to several dozen infections (Shin, Feb. 23, 2020, p. 2). The super spreading involves the shedding of viruses in a number of contexts that result in high numbers of infections.

At present, even though several newborns were found to be infected, it is not generally thought that the virus passed to them from their mother but could have come from nosocomial (hospital-acquired) infections.

**Counting cases of infection**

Who has it, and who doesn’t? Diagnostic testing is a lagging indicator because of the incubation period, the guesswork in knowing who to test (such as from contact tracing), and the challenges of having sufficient cases to detect a signal. Many countries also
had to ramp up their surge capacity in order to be able to do lab-standard testing. The slowness of deployment is thought to have enabled silent spreading of the infection, many undiagnosed cases, and the existence of hidden clusters without societal awareness.

How to count the various infections also has changed over time. Initial counts came from testing of those who were very ill with respiratory illnesses, lung-based disease and/or pneumonia, and the testing was based on RNA. On Feb. 13, 2020, Chinese health authorities started counting cases that were “clinically diagnosed” based on lung imaging, which included more presumptive positive cases (those found to be positive in state lab tests but without the confirmatory testing by the Centers for Disease Control and Prevention yet), but was also less exact (without genetic validation).

The diagnoses through “pneumonia imaging features” (Talmazan, Feb. 13, 2020, p. 2) serves as a quick shorthand but the validations may occur later with follow-on RNA testing. Follow-on analysis found that there are visual indicators for lung infection by SARS-CoV-2, with “hazy and gray” rounded lung lesions near the outer parts of the lungs (as differentiated from bacterial lung infections) as discovered by radiologists Adam Bernheim and William Chung (“W.H.O. raises coronavirus warning...” Feb. 28, 2020). The patches are “fluid in the lung spaces” (Woodward, Feb. 20, 2020, p. 7).

The new numbers made the death rate lower (because the denominator of cases rose). The computed tomography (CT) scans of lungs, as “clinically diagnosed” cases, was then reversed about a week later by Chinese health officials based on “improved testing capacity” (Woodyatt, Kottasová, Griffiths, & Regan, Feb. 21, 2020, p. 1). External global health experts asked China to count asymptomatic cases because people without symptoms may still be infectious, and such individuals are regularly included in counts globally, so that such numbers are com-
parable (Woodyatt, Kottasová, Griffiths, & Regan, Feb. 21, 2020, p. 4). The numbers coming out of the country at the epicenter of the coronavirus outbreak has always had detractors who question the reliability.

However, the counting has been problematic anyway because of the lockdowns preventing people from going to hospitals...and because of the dearth of test kits for the RNA testing...and other factors. The U.S. CDC rollout of testkits were not without problems either (Steinbuch, “Some coronavirus test kits...,” Feb. 13, 2020), with problems reported with the reagents.

The infections were spreading quickly outside of China as well, with cases on every continent but Antarctica by February 26, 2020. The first human-to-human case of coronavirus transmission in the U.S. was confirmed in Illinois near the end of January (Schumaker, Jan. 30, 2020, pp. 1 – 2). On Spain’s Canary Island, an Italian guest tested positive for the coronavirus, resulting in the lockdown of the hotel (Mulligan, Talmazan, & Radnofsky, Feb. 25, 2020, p. 1).

A sharply increasing frequency trajectory

In the reportage, there have been time periods when infections seemed to be waning, but so far, those have proved to be so-called false dawns. As the capabilities to count more accurately across wider swaths of the population have come online, more cases have been verified. There have been moments commemorated in mass media, such as when the COVID-19 death toll surpassed that of SARS (Pereira, Feb. 9, 2020), and in a much shorter time period. One journalist observes: “It took eight months for SARS to infect more than 8,000 people. COVID-19 has infected more than 75,000 people in about eight weeks” (Woodward, Feb. 20, 2020, p. 5). China still has the most known cases in the world, but the target is a moving one, with larger clustered outbreaks in South Korea, and Italy with the largest outbreak cluster outside Asia (Griffiths, Marsh, & John, Feb. 23, 2020). The count
then was 77,100 in China, 840 in Japan, and 833 in S. Korea, and 219 in Italy with the biggest outbreak outside of Asia (Borghese & John, Feb. 24, 2020, p. 1), at that time. In Qom, some 50 died of the novel coronavirus in February (Aaro, Feb. 24, 2020, p. 2), and Iranian travelers in “Canada, Lebanon, and the United Arab Emirates” were found to be infected, too (Aaro, Feb. 24, 2020, p. 7). There are concerns about North Korea’s claim that the coronavirus does not exist in their borders, given the lack of transparency and state of healthcare.

Even as the numbers tick up and various milestone counts are observed, people are sometimes more responsive to seeing known figures fall ill [like statespersons like in Iran’s deputy health minister, Iraj Harirchi (Chulov, Feb. 25, 2020), who later died] and the late Dr. Li Wenliang, an ophthalmologist who first warned about the new coronavirus ahead of the Chinese government. Putting known faces to the disease humanizes the issue for many.

Likewise, the cases in S. Korea may not have been salient to many Americans until news came out that first a military dependent (McLaughlin, Feb. 24, 2020) and then a U.S. military member was found to be infected with the novel coronavirus. Later news suggests that the U.S. military base may ramp back on operations due to the outbreak.

Formal (provisional) naming

In an unfolding crisis, the pathogen has the advantage of initial stealth and hiddenness, with as-yet unknown capabilities. As it interacts with the environment and living people, its tendencies start to emerge, and empirical-based observations may inform on its various effects. Also, the naming of the pathogen is part of human processes, for accuracy and for common knowledge sharing. On Feb. 10, 2020, the World Health Organization formally named the illness caused by the coronavirus “COVID-19” [with “CO” for “corona,” “VI” for “virus,” and “D” for disease, and
the “19” for “2019” to represent the initial year of case presentation (Gonzalez & Ryan, Feb. 11, 2020, p. 2; Edwards, Feb. 11, 2020). Initially, the Chinese government referred to the disease as the “novel coronavirus pneumonia” or “NCP.”] The pathogenic virus was named SARS-CoV-2 (Gonzalez & Ryan, Feb. 11, 2020) with “SARS” representing “Severe Acute Respiratory” and “Co” for “Corona” and “V” for “Virus,” and “2” representing the version (which follows the first SARS outbreak in 2003), replacing the initial shorthand version dubbed “2019-nCoV” (with “2019” standing for the year of the emergence, “n” for “novel,” and “CoV” for coronavirus), an earlier version of the name also by the WHO. A final name will be decided by the International Classification of Diseases, and it will be voted on the International Committee on Taxonomy of Viruses (Smith, Jan. 31, 2020, p. 3). Naming rights usually belong to the scientists that discovered the particular virus (Branswell, Jan. 23, 2020), so there could still be new names applied before a final one is decided. In the current age, there is awareness of the need to not stigmatize a city or its peoples by putting the location name in the disease name or the virus name. In 2015, the WHO decided to “avoid naming new diseases after people, places, or animals” because of the potential associated stigmas (Smith, Jan. 31, 2020, p. 2). Keiji Fukuda, Assistant Director-General for Health Security of the World Health Organization, is quoted: “We’ve seen certain disease names provoke a backlash against members of particular religious or ethnic communities, create unjustified barriers to travel, commerce and trade, and trigger needless slaughtering of food animals” (Smith, Jan. 31, 2020, p. 2). Current referents are likely temporary placeholder ones, at least in the formal scientific sense.

SARS-CoV-2 effects on the human body

Some of the textual descriptions, even without graphic videos or imagery, from a distance, may read as hyperbolic: coronavirus can “cast a storm over the whole human body” and lead to “honeycomb lungs” (from “punched holes in the lungs” from the
pathogen) and multi-organ effects (particularly the liver and kidney) and failure (McKeever, Feb. 14, 2020, pp. 1-2, p. 4). Coronavirus can cause a “hyperactive immune response” in the body: “Cytokines are proteins used by the immune system as alarm beacons—they recruit immune cells to the site of infection. The immune cells then kill off the infected tissue in a bid to save the rest of the body” (McKeever, Feb. 14, 2020, p. 3). Such over-reactions of the body can be deadly.

Reverse zoonotic transfer from humans to animals?

On February 29, 2020, a story came out that a pet dog in H.K. was under quarantine for testing “weak positive” for the SARS-CoV-2. (Sanchez & Lockwood, Feb. 29, 2020). Later came word that a tiger in the Bronx Zoo in New York was found to be infected (Goldstein, April 6, 2020).

Modern-day quarantining

Given the sudden onset of the outbreak, people describe lives interrupted. There is a couple whose adoptive child is stranded abroad (Kaur, Chen, & Cartaya, Feb. 10, 2020). There is a young person going to an overseas job who is on hold for the near future. There are graduate students studying in China whose governments cannot afford to evacuate them. There are students on a study cruise who have a member ill who cannot find haven in nearby countries.

Then, the enforced “social distancing” is being effected on a scale never before applied, in the hundreds of millions of people, to lower densities of persons to lower the spread of a highly contagious pathogenic agent. Here, people are often quarantined in their particular circumstances.

One visually salient and eye-catching example related to the forced quarantining of people on cruise liners who were asked to stay in their cabins and not offload at various ports of entry
(which often denied their entry). While the respective port’s leadership was trying to protect their own citizens from the novel coronavirus (and to be able to keep tabs on the various individuals in one location), cruise ships were not built with filtration that can control for viral dispersion, and the staff were not trained in quarantine measures (of sanitation, of effective isolation), and they did not have the equipment or personal protective equipment (PPE) for effective protection of the workers. It was found that the on-ship quarantining likely resulted in a number of infections that would not have occurred otherwise had the individuals been flown home sooner (Mansoor, Feb. 13, 2020). At the time, there were “more cases aboard the Diamond Princess than anywhere else in the world outside of China” (Feuer, Feb. 13, 2020, p. 2). As part of the Carnival Princess Cruises, the Diamond Princess had 2,666 passengers and 1,045 crewmembers; it arrived at Yokohama, Japan, on Feb. 3. When it was found transmissions were continuing on-ship, a phased approach was designed for the removal of passengers to onshore facilities for a 14-day quarantine beginning on their disembarkation (Feuer, Feb. 13, 2020, pp. 2-3). Those older and with underlying health conditions were prioritized above others (Feuer, Feb. 13, 2020, p. 3). Indeed, those who are older and are symptomatic are at much higher risk of a severe case of the respiratory disease. The logistics of taking responsibility for the cruise ship guests and crew would be a challenging feat, involving liabilities for the citizens of various countries and no obvious funding mechanisms. (Side Note: It is unclear how many countries have the capability to provide housing, food, medical attention, and other support for thousands of cruise ship travelers who may or may not be infected with a highly contagious and novel virus, all criticism aside. Any decision would involve various trade-offs.)

The U.S. government’s evacuation of its citizens from the Diamond Princess cruise ship was criticized for its discomfort, with people loaded onto two cargo planes “that had been converted into flying quarantine wards,” with flight attendants in hazmat
gear and 14 passengers identified as infected (Italiano, Feb. 22, 2020, p. 1). One area involved “ceiling-to-floor mylar sheet” separations for those who’d tested positive. Further, the journalist writes: “A six-bed ‘bio-hazard lab module’—basically a large, pressurized crate that was strapped to the floor of the plane, and designed to be off-loaded, as is, onto a truck or train—awaited any who began to cough and sneeze” (Italiano, Feb. 22, 2020, p. 3)

There are also various forms of government-enforced to self-enforced home quarantining (self-quarantining), a version of “sheltering in place” during disasters. Writ large, if people can maintain quarantine, they are not interacting with others while shedding viruses, and they are not in public places shedding viruses (which can then be picked up through fomite transfer from public surfaces). The thinking is that people have conveniences and stocked resources in their homes, where they may remain for a length of time. “Home” may feel safe but not always be necessarily safe. There were some storylines echoing the prior SARS outbreak in Hong Kong in 2003, in which an apartment building was sealed off because SARS was spreading through its air handling system. In the more current version, “over 100 residents have been evacuated from an apartment building in Hong Kong after two people fell ill with the deadly new coronavirus, stoking fears 2019-nCoV could be spread through pipes” (Gander, Feb. 11, 2020, p. 2) or “faulty piping” (Winsor, Feb. 11, 2020, p. 2). An earlier infected person was 10 floors away from the more newly infected individual. In another case, a family of nine were all infected after sharing hot pot (Farber, Feb. 10, 2020). One work highlighted different experiences of quarantines under different locations and contexts (Andone, Feb. 9, 2020), with a sense of empathy. In terms of zoomed-in locations of various outbreaks, some of been community hotspots. One was a welfare center for the elderly in S. Korea (Choi, Feb. 23, 2020). Another was an elder care center in Kirkland, Washington, in the U.S. (Boodman & Branswell, Feb. 29, 2020). A S. Korean church was another physical locale for viral spread (“South Korea
In these and other cases, contact tracing was not particularly effective, suggesting that community spread was occurring, with members of the local population cross-infecting each other.

In terms of visuals in the respective articles, there are salient images. One photo shows Venice Carnival revelers in full costume walking past a masked police officer in a fluorescent vest as a point of contrast. There is a health worker in full protective gear picking up a sealed bucket labeled for medical waste. Some photos show stores with depleted shelves. Some show stock images of microbial-based disease researchers in biocontainment. Some demonstrators carry signs against the repatriation of U.S. citizens in various cities, with the signs reading: “Don’t turn our city into another Wuhan!” and “Say NO to coronavirus in our city” (“Coronavirus patients at...,” Feb. 24, 2020). The unwelcome of the ill is not only to foreigners but fellow citizens.

One iconic image shows an older Chinese woman looking up at a drone that has been used to warn her about the respiratory disease: “Yes auntie, this is the drone speaking to you. You shouldn’t walk about without wearing a mask...You’d better go back home and don’t forget to wash your hands” (Griffiths & Gan, Feb. 10, 2020, p. 1). Her image has been usurped for various social memes, with the drone addressing her in different ways and with different messages. Artificial intelligence has also been harnessed, such as a “temperature checking tool in Beijing...(that) can detect an abnormal body temperature and alert authorities who can then do a second check on the person” (Kharpal, Feb. 24, 2020, p. 3). Another application can “detect people not wearing masks in public” (Kharpal, Feb. 24, 2020, p. 3). Another application enables knowledge of whether one has been near a person who has been infected with COVID-19 (Kharpal, Feb. 24, 2020). While these endeavors impress on one hand in terms of the capabilities of “mass surveillance” to fight a potential pandemic, there are also fears that such applications may extend well beyond
the outbreak and result in heightened government controls and social oppression. Some innovations use extant technologies but in refreshing ways. S. Korea innovated a drive-through testing center to enable more efficient testing (Elbaum, Novaga, Shi, & Kim, Mar. 3, 2020, p. 2).

**Innovations from science**

This global health challenge has rallied the world’s leaders and scientists and industries to try to find a solution, against very hard and complex challenges to find lifesaving measures, in timelines that are ambitious and even “aspirational,” according to one of the scientists (Cannon, Feb. 22, 2020, p. 2), something of a moonshot. One publication described the potential for developing antibodies to the virus using tobacco plants (Owermohle, Feb. 15, 2020), given their speed of tobacco plant growth. An existing drug that may have an effect on coronavirus is in clinical trials (Tirrell, Feb. 25, 2020). Clinical trials have started on a possible coronavirus treatment at the University of Nebraska Medical Center with participating infected persons who’ve signed on being cared for in the biocontainment unit (Anderson, Feb. 25, 2020, p. 3). Other biotech companies are working on possible vaccines. Some of the initial trials of the potential vaccines could begin in April, some five months after the initial reports of the COVID-19 outbreak, “but the process of testing and approvals would last at least a year” (Ziady, Feb. 25, 2020, p. 1). One that is on the fast track is the mRNA-1273 vaccine by Moderna that will be one of those tested shortly. The fast-tracked approach shows something of adaptivity given the circumstances and prior groundwork load in the eventuality of a disease outbreak. Multiple other approaches are being taken by various pharmaceutical companies.

There have been innovations in the uses of surveillance technologies as well. As mentioned, drones were deployed to warn citizens of the risks out on the streets. Chinese authorities also
deployed an app to “detect whether users have come in ‘close contact’ with the sick” (Feuer, Feb. 10, 2020, p. 2).

**Economics, markets and pricing risks**

This disease outbreak has had cascading impacts. Given the risks of human transmission, tourism has shut down around the world. The stoppage of Chinese tourists to destinations in Asia are thought to have impacts on the respective economies (Peck, Feb. 7, 2020); some “150 million Chinese tourists traveled abroad in 2018” (p. 1), each spending large amounts in the various destinations. Various professional conferences have been postponed or cancelled; some have gone virtual (with the assistance of web conferencing tools and other technologies). Some events are being held even though some participants are cancelling their presentations and others are signing petitions to cancel those events because of the health risks. Factories and workplaces have temporarily closed, resulting in disruptions to manufacturing and supply chains (Collins, Jan. 29, 2020) and work. Oil prices have fallen because of less demand. GDP (gross domestic product) is predicted to fall given the stoppage of people’s work. The likelihood of an interest rate cut by the U.S. Federal Reserve has risen given the “economic pandemic” ensuing from the disease outbreaks from the novel pathogen (Riley, Feb. 24, 2020), but these affect demand, and they do not enable supply (which is hindered by the travel restrictions). In the near-term, there is expected to be high disruption. However, there have also been affirmations expressed of long-term prospects for the U.S. economy by one of its billionaires, Warren Buffet (Funk, Feb. 24, 2020). There have been slides to U.S. stock values taking nosedives and risks to “corporate profits and economic growth” (Horowitz, Feb. 24, 2020). Global stock value drops suggest risks to major economies (McLean, He, & Riley, Feb. 24, 2020). In the week ending February 28, 2020, the DJIA (Dow Jones Industrial Average) fell more than 10% in value in the week, indicating a “correction” on the market in consideration of the coronavirus.
There are effects on small businesses, too. Kim Tae-woo, owner of a convenience store in the East Daegu train station in S. Korea, quipped: “Things are beyond quiet here. It feels like I’m at a meditation centre. I’m thinking of removing the magazine stand. No one has the peace of mind to flip through them now” (Kim, Feb. 23, 2020).

There are expected to be mounting hospital bills and legal liabilities for workplaces that send their employees into events or spaces where they acquire the novel coronavirus. The various potential effects from the COVID-19 outbreak radiate outwards and in various directions.

**Infected prisoners in China**

Another storyline emerged that there were some 500 cases of infections in four Chinese prisons across three provinces (Wang & Myers, Feb. 21, 2020), with some attributing the infections to a coughing prison guard (p. 1) (which might be an apocryphal storyline). Responsible officials were fired in relation to these prison outbreaks, according to a Chinese official at the Chinese Ministry of Justice (Winsor, Feb. 21, 2020, p. 2). [The reference to prisoners had a darker tone given the harvesting of organs from prisoners given the death penalty. Otherwise-healthy people who survive the infection may have antibodies which may be used to shore up the health of others.]

**Politics in a time of mass danger**

At the global level, there are bodies like the World Health Organization focused on human health, for a kind of collective public health framework. Governments have stepped forward to fund endeavors to deal with the SARS-CoV-2 COVID-19 outbreak. The PRC has said it would spend $10 billion (Pound, Feb. 9, 2020). The White House has initially asked for $2.5 billion (Taylor, Feb. 24, 2020). The Gates Foundation has promised up to
$100 million to “improve detection, isolation and treatment efforts; protect at-risk populations in Africa and South Asia; and accelerate the development of vaccines, drugs and diagnostics.” (“Bill & Melinda Gates Foundation…,” Feb. 5, 2020).

People tend to be political beings, and this even more so in times of crises. In times of war, under severe social duress, people’s civil rights are often suspended. That analogy applies with the application of so-called “wartime measures” in Wuhan, Hubei Province (Gander, Feb. 13, 2020, p. 1). These have included controls on human movement (travel bans, lockdowns, mass quarantines, door-to-door health checks, enforced home quarantines, and others, in China, the country with the epicenter, and others. In China, citizen journalists have gone missing (Li, Feb. 12, 2020) and disappeared (Gan & Thomas, Feb. 9, 2020), with the citizen activists thought to be arrested by authorities for their activism. There has been censorship and the control of information (Feng & Cheng, Feb. 25, 2020). The Chinese government has also worked to sterilize cash with “either ultraviolet or heat treatments” (Taylor, Feb. 17, 2020, p. 2) and laundering (Yeung, Feb. 17, 2020). In other cases, cash is destroyed and reprinted. There have been messaging that things were returning to normal and that the easing of Wuhan’s quarantine was imminent, but that was retracted shortly thereafter (“China announced easing…,” Feb. 24, 2020). The challenge is that there are huge pressures to take different courses of action, and every day lost to non-work also exacts a societal toll.

Dr. Bruce Aylward, heading the W.H.O. team in China, praised the Chinese lockdown: “China has taken one of the most ancient strategies for infectious disease control and rolled out probably the most ambitious and, I would say, agile and aggressive disease-containment effort in history” (Winsor & Schumaker, Feb. 24, 2020). Such praise stands against the critiques of journalists and others, who are seeing an unfolding and uncontrolled pandemic (Brackett, Feb. 25, 2020). Such endeavors as “shutting down bor-
ders, building walls, cancelling all air travel and quarantining entire nations indefinitely” is not going to continue into the foreseeable future per se because there are other considerations; containment is about slowing down the spread of an outbreak and to “buy time to prepare, but if a pandemic hits, by definition, containment has failed and further attempts will be pointless, if not counterproductive” (Evans, Feb. 23, 2020, p. 1), at which time the main endeavors will be on mitigations.

There are predictions that “Xi Jinping’s dreams of a Chinese century” may be “derailed” by this outbreak (Campbell, Feb. 6, 2020). The threat to the reputation of the P.R.C. as a trustworthy trading partner is on the line as the size of the outbreak and its implications are becoming clearer (Bremmer, Feb. 17, 2020, p. 49). After U.S. officials restricted entry into U.S. from China in late January, the Chinese government returned the favor and advised their citizens to avoid travel to the U.S. for “safety reasons” (COVID-19 Update: South Korean toll soars..., Feb. 24, 2020). One work suggests that the S. Korean approach may be the one for a “new normal,” in their lack of panic, their state of “no rioting, no fearful mobs opposing the housing and care of hundreds of infected patients in their city” but rather just a sense of “stoic calm and quiet” (Pannell, Feb. 24, 2020, p. 2). Chinese government spokespersons have also accused the U.S. of spreading panic over the coronavirus outbreak. The damage may extend to the global system, with this outbreak as “a milestone on the road toward the end of the first phase of globalization” (Bremmer, Mar. 16 – 23, 2020, p. 32).

The United States began airport screenings in January and started expanding these out beyond major hubs on Jan. 17, 2020 (O’Reilly, Jan. 17, 2020). Those new arrivals showing symptoms in New York, Los Angeles, San Francisco, or Chicago (and later Seattle) were tested for coronavirus (if they did not test positive for the flu first) and quarantined, starting February 14, even for those who had not traveled to China (Rahhal, Feb. 14, 2020, p.
2). Problems with the diagnostic test meant that fewer tests were available and that testing could not be distributed geographically until the end of February. The numbers are difficult to gauge given the risks of actual infection rates being masked with the flu season. One reporter observes:

This flu season, 823,555 patient samples have been tested for flu. More than 155,000 of those—nearly 19 percent—have tested positive. But if the testing protocol now installed at labs in Seattle, New York, Los Angeles, San Francisco and Chicago were expanded to the rest of the US, the remaining 668,555 samples that tested negatively for flu would also get tested for coronavirus. (Rahhal, Feb. 14, 2020, p. 3)

Indeed, the stakes are high beyond human health: how political leaders respond will result in public reward or punishment at the ballot box in a democracy (Collinson, Feb. 25, 2020).

For all the importance of government capabilities at scale, people have to adapt together en masse for this to work. So many decisions are made and actions taken at the common citizen level.

**Animal conservation**

Animal conservation has emerged as an important issue. Grace Ge Gabriel, Asia regional director of the International Fund for Animal Welfare, is quoted: “This issue is not just a conservation issue anymore. It’s a public health issue, a biosafety issue and a national security issue” (Nuwer, Feb. 19, 2020, p. 2). The mass fumigations have had side effects not only on the environment but also on animals. Journalists have recorded 135 dead animals in a mass die-off in Wuhan attributed to disinfecting efforts by Chinese official (Froelich, Feb. 22, 2020).

**Advantage-takers**

As part of the response to disasters, officials always known to
warn their citizens against fraudsters/hucksters and other advantage-takers. There are those who will bilk homeowners by promising fixes to their property but abscond with the initial payment or do shabby work (without the proper certifications or certifications). Indeed, the coronavirus outbreak has brought out “cybercrooks” with “coronavirus phishing email” attacks (Weisbaum, Feb. 18, 2020, p. 1). At street level, there has been hoarding of various goods and price gouging.

There have been reported cases of pranksters who have caused undue fear like a man falling and convulsing at a metro station and his confederates nearby claiming he had coronavirus (Ullah & Tarasova, Feb. 11, 2020).

There have been challenges to human safety and social order, through xenophobic attacks (against foreigners) (Shah, Feb. 17, 2020, p. 44) and racist assaults (Yan, Chen, & Naresh, Feb. 21, 2020). Cruise lines have banned Chinese nationals (Lovelace & Feuer, Feb. 7, 2020). In the U.S. there has been avoidance of Chinatowns and suggested boycotts of a Chinese restaurant, Panda Express. In one country, individuals in an Islamic mosque were surrounded and tested for fever. The sub-narrative here is that the “others” are the carriers of the virus, the ill, and they are the ones that threaten the domestic populations; here, shared humanity (biological and otherwise) is denied, and people have retreated to their own “tribes.”

In the early phases of a pathogen with pandemic potential, sometimes, information and various types of quarantines and light medical interventions are the only available defensive tools for the health of human populations. In these early phases, as in the “fog of war,” much is still unknown, and often, the rumors can be wild. In the face of fear, people have a “fight or flight” response. There are attendant risks of fear reactions by public groups and by law enforcement (including militaries) that may lead to violence. This is why health professionals emphasize “facts, not fear” or the use of information to mitigate the fear response.
False news of coronavirus infections in the country led to violent protests in the Ukraine, even though no confirmed cases of coronavirus infection exists. One account reads:

The trouble began as a plane carrying evacuees from China landed in Ukraine on Thursday. In a village in central Ukraine, where the evacuees were due to be taken to a health spa to be quarantined, local people began attacking police and tried to blockade the convoy carrying the evacuees. Residents at the village of Novi Sanzhary set alight tires and barricaded the road to the spa, before attacking the convoy with the evacuees onboard. (Reevell, Feb. 21, 2020, p. 1)

The high levels of anxiety do not exist there alone but likely around the world. In China, hotlines were set up to help people self-quarantined to cope with mental health issues and their “psychological distress” (Baculinao, Shi, Wu, & Talmazan, Feb. 23, 2020, p. 2). Some people have gone to social media for support. On Chinese platforms, the hashtag campaign was translated as #howtodealwithfeelingveryanxiousathome, and at the time of one article’s writing, there were over 290 million views on Weibo (Baculinao, Shi, Wu, & Talmazan, Feb. 23, 2020). The research on whether people experience more (or any) negative psychological consequences is mixed, with some finding no significant difference between those under quarantine or not (Wang, Xu, Zhao, Cao, He, & Fu, 2011). As to whether people adhere to self-quarantines, one study found only 73% did, among both patients and staff exposed to norovirus (Rao, de Gier, Caram, Frederick, Moorefield, & Woods, 2009). An earlier study related to the 2003 SARS outbreak found that self-quarantines worked better when there was effective messaging from government authorities and the quarantine was seen as legitimate (DiGiovanni, Conley, Chiu, & Zaborski, 2004). A weak extrapolation from the prior quarantine research might suggest that self-quarantines, as quarantines in general, are porous and imperfect. They are also enforced in different ways in different social contexts, with some receiving
house visits from health professionals and others receiving digital reminders, and so on. In this outbreak, there have been multiple reports of people breaking isolation (for those infected or presumed positive) and breaking quarantine (for those not known to be infected) (Edwards, Mar. 3, 2020; Litvinova, Feb. 17, 2020). Government officials also worry about the lack of financial reserves of workers and are advocating for a large-scale federal bailout in the U.S. to encourage those who are ill to remain home and to enable businesses to request that their employees engage in telework, so that the scope of the outbreaks may be lessened and the healthcare systems not overwhelmed (Gottlieb, as cited in “Former FDA chief warns...,” Mar. 8, 2020).

The mass media articles collected in February 2020 around COVID-19 and SARS-CoV-2 have been around particular themes:

- scope-of-threat (how risky the novel coronavirus may be) and counting articles (how many are infected and where);
- how-to articles for common citizens (in various states: to remain healthy and avoid infection, to ride out an infection, to avoid infecting others)
- logistics articles (how countries are fighting the virus, mass expenditures, contact tracing, censoring, arresting activists, quarantines, travel alerts, border controls, evacuations; how foundations are fighting COVID-19; how biotechnology companies are fighting);
- new science approaches (vaccine research, human testing);
- second-order effects (potential effects on economies, supply chains, manufacturing, work life, technologies, stocks; potential effects on politicians and leadership)
- projections into the future (near-future, mid-future, far-future)
- human interest stories (people’s direct experiences and
In terms of the classic “5Ws and 1H,” the order of focus has been “what, who, when, where,” and then the “why” and the “how.” In an abstract sense, the articles began with a sense of it is them vs. us…and we can keep this virus out from local spaces. This came from the border controls and travel alerts. Then, as the reports expanded out with new encroachments in geographical space, it became a race of stamping out sparks of fire by isolating the ill and preventing the spread that way. Instead of “elsewhere,” the sense was, “here.” At various points, there have been shifts between the expected and the unexpected and the acceptance of so-called “new normals.” Emotionally, there have been sparks of mass anger, from blaming other countries or other practices, to refocusing on what will be beneficial in facing the actual challenges.

Beyond articles, there are various other information channels, many in real time, with live reports, live web logs, live alerts, and rolling continuous coverage on cable news. There are online “counter” and data dashboard sites that list the numbers of active cases, closed cases (recovered or dead), and deaths, among others. There are also often choropleth maps showing locations of the new infections. Information may be distributed with “visual explainer” approaches to simplify the messaging. Then, there are the Q&As (questions and answers) and FAQs (frequently asked questions). There are timelines of the viral outbreak. Some pages include collections of hyperlinks. “Online training” is seen as an important tool in fighting the emergent coronavirus (“Online training…,” Feb. 7, 2020).

The core information sources have been government health agencies, then news organizations (disseminators, working with professional analysts), and social media (disseminators, with common folk). There have been specialist informants from various universities, research laboratories, corporations, think tanks, and health organizations. As the information moves from the
Social Responses on Social Media

The fast-moving discoveries about the infections by coronavirus and the viral spread of information on mass media and social media caught people up short. On social media, people shared information about their fears of going out in public and the discomforts of self-quarantines. Some showed videos of emptied cities on their smart phone videos. Some complained about the unavailability of certain foodstuffs. Some showed photos of confrontations of people with police in full hazmat personal protective equipment (PPE).

Some who have fallen ill describe their firsthand experiences with the virus, with those experiencing milder cases sharing (uncontrollable coughing, in one description) able to share and those with more severe cases not (with reports of people losing the ability to talk, others with loss of consciousness, others with febrile seizures, and others). One early analysis has identified aspects of people that may make them more vulnerable: age, those with “chronic illnesses” (including “high blood pressure, diabetes, heart disease, chronic lung disease, or cancer”), and maleness (Shapiro, Feb. 22, 2020, pp. 3–4). Perhaps it is not gender per se that is the differentiating issue but the rates of male smoking vs. female smoking in the Chinese context, with 50% of Chinese males regularly smoking and only 2% of Chinese females. (Shapiro, Feb. 22, 2020, p. 5). Other underlying health conditions that may have more severe effects with SARS-CoV-2 may include asthma, compromised immune systems, and other issues, in co-morbid interactivity. There is survival advantage to the young and healthy, without compromised immune systems. The severe stage of the disease occurs apparently some 3–6 weeks after infection, and for many, “the time to death is three to six
weeks” (Gottlieb, as cited in “Former FDA chief warns...,” Mar. 8, 2020).

Some brought humor as a coping mechanism. Some of the social imagery picked up in mass media articles show a family in a crowded room, with children in bunkbeds, waiting out a quarantine on a cruise ship. Others describe the claustrophobic sense of quarantines, even in the lap of “luxury” on a cruise ship, with tensions among those quarantined together (Wu, Feb. 22, 2020). One male passenger on the Diamond Princess, Matthew Smith, Tweeted images of the food on board ship (Schrader, Feb. 7, 2020) to deal with boredom. One meal involved two croissants, hash browns, sausages, bacon, a muffin, an apple, and “Japanese yogurt with aloe vera” (Gaynor, Feb. 8, 2020). Some earlier social images showed even a celebratory air of those quarantined on a cruise ship (Jamieson, Feb. 8, 2020). Another shared imagery (and video) showed a robot (named Little Peanut) delivering food down a long hallway of a hotel to those travelers from Wuhan quarantined in Hangzhou (Albrecht, Jan. 29, 2020). For some, the social sharing offers a way to connect socially and to contribute to the mass narratives and understandings. The various faces of SARS-CoV-2 (formerly 2019 n-CoV) are varied for those willing to share. Most trend younger. Some self-identify as being positive for the coronavirus. Others claim health and fear of the infected. Some works are purely for social sharing. Other works are framed as citizen journalism exposes of government suppression of data. Regardless, mass media professionals and health professionals alike are trawling mass media for crowd-sourced information.

As the virus moves between people and on objects (potentially), it seems that they are manifesting differently in different ways across populations. In the moment, the various locales of focus in mass media are wet markets, hospitals, airports, airplane cabins, cruise ships, apartment buildings, streets, people’s homes, border crossings, restaurants, schools, and other locales. A macabre
guessing game has arisen about where the viral infections will turn up next. There is a phantasmagoric element, perhaps informed by “pandemic” games and movies and zombie apocalypse meta-narratives. (Some of the shared social imagery refer to these ideas directly. For example, one sign reads: “Quarantine Zombie Outbreak: No one shall enter or leave this area without written permission of the local health authority. Anyone found violating this regulation will be fined not less than $100.00 nor more than $1,000 for each violation. (US Art. 673).” Another reads: “Warning: Zombie Outbreak. This area under strict quarantine. Authorized personnel only.”

In the real, countries with different healthcare systems and resources will have different levels of ability in protecting their population’s health. With the community spread, where the viral chains cannot be accurately traced person-to-person, the reports of presumptive positives are rising, and the risks are from both without (outside the country) and within (inside the country). “Community spread” refers to a state where there are chains of infections and clusters without ability to identify back to the source through contact tracing (MacKenzie, Feb. 24, 2020). At this point in the disease spread, with falling efficacy of the stoppage of people’s movements, generally, attention turns somewhat more to health mitigations and monitoring and surveillance, to best use scarce resources, and not to continue so-called “medieval” approaches of lockdowns and stoppage of human movement. Public health officials suggest that there are risks and benefits to any of a range of decisions that can be taken, and the proper timing may be difficult to discern. Disruptive interventions may be triggered based on new data, but community mitigations may interrupt people’s regular lives and interfere with livelihoods, so some consideration has to go into what measures are reasonable to ensure the public health while enabling regular societal functioning where possible.

Certainly, there are various types of self-expression around this
outbreak. One article described a painter “known for a particular style of cell biology paintings, in which he emphasizes that molecular processes in our body don’t stand on their own (despite how they’re usually shown in textbooks), but that all these components are part of a crowded environment” (Amsen, Feb. 10, 2020, p. 2). This depiction is of a complex visual. Here, the first coronavirus sketch was initially shared via Twitter on January 27 and evolved over time (Amsen, Feb. 10, 2020, p. 3). The final one was completed Feb. 5 and is “a close approximation of what a coronavirus looks like, showing the spike proteins in pink, the nucleocapsid in lavender and the mucus background in a suitable greenish yellow” (Amsen, Feb. 10, 2020, p. 5). At present, David S. Goodsell, the artist, hosts the image on his “Molecular Art | Molecular Science home page (https://ccsb.scripps.edu/goodsell/2020/02/10/409/). While people may take a human-centered view, the art might suggest a more nature-based and systems-based one. And yet, there is also something of a femme fatale feeling to the painting, beautiful and deadly and alluring. [This article and others show a fresh angle to the news story, many by freelancers or “stringers” with unique angles based on their access to information, their respective unique locations, and their fresh ideas. Some articles from less reputable publishers are clearly click-bait, designed to attract human traffic and clicks on their articles to sell to advertisers as “attention.”]

The pandemic potential of SARS-CoV-2, a zoonotic virus which causes COVID-19, has captured the world’s attention, through formal mass media and informal social media (esp. social imagery and social video). To contextualize this social image analysis and video transcript analysis work, the set of 669 articles were read and coded, resulting in the prior summaries. The reading and the visual analytics was interleaved so each could inform the other (This may be seen in Steps 3 and 4 in Figure 1 shown earlier.). This work explores multiple social imagesets (thousands of images) from Google Images (captured from various seeding terms related to the outbreak) and social video transcripts from...
Google’s YouTube platform to infer focuses of mass human attention in terms of (1) messaging and information sourcing, (2) meta-messaging and subtexts, and (3) invisibilities (what is not expressed). This compares the imageset messaging against mass media articles from the same time frame. This work has implications for a mass-scale social response to an unfolding global biosafety/biosecurity risk based on learning from more organic and emergent social communications.

A general sequence of topics may be discerned from a close read-through of the respective articles in the collection. (Table 1)
General Topical Time Order of Mass Media Articles about the Novel Coronavirus (February 2020)

What is coronavirus? What are its features? How does it behave in the world?

How much of a threat is the coronavirus? What is the scope of the threat?

What are the modes of transmission?

- What is the death rate? Infection rate? Do super spreaders exist? Can people be reinfected (or do they develop some defense)?

- At macro levels? At meso levels? At micro levels?

What are comparable viruses in the past?

What is community transmission?

How can one protect oneself? (various how-to’s)

- What is personal protection equipment (PPE)? How should masks and gloves and clothing be worn?

What is hand hygiene?

What are fomites?

Where is the coronavirus from? Was it (1) evolved in nature or (2) human-made or (3) researched and accidentally released?

How accurate is the information from various government sources? What is misinformation and why?

What sorts of frauds are occurring in relation to this disease outbreak?

Who are foremost (and recognizable) human personalities in this issue?

What is the formal way to name this viral pathogenic agent? The disease?

What is contact tracing? How effective is contact tracing?

Where are outbreaks occurring? Cruise ships? Vacation islands off Spain? Why?
What are the various government interventions? Messaging from public health officials?

How effective is forced quarantine?
  
  How effective is forced quarantine across various physical contexts and situations?

How are people coping with quarantine? How do they use humor? How do they handle psychological pressures? How do they deal with anxiety?

How effective is self-quarantine? How effective is home quarantine?

How effective is social isolation?

What medicines or therapeutics are effective?

What hospital medical care is most effective?

Can the virus survive out-of-season (winter), or does it seem to be able to manage year-round?

Has community spread begun?

How are societies coping with the disease outbreaks?

What is meant by xenophobia?

What are social strifes?

In the long-term and the short-term:

What are the political implications of these outbreaks (and resulting interventions)? For governments? For leaders?

What are the economic implications of these outbreaks (and resulting interventions)? For governments? For societies? For individuals?

What are the manufacturing implications of these outbreaks (and resulting interventions)?

What are the tourist implications of these outbreaks (and resulting interventions)?

What are lifestyle implications of these outbreaks (and resulting interventions)?

Can scientists come up with an effective vaccine? Medicine?
Will COVID-19 become a permanent and established part of the human microbiomes?

What are ways to protect the public health while balancing other concerns such as people’s need to work and live? What are ways to intervene without causing extensive public disruption? Economic disruption?

Table 1: General Themes on a Time Trajectory for Mass Media Articles in February 2020

There are some ways to use computational text analysis to provide a visual sense of the works. A word cloud indicates some of the main focuses of the haul of articles (Figure 2).
This word cloud shows word frequency focuses from the mass media articles related to the novel coronavirus outbreak in the first three months.

*Figure 2: Word Cloud of 669 Articles in a Combined Emergent Coronavirus Article Set*

A cluster diagram shows some of the main focuses in terms of proximity of discussions. (Figure 3)
Some themes may be observed from the mass media articles: expanding outbreaks globally, 2019/2020 outbreak, and China as epicenter.

*Figure 3*: A Cluster Diagram of Collected Emergent Coronavirus News Articles

An extracted word tree around “therapeutics” suggests some major challenges ahead. (Figure 4)
In a disease outbreak, there is not only disease surveillance but also social surveillance, of postings on social media. In this outbreak, some of the major social media platforms (Facebook, Amazon and Google) have met with the WHO to “stop coronavirus misinformation” (Farr & Rodriguez, Feb. 14, 2020). However, misinformation has been found to have been spread around this novel coronavirus outbreak, contesting “basic facts, basic science” and fomenting conspiracy theories (“Coronavirus misinformation spreads…,” Mar. 2, 2020) and other conjurings. Some foreign governments are thought to be the sources of some
of this misinformation (“Coronavirus misinformation spreads...,” Mar. 2, 2020). With a sufficient size of public awareness and commentators, various interpretations tend to emerge.

This work combines multiple types of information to understand the information from mass media and social media in the third month of the COVID-19 outbreak to understand the basics facts as known at the time period and to see what social images were being shared on Google Images with multiple different comparative seeding terms (and also what information was shared on social videos on Google’s YouTube). The general sequence of the work may be seen in Figure 1. (The articles were collected from Feb. 8 – Mar. 1, 2020, but these included works published from late January onwards. The social imagery were all collected on the same day with the same means, on Feb. 17.)

**Manual Analysis of the Five Social Imagery Sets**

While the social imagery is analyzed in a bottom-up coding style, there were some basic questions asked to help guide the coding. In retrospect, there is a kind of binary built into many of the questions:

- How is health danger depicted? How is biological safety depicted?
- Do they show understandings of the underlying science, even in a popular sense? Or are they misrepresentational?
- How is risk depicted? How is uncertainty depicted?
- Are issues sensationalized? Politicized?
- Are visual ideas socially constructive or not? Are they helpful or not? Are they prosocial or not?
- Do they promote social rifts?
- Do they show social rifts?
- Do they show racism? Xenophobia?
- Are victims of the pandemic only of a particular race
and ethnicity? A particular demographic?
• Are bio-threats depicted as particular demographics of individuals?
• Are victims de-humanized or objectified?

• Do the social images encourage proper biosafety/biosecurity behaviors?
• Do they promote personal hand hygiene? Do they promote environmental sanitation?

• Who are the human personalities here?
• Who do the communicators (sharers of social imagery) respect? Disrespect? How is this shown?

• How is government depicted? How is citizenry depicted? Are they depicted as working together, or at odds?

• What do the social images suggest about how the broad public will respond to the epidemic / pandemic?

The seeding terms were five different ones: “quarantine,” “coronavirus,” “coronavirus quarantine,” “influenza,” and “flu.” These terms with the related social imagery tags on Google Images may be seen in Table 2. All five sets had some shared images from the current emergent coronavirus outbreak, but they had unique aspects as well.
<table>
<thead>
<tr>
<th>Seeding Terms (for Google Imagery Searches)</th>
<th>Social Imagery Tags (in original form and order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>quarantine</td>
<td>movie, zombie, symbol, biohazard, cartoon, flu, city, jennifer carpenter, australia, jay hernandez, outbreak, medical, disease, hazmat, office, room, cdc, bubble, lego, angela, sign, real life, suit, infectious disease, plastic, poster, fish, laurel halo, wallpaper, ward</td>
</tr>
<tr>
<td>coronavirus</td>
<td>sars, human, mers, transmission, replication, middle east, pathogenesis, prevention, life cycle, fip, treatment, map, discontinuous transcription, common cold, labeled, recombination, pneumonia, rhinovirus, oc43, virion, helical, feline, phylogenesis, feline, phylogenetic tree, pathophysiology, microbiology, capsid, novel, particle, bat, family</td>
</tr>
<tr>
<td></td>
<td>[“FIP” is “feline infectious peritonitis”.]</td>
</tr>
<tr>
<td>coronavirus quarantine</td>
<td>outbreak, quarantine zone, youtube, southern california, little peanut, tel aviv, disease, fanling, robot</td>
</tr>
<tr>
<td>influenza</td>
<td>virus, flu, cartoon, pandemic, disease, treatment, structure, poster, hemagluttiniin, prevention, microscope, diagram, vacuna, gripe, infographic, respiratory system, causes, cold, labeled, hospital, human, type a, seasonal, sick, cdc, contagion, ah1n1, electron microscope, transmission, pneumonia</td>
</tr>
<tr>
<td>flu</td>
<td>cartoon, influenza, cold, sick, virus, fever, clipart, sore throat, vaccine, woman, man, stomach, nose, infographic, cough, prevention, child, animated, baby, treatment, headache, transparent, cdc, person, humor, boy, pandemic, cute, ill, diagram</td>
</tr>
</tbody>
</table>

*Table 2: Seeding Terms for Google Imagery Searches and Related Tags*
A screenshot of portions of the social imagesets may be seen in Figure 5.

Figure 5: Five Semi-Related Social Imagesets Related to the Emergent Coronavirus Outbreak (Three Months In)

This visual shows a screenshot of parts of the five social imagesets.

“Quarantine” social imagery (877 images). The “quarantine” set showed various types of quarantining including those of goods, food animals, fish, and particular products that may include non-native insects. This set included a number of signage indicating
“quarantines” from commercial stock imagery. (Most of these are “keep out” images as if the viewer were not infected...as contrasted to the social imagery of people who were under quarantine with unknown statuses, maybe even to themselves.) There were images from electronic games, movies, and books around quarantines. There were some jokes about quarantines, such as in relation to Brexit...and a man sleeping in a tent in his yard while on a political ad quarantine. Some images related to the coronavirus show “witnesses” with photos of people in full hazmat gear in various otherwise-normal locales, an autopsy room, people in lines waiting to pass health checks, and others.

“Coronavirus” social imagery (657 images). This set showed various informational graphics and electron microscope images of various viruses.

“Coronavirus quarantine” social imagery (730 images). This image set showed a lot of from-life imagery of emptied streets, people in hazmat suits, government officials speaking from podiums (political leaders in front, professional staff beside and behind them), people stepping off planes and being doused in some sort of disinfectant, photos of journalists on docks next to quarantined cruise ships, emptied lounge areas, busses for the transport of people possibly exposed to SARS-CoV-2, adults and children wearing facemasks, airplanes, ambulances, signage, maps, and others. A sign at a military base reads: “Warning Hazardous Live-Fire Training Area.” One potent image shows a person lying on his back in the street and covered, with three people in hazmat suits standing back, and a woman in the foreground walking a bicycle by. One shows a woman in home quarantine with her family, who are in the basement. She is in full protective gear, and she is laying a plate of food on the basement stairs for her family below. There are selfies of individuals wearing facemasks. There are people hurrying along with their luggage. A person in a wheelchair is having her temperature taken with a device at her forehead. Many of the electron microscope images
of the virus are in grayscale or toned with light green or light blue, but the illustrated ones of the virus use warning colors (orange, yellow, red). One astute illustration shows people of all colors and genders wearing facemasks, which helps break the narrative of photos of people of Asian descent wearing facemasks and being tested for their temperatures based on the epicenter of the outbreak. Some images show people’s heat signatures as they walk by temperature-checking stations at airports and railway stations and other locations. Some images show lives interrupted: a couple at their wedding, athletes at practice, and others. Some photos show people in full hazmat suits decontamination an airplane’s porous cloth seats with little spray bottles (instead of doing full fumigations).

In this full set, 97 of the images (13%) showed individuals standing alone in the shot (and there were another 10 images where people were at a podium or in front of a television camera addressing an audience. This brings up a sense of just how often people are social and in groups, dyads, triads, and crowds. This begs the question of how people will do in social isolation, and whether they are comfortable being alone.

“Influenza” social imagery (951 images). This set shows diagrams of various types of the flu virus, diagrams of the mechanics of its function, prevalence data visualizations, choropleth maps, and other similar images. People are shown in facemasks, and some of the images show drawings of people lying in bed and not feeling well…but without the sense of a dire threat.

“Flu” social imagery (915 images). This set shows adults and children with sniffles and sitting under blankets holding a mug. They show a person’s arm in a muscle pose as if they have power and choices in their health. The “flu bug” is shown as a cartoon character with a face and a giant grin and big eyes. The messaging here is about the inevitability of the flu…and a message of it being manageable and something of light misery. A diversity of
the human population in race and gender and age are depicted here.

So what do the various sets show altogether?

1. Messaging and information sourcing
2. Meta-messaging and subtexts
3. Invisibilities (what is not expressed)

(1) Messaging and information sourcing

In the social imagery around the novel coronavirus, the extracted thematic messages are as follows, in descending order of frequency:

- **The threat is real.** The novel coronavirus is a serious global threat. The maps show the spread of the SARS-CoV-2 infections around the world. The spread is mostly invisible and so evoke massmind surprise.

- **Government knows best (at least with what is knowable).** People need to listen to their respective government officials. This is a time of unusual measures, in which government can override civil liberties and personal freedoms, with the military, the police, border agents, and others able to stop anyone and quarantine them.

- **If you’re infected, you’re a temporary “enemy of the state.”** There is a sense that those who are infected can be mass-incarcerated, forcibly tested, removed from one’s home, and stopped at any of the world’s borders. The visuals show dire atmospherics around the infected.

- **This is going to be expensive.** The economic disruptions, manufacturing stoppages, social disruptions, gov-
ernment interventions, and burdens on healthcare will be expensive to taxpayers around the world. There are invisible costs as well. Those who are tested and quarantined may or may not have their costs covered by government, after the initial wave of testing (to help inform epidemiological work), to map the spread of the novel coronavirus. One individual who had asked to be tested stateside ended up with a bill of over $3,000 for all the related work (Conarck, Feb. 24, 2020). For those who are uninsured, their personal finances will take a hit, and even the insured may not be guaranteed coverage. This suggests that people may be disincentivized to report given the potential cost, which may mean less accurate surveillance.

• **Social ties are fraying.** Societies are in a partial breakdown, with emptied streets full of garbage, people isolated in their homes, stores with empty shelves, hospitals overwhelmed with patients in hallways, and draconian measures on the streets. Where this all ends may be a shift to a “new normal,” where people engage with each other differently. The casual intimacies may slow, and people may be more mindful of how they interact and what routes of transmission they are exposing themselves to with every decision. Or if past is prologue, people will lapse into “global amnesia” after various human endeavors help the spread end (Holcombe, Mar. 3, 2020).

• **The global order is at risk.** The global order is fracturing, with border blocks, lockdowns, and accusations.

• **The general public is playing catch-up with information.** Some of the social imagery suggests a blithe public unaware of the risks and caught up in the “adventure” of being stranded on a boat or a cruise ship... Others, though, indicate the disruption of being evacuated under the shadow of a potential pandemic, with one showing a young man in a facemask and his writing
that at that point of his evacuation, after “travelling for 40 hours,” he is “mostly grease at this point.”

(2) Meta-messaging and subtexts

• **“It’s actually happening.”** One meta-message is that all the years of warnings from fiction (video games and movies and books) is finally coming true, and the “end of days” may be near. (There is a catastrophizing theme.) One researcher observes: “The Hollywood outbreak narrative is a classic because it so effectively plays on our fears about globalization, immigration, ineffective borders and invisible threats” (Schweitzer, Mar. 8, 2020). Whereas people were voyeuristic prior about mass disease and death, this contemporaneous reality brings to light the actual seriousness of such a context.

• **Social breakdowns are occurring.** Another meta-message is that there are serious limitations to a number of critical entities: governments, medical science, corporations, financial systems, and others. Government missteps are called out by journalists and insiders. Medical science may be suggestive of particular truths, but at this time, convergence has not occurred for many fundamentals. Corporations have taken a lead role in protecting their workers by encouraging their telework, but other corporations are described as offering small financial inducements for people to follow through on their cruise trip reservations even as the popular narrative is that they cannot maintain sufficient sanitation or air filtration to protect against novel coronavirus spread. Supply chains are sorely strained and even broken for many products. In terms of concepts and practices, globalism is under strain, and there are cracks in the façade.

• **“You’re on your own.”** Another message is “you’re on your own.” Government and other functions seem to
have stretched resources beyond breaking, and many of the expectations that citizens have of their respective governments seem to have gone by the wayside. Cruise ships do not have BSL 3 or 4-level ability to isolate viruses. People in their homes do not have access to ventilators or ways to treat the ill.

- **“We’re here for you, from a physical distance but a social and digitally mediated closeness.”** A positive message is that the broad global community is connected via social media and are rooting for each other. On social media, people are willing to share a laugh…and commiserate over the government-enforced quarantines and lockdowns and self-quarantines. Social media may help mitigate what novelist Liz Moore calls “an oversoul of loneliness,” defined as “a connectedness among the world’s lonely” (Moore, 2012, p. 317). If the human condition is about being alone, it is also about connecting in bridges across that loneliness. It is about the drama of personal, lived stories, their sharing, and empathic understandings by others.

(3) **Invisibilities (what is not expressed)**

There is a WYSIATI (what you see is all there is) assumption among some but not others. This cognitive bias is a limiting one, and it should always be assumed to be wrong in every context. Not everything relevant in any context is wholly seeable, much less observed. The social visuals around COVID-19 and SARS-CoV-2 are about invisibilities, viral filaments that are only seeable with electron microscopes.

- **24/7 work, planning, and projections.** Certainly, the ramp-up of endeavors by epidemiologists, health experts, data analysts, scientists, modelers, and policy makers has long gone into over-drive, with non-stop work. Given a naïve population without natural protec-
tions against the novel coronavirus, time is of the essence. The professionals in the field need to assess risk accurately as the collected data converge on particular probabilities that enable extrapolations of risks and rates of infection, death, and recovery, among others. National security folks are likely on high alert, and there is non-stop work all around the world, to understand implications and enhance decision-making and resource provisioning and other work for domestic containment (stopping the spread of infectious diseases among the peoples of the country). [For contagious disease experts, such outbreaks are factors of not if but when, given human lifestyles in a complex biological world (Davies, Feb. 5, 2020).]

- Plans are being made and updated on the fly as new information emerges.

- **Malicious misinformation.** There are reports now of government-sponsored misinformation around SARS-CoV-2 to disrupt other countries. There are reports of the Russian Federation targeting the U.S. with erroneous messaging. The #fakenews phenomenon has been documented by multiple sources. (Wolff, Mar. 4, 2020) The misinformation has become so prevalent that there is actually a Wikipedia page titled “Misinformation related to the 2019-20 coronavirus outbreak” at [https://en.wikipedia.org/wiki/Misinformation_related_to_the_2019%E2%80%9320_coronavirus_outbreak](https://en.wikipedia.org/wiki/Misinformation_related_to_the_2019%E2%80%9320_coronavirus_outbreak). Common themes include shutdowns of cities and nations (Lytvynenko, Mar. 16, 2020; Schiffer, Mar. 16, 2020). Government officials suggest that such misinformation is to foment panic and social strife and social disarray. In a time of crisis, opportunists and malicious individuals will emerge. (One sheriff made this point by posting on their police media feed to ask criminals to take a hiatus from crime during the coronavirus outbreak. One way to interpret his commentary
is that even in times of crisis, crime does not take a holiday. People need to be vigilant and careful. They need to engage with police in community policing.)

- **Fear and anxiety.** As the information has become more salient to broad populations, there have been actions that may indicate fear and anxiety: runs on stores to shore up supplies at home, withdrawals of funds from various stock market investments and a “flight to safety” in bond investments, social leeriness, and other reported behaviors. There are xenophobic messages. There are racist comments and violent actions. These are some of the observables. What is not directly visible is the sense of nervousness in people, stemming from having to face an unknown, and dealing with discomfiting emotions.

The broad public is almost never privy to the hidden hands of government so as not to spook them and to not encourage rumor-mongering or to muddy messages. Messages are kept simple. What the public sees is also limited. Those members of the public who are parts of the various teams are not at liberty to share, in general.

So what does this all mean for digital services in a time of crisis, in this case a complex one involving biosafety/biosecurity and economic impacts?

- Government has to make sure that their exposures to public are constructive and prosocial. Their more extreme actions have to understood as prosocial. Screaming matches with the public and the uses of force on people not wearing masks in public seem counterproductive. (This was captured by a member of the public and shared globally.)
- The free access to social media is an important part of people’s coming with fast-changing contexts. People find solace in sharing their predicaments with others,
and others (journalists, public health professionals, government officials, and fellow citizens) can benefit from the insights of people in all their respective contexts.

- People often use social media to filter their news, and to help them decide how to make decisions and what actions to take. Social media offers important insights for people.
- The social imagery may be viewed as an indicator of massmind moods, sentiments, and partially of their understandings of the challenges and what is asked of them.

SARS-CoV-2 stems from an as-yet unknown original host animal species (Bats?) and as-yet unconfirmed intermediate host animals (Pangolins? Snakes?). At present, it is thought that the intermediate host is the pangolin, based on a report from scientists from the South China Agricultural University reported in the government-run Xinhua News Agency and other media sources (Ricard & Castelnau, Feb. 8, 2020, p. 2). Pangolins are described as “an endangered animal that looks like a scaly anteater” (Sheehy, Feb. 7, 2020, p. 1) and a “scaly mammal” (Guzman, Feb. 2020) and “an endangered, highly trafficked creature that looks like a cross between an anteater and an armadillo” (Achenbach, Feb. 7, 2020, p. 1). It is reported that the “genome sequences of viruses in pangolins to be 99 percent identical to those in coronavirus patients” (Guzman, Feb. 2020; Cyranoski, Feb. 7, 2020, p. 2). There is an initial report that suggests that a human may have infected a pet dog (Sanchez & Lockwood, Feb. 29, 2020). [Food animals are consumed around the world, both farmed and wild-grown. For many, the consumption of bush meat and wild animals (as protein) is critical for survival.]

Social imagery during a crisis shows a very lived sense of the issue at a personal ego-based level. The people are individuals caught up in the moment, and they are the witnesses of various actions by the government, by their fellow citizens, by others,
and by themselves. These images are often surrounded by narratives through shared narrations (voice) and ambient sound and their own writing. The production values may be low, but many of these from-life factors are mitigated by the quality of the smartphones and the cameras (even at night, even with motion). For many sharers, there is an innocence around the sharing, without privacy protections or faces fuzzed (or covered) or locations hidden or metadata occluded or omitted.

**Social videos.** Social videos around this epidemic tend to repeat data from other mass media sources, in a way that may be consumed as “transient” information. These focused on simple messaging, mostly around how people may stay safe but also what they should do if they suspect that they may have been infected. Many are critiques of responses to-date and some “armchair quarterbacking.”

A computational analysis of the transcripts shows focuses of the respective videos. (Figure 6)
Social video shows simpler summary topics and lived experiences and lived concerns.

*Figure 6: A Word Cloud from Social Video Transcripts Related to the Novel Coronavirus Outbreak*

Autocoded themes show a focus on top-level topics and related sub-topics. (Figure 7) These provide a gist of the initial narratives related to the outbreak.
This treemap diagram (area chart) shows common autocoded themes, with the most popular themes to the left and less common ones to the right. The leftmost column shows “virus,” “people,” and “information” as high level topics.

**Figure 7: Autocoded Themes in the Social Video Transcripts Related to the Novel Coronavirus Outbreak**

The autocoded sentiment of the social video transcripts show trending negative, but with a majority of the text neutral (Figure 8). So what words there were that contained sentiment trended “very negative” or “moderately negative.”

The social video transcripts’ sentiment trends negative.
Digital services in transnational crisis. In terms of digital services in crisis, social media platforms are harnessed by professional message-makers along with the general masses.

For official messaging, government officials, doctors, national security personnel, and others need to be factual, clear, and accurate about the proper self-protection and other-protection behaviors of a broad populace. They have to walk a fine line between shaping fear so people are not oblivious to the risks but not to amp up the fear to a point of panic and catastrophizing, where people “freeze” or act irrationally or go to fatalism and passivity. Their goals are to promote both biosafety and biosecurity.

With any sense of population threat, complex disease science, and wall-to-wall media coverage, the misunderstandings can become rampant and the rumors wild. (The author was riding a shuttle bus when the driver mentioned her ideas that the novel coronavirus was from a government lab and was released for “population control.”) These may be transferred on public channels and private encrypted ones, and they may be textual, visual, and often multimodal. Social imagery is created by people for people, and these are inherently vague and ambiguous, multidimensional, and multi-meaninged. The study of such imagery may provide a fresh angle at understanding mass-scale social responses to an unfolding global biosafety/biosecurity risk.

Discussion

In the face of extreme threat, there are positive and prosocial behaviors and there are negative ones. Generally, it is positive for people to stay informed, understand the world factually and based on empirical data, maintain social order, treat others with...
respect, cooperate with government officials, be prepared for various eventualities, and others. In this particular case, some of the pros and cons of behaviors by the world citizenry (in various levels of scale) are depicted in Table 3. The understanding is that time is of the essence, and resources are limited, and human lives are on the line. This is a “push comes to shove” moment, to use a common colloquialism.
| Pros of Strategic Messaging around COVID-19 and SARS-CoV-2 | Cons of Strategic Messaging around COVID-19 and SARS-CoV-2 |
Micro Individual (Ego) Level

- Stay informed through trustworthy sources (and be able to discern truth from lies)
- Engage the COVID-19 and SARS-CoV-2 information factually and based on empirical research
- Maintain social order by following reasonable directions from government officials
- Treat others with respect
- Avoid stereotyping others
- Set up a household for potential self-quarantining (sheltering in place), if necessary, with proper supplies for the 14-day period
- Maintain proper hygiene
- Maintain proper sanitation
- Avoid spreading rumors
- Engage in proper social distancing
- Cover coughs and sneezes
- Stay home when ill
- Support those in need, such as the elderly in their grocery shopping

Micro Individual (Ego) Level

- Use improper hygiene methods (and cross-contaminate physical spaces)
- Engage in unnecessary risk by going to crowded spaces
- Travel to disease epicenters and “hot zones” where outbreaks are occurring (visibly or invisibly)
- Communicate incorrect information (rumor-monger)
- Fail to cooperate with government health authorities
- Foment panic and alarm among social group and others
- Stereotype others, such as by perceived race or ethnicity
- Promote xenophobia or fear of foreigners and the foreign
- Take advantage of others through scams
- Cause runs on respiratory masks by buying them unnecessarily
- Hoard necessary foods and other goods for self-quarantining (and denying access to others and driving up prices)
- Fail to support family, friends, neighbors, and the larger community
<table>
<thead>
<tr>
<th>Meso Societal (Group) Level</th>
<th>Meso Societal (Group) Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governments</td>
<td>Governments</td>
</tr>
<tr>
<td>• Set up proper leadership and empower that leadership to take the appropriate actions</td>
<td>• Fail to take necessary actions</td>
</tr>
<tr>
<td>• Set up expert task forces</td>
<td>• Fail to create the bureaucratic structures for addressing the crisis</td>
</tr>
<tr>
<td>• Put wise and effective policies in place</td>
<td>• Level blame against other countries</td>
</tr>
<tr>
<td>• Put wise and effective practices in place</td>
<td>• Level blame against particular groups of people</td>
</tr>
<tr>
<td>• Activate emergency plans as appropriate (and de-activate at the right time)</td>
<td>• Misattribute causes</td>
</tr>
<tr>
<td>• Provide necessary resources to the respective arms of government</td>
<td>• Fail to act in good faith with other countries</td>
</tr>
<tr>
<td>• Share relevant and accurate information</td>
<td>• Share misinformation</td>
</tr>
<tr>
<td>• Coordinate effectively among local to global entities</td>
<td>• Cast aspersions</td>
</tr>
<tr>
<td>• Share research accurately and appropriately</td>
<td>• Act in discriminatory ways against others’ citizens</td>
</tr>
<tr>
<td>• Support relevant industries</td>
<td>Citizenry</td>
</tr>
<tr>
<td>• Aid countries with restricted resources (as available)</td>
<td>• Public figures foment conspiracy theories, stereotyping, unsubstantiated rumors, and other negative messaging</td>
</tr>
<tr>
<td>• Maintain sanitation services</td>
<td>Private industry</td>
</tr>
<tr>
<td>Citizenry</td>
<td>• Discriminate against people and people groups</td>
</tr>
<tr>
<td>• Take proper hygiene actions</td>
<td>• Do not practice sufficient sanitation</td>
</tr>
<tr>
<td>• Maintain civility</td>
<td>• Have employees that do not practice sufficient hygiene</td>
</tr>
<tr>
<td>• Maintain social order</td>
<td>• Spread rumors and fear due to misinformation</td>
</tr>
<tr>
<td>Private industry</td>
<td>• Encourage employee travel to “hot zones”</td>
</tr>
<tr>
<td>• Those able to create jobs for this displaced by the “movement of people” restrictions of</td>
<td></td>
</tr>
</tbody>
</table>
governments (Thorbecke, Feb. 12, 2020)
- Those that can produce goods for the population needs do so (such as through surge capacity)
- Build substitute or new supply chains to ensure business continuity (and consumer support)

where the disease is endemic and / or spreading
- Engage in price-gouging; engage in hoarding and profiteering
- Misrepresent the features of goods, products, and services
- Cut corners in production (especially with supply chains under pressure)

Macro Global (Human Population) Level

Global entities
- Provide critical leadership
- Provide critical expertise
- Provide resources to the proper organizational entities (strategically and fairly)
- Collect and share relevant information
- Communicate inclusively
- Include the global community of nations
- Show respect for peoples
- Shore up “too big to fail” systems

Macro Global (Human Population) Level

Global entities
- Fail to provide critical leadership
- Tap irrelevant expertise
- Share erroneous information
- Fail to support all members in an egalitarian way
- Work non-inclusively
- Fail to show respect for peoples
- Waste time
- Waste resources
- Make the epidemic worse
- Fail to shore up systems; enable breakages from fragility

Table 3: Pros and Cons to the Strategic Messaging around COVID-19 and SARS-CoV-2 Three Months In at Various Scales
At the micro, meso, and macro levels, there are unique challenges of learning, research, focus, decision-making, resource applications, and other factors. At the macro level, there are the challenges of so-called “disease diplomacy” (Belluz, Feb. 10, 2020, p. 1), with global leaders needing to respect the leaders and peoples of various countries while cajoling cooperation and effective disease-fighting efforts. There are needs to maintain multiple macro-scale systems that humans need to thrive in community, such as maintaining population health, protecting health workers, supporting “economic stability,” and others (Frieden, Feb. 25, 2020, p. 2). There are also needs to ensure that people stay in their respective labor markets and not withdraw. There are needs for people to engage as consumers and not pull back into their own spaces.

**Future Research Directions**

The combination of the social image analyses, social video transcript analyses, and mass media articles around the outbreak of COVID-19 from SARS-CoV-2 may be summarized at a very high level as a mix of known knowns, known unknowns, unknown knowns, and unknown unknowns (Figure 9).
Some COVID-19 / SARS-CoV-2 Knowns and Unknowns in Real Time (in a 2x2 table)

This 2x2 table shows some known knowns, unknown knowns, known unknowns, and unknown unknowns about SARS-CoV-2/COVID-19, in early days.

**Figure 9**: Some COVID-19 / SARS-CoV-2 Knowns and Unknowns in Real Time (in a 2x2 table)

The science-based questions raised in this global-scale disease outbreak will take years to fully study, with current methods and technologies and future ones.

- How did this virus evolve?
- What capabilities did it evolve to be able to infect humans?
- What are ways to prevent its efficacy in causing disease in humans?
  - How long do human immunities from antibodies last?
  - What treatment interventions may be used against
SARS-CoV-2?

• Are there vaccines that may be developed against this threat to human health?

• What policies and practices are most efficacious against such disease outbreaks? To slow to spread? To achieve containments?

• What are actions to avoid and why? (The crisis event post-mortems will take years given the complexities and the “unknown unknowns” at present. These will likely include in-depth counterfactuals and alternate approaches and modeling of what would have happened had decision makers and actors taken on different endeavors at different times, with available resources.)

• What are ways to protect the social fabric and social order?

One central one in the public mind will be how this virus originated, whether it emerged from a wet market in Wuhan, Hubei Province, in the PRC, from natural mutations or some other means. (One question posed by several articles is whether the pathogenic strain of coronavirus may have escaped from a biosafety lab, or worse, a bioweapons lab, with the seeding story from named scientists from multiple institutions of higher education in the PRC.) Another one will be when it actually emerged, and if the mid-December 2019 date is accurate. Certainly, how the virus manifests in different geographical regions will be of interest. There will be further studies of how the virus affects people, in different demographic slices (and with different health statuses). Whatever is learned will optimally be applied to yet future disease outbreaks and coordinated protocol-driven responses that will be most efficacious and non-wasting of time and resources and lives. There have been media mentions of possible studies of communities with blood tests for antibodies for evidence of past infections of SARS-CoV-2 that may have man-
manifested asymptotically (or sub-clinically) for deeper insights about community spread and other factors.

As to follow-on research for this work, it may be helpful to apply the three-part approach of studying “(1) messaging and information sourcing, (2) meta-messaging and subtexts, and (3) invisibilities (what is not expressed)” in different social media platforms (by brand, by type, by language, by region, and others). There may be insights by shared social imagery in different regions in particular time periods.

In the narrative Ian Bremmer’s “G-Zero” world, does the COVID-19 disease outbreak further weaken globalization by sending various nation-states into social distancing and mutual isolation, or does it help integrate them against a shared viral enemy? Does the global social order unravel further, or does it start to be put back together based on leadership and shared interests?

**Conclusion**

In somewhat early days, there was the sense that a “quick recovery from coronavirus” would occur (Ziady, Feb. 22, 2020). Many depictions in social media showed a blitheness, with people walking around deserted streets marveling at the emptiness and the spectacle of it instead of more directly taking precautionary measures. Those quarantine on cruise ships were focused on the free food (and even those in quarantine in the U.S. were bragging about how they had access to 24/7 food). Some of the quarantined have filled time making social memes. One shows a bus driven by a person in full hazmat clothing, with the words: KEEP CALM AND CARRY ON. As time has passed, there seems to be real cause for deep concern for human health. In early days, makeshift facemasks were created from “sanitary pads, bras, and even fruit” (Perper, Feb. 8, 2020, p. 4), and people wore inflatable costumes (p. 3); people bought condoms to pass the time (p. 6);
some 200 users of WeChat joined a group “looking for love under lockdown” (p. 7). A recent work showed how masks have entered the mainstream and part of how people accessorize and self-express (Venkatraman & Kesslen, Mar. 1, 2020). However, those who’ve been paying attention have had a crash course in biology, and optimally, their amateurish “mental models” are aligning a little more with expert “conceptual models” about the health threat.

Historically, this outbreak is “only the sixth time the WHO has declared a global health emergency” (Schumaker, Jan. 30, 2020, p. 1). While there is reticence to call this a pandemic, many already are, given the fast spread to dozens of countries (Belluz, Feb. 6, 2020, p. 10), but it is not clear whether this will be more similar to the common cold or the Spanish Flu (which resulted in between 50 – 100 million deaths worldwide). Whether this is an unfolding pandemic or not, nations are asked to prepare for the worst case scenario (“Coronavirus: World must prepare...,” Feb. 24, 2020). At present, there is an estimate that “two-thirds of coronavirus cases from China” are currently undetected worldwide (Berry, Feb. 22, 2020). At this particular moment in time, the numbers of known cases continue to rise, with more examples of invisible lines of transmission through community spread. Stock markets have been shedding value across the world, with “market corrections” occurring (drops of 10% or more from highs in values); the U.S. stock market entered “bear market territory” in the second week of March 2020. How people invest suggests something of public sentiment and their expectations for the future; it serves as a proxy measure of confidence in the present and the future. The coronavirus continues to mutate and evolve into different strains, with unclear ultimate outcomes (Stankiewicz, Feb. 10, 2020, p. 2). Chinese scientists have identified a “second, more dangerous coronavirus strain” through phylodynamic analysis, and they suggest that this strain is not only more easy to spread but also more pathogenic (Healy, Mar. 6, 2020); this interpretation has been rebutted by other scientists, however, at the MRC-
University of Glasgow Center for Virus Research in Scotland. If nothing else, the prior may suggest something of the “fog” surrounding mass-scale outbreaks with a large number of endeavors occurring simultaneously. There are varying projections for how the outbreak will continue, whether warmer temperatures may change the infection rate (Puleo, Feb. 11, 2020). Some are predicting that the virus will find a foothold in the U.S. and around the world (Lovelace, Jr., Feb. 12, 2020). One research study suggests that 40 to 70% of the world’s adult population is estimated to be infected with coronavirus at some point (“Coronavirus quarantines could...,” Feb. 27, 2020; Marc Lipsitch, 2020, as cited in Hamblin, Feb. 2020, p. 4) and “millions of people dying” (Lipsitch, as cited in “Epidemiologist predicts...,” Mar. 2, 2020). As sophisticated as disease models are with the various datapoints, how well these represent the world (external validity) is up for debate in a highly dynamic space. At the time of publication, the WHO released findings that the global mortality rate for the novel coronavirus is 3.4% (Winsor, Mar. 4, 2020), orders of magnitude greater than the 0.01% for the common flu (caused by multiple strains of other coronaviruses). Data from the World Health Organization and the Chinese Center for Disease Control and Prevention suggests heightened risks of death for those infected by SARS-CoV-2 based on health conditions: cardiovascular (10.5%), diabetes (7.3%), chronic respiratory (6.3%), hypertension (6.0%), and cancer (5.6%) (Engel, Mar. 9, 2020). Those who are older are also at greater risk (in descending order): 80+ (14.8%), 70 – 79 (8%), 60 – 69 (3.6%), 50 – 59 (1.3%), 40 – 49 (0.4%), 30 – 39 (0.2%), 20 – 29 (0.2%), 10 – 19 (0.2%), and 0-9 (none), with current data (Engel, Mar. 9, 2020). There are suggestions that this pandemic may spread to “developing-world cities where huge numbers of people live, health care facilities are poor and millions lack the money to afford whatever care is available” (Bremmer, Mar. 16 – 23, 2020, p. 32), with outsized impacts on the developing world and emerging markets. In these regions, people have less access to healthcare, expensive pharmaceuticals and therapeutics, personal protective
equipment, and other tools to protect against this novel coronavirus. Density reduction may be less possible given that many live day-to-day and require work for subsistence.

Is it possible that the viral spread may slow over the summer? Early data do not suggest so given spread in countries already experiencing high heat (like Australia). Some are suggesting that the “boomerang” effect may occur in which there is an apparent drop in novel coronavirus cases and a sudden spring back in numbers, based on experiences with prior outbreaks (one mentioned is the Spanish Flu outbreak of 1918, with an estimated 50 – 100 million deaths around the world based on historian and epidemiologist contemporaneous assessments). The magnitude of the challenge is enormous, and the disease space is complex. Humanity has more tools in its arsenal than before, but it is unclear as to whether it is up to the challenge, or what the cost in human lives will be in the meantime.

Ideally, the point of the respective quarantines, travel bans, decontaminations, and other efforts, is to “halt the outbreak and then eradicate the microbe” (Begley, Feb. 4, 2020, p. 1). This would require all countries with infected persons to achieve complete control, so the reproduction rate of infections is 0-1 (with a basic R-nought/R_0 or reproduction number or the number of other persons each one infected person infects during an infectious period). Any R-nought above 1 means that the infection spreads; anything lesser means that the outbreak slows and ends. There is a theoretical and practical point at which such a spread not may not be possible if the virus makes a continuing position in human populations by which it survives in an independent and self-sustaining way, emerging and re-emerging as a seasonal virus. As with other respiratory viruses, in the long term, people may have no long-lasting immunity to them (if they are able to acquire immunity). For any one person, the risk is low, one out of the population of the world [one out of 7.8 billion in early 2020 (“Current World Population,” Mar. 4, 2020)]. How-
ever, that is a naïve counting game. Those who are in hot zones are clearly at much different risk, and the accounting then is different. Those receiving the news coverage experience “direct address” and can understand the personal threat (even if their understanding of actual risks may be skewed egoistic and non-statistical). Indeed, no one wants themselves or their families to be fodder to a pathogenic virus. And most people also do not want to cause harm to others.

Criticisms of various governments and their preparedness are rife (Garrett, Jan. 31, 2020, p. 2; Belluz, Feb. 10, 2020), even as history-making playbooks are being written and rewritten for fighting epidemics and pandemics. One critique, by Dr. Scott Gottlieb [ex-Food and Drug Administration (FDA) chief], has already been made in the U.S. that an “all the above approach” to such a crisis is preferable to going with just a linear one [in regards to the missed opportunities in the few weeks that U.S. health officials did not have a working diagnostic test for SARS-CoV-2 because of production challenges as headed by the CDC (Face the Nation, Mar. 1, 2020)]. He also went on to suggest that multiple approaches may be used to treat the ill: “antibody-based prophylaxis, treatments, vaccines, an all of the above approach” for a range of options]. In that time, it is thought that several hundred or even in the low thousands of cases may have gone undetected because of the unavailability of mass-scale testing even as of mid-March 2020. Globally, there have been piecemeal approaches, without a clear collective strategy (Bremmer, Mar. 15, 2020). (With so much partially known and speculated, there is still much to learn about the virus, its mechanisms, its evolutions, and how humanity can best fight this pathogenic agent in the various contexts and cultures of human populations.

Meanwhile, people stock up on single-use facemasks with limited effectiveness. They stockpile food at home in order to be able to self-quarantine as directed. People meeting greet each other with elbow bumps (in lieu of handshakes) and polite social
distance. They have set up work offices in their respective homes. They hold their breaths and wait. Many public health officials warn that “significant disruption” is to come given the behavior of the pathogen and human systems (Winsor, Schumaker, & Nathanson, Feb. 25, 2020). There are calls for preparations, to enable “teleschooling, working remotely—should face-to-face interactions need to be reduced” (Winsor, Schumaker, & Nathanson, Feb. 25, 2020, p. 3). Online, some have shared DIY (do-it-yourself) homemade sanitizer mixes after a run on stores and online shops drove up prices for this product and made them unavailable (Butler, Mar. 1, 2020).

It is possible to summarize the current holistic public understandings in a “data summary” fishbone diagram. The bones at the top refer to systems-level engagements, and the bones below the midline are for individuals. (Figure 10). Various strategic actions may be taken at different levels. How various societies mobilize will affect outcomes across a range of factors like human health and economic systems. In some ways, pre-existing investments in infrastructure and knowledge will be the difference as the rolling infections move across different regions.
This fishbone diagram shows some macro and micro approaches to combating this pandemic.

Figure 10: Some Human Interventions against COVID-19 / SARS-CoV-2 (a “data summary” fishbone diagram)

Current estimates are that the first wave of infections may move through the U.S. through mid-May 2020, at which point the viral spread will slow because either people have been infected and have some immunity against re-infection, or are generally not susceptible (for whatever reason), or are sufficiently unexposed. The idea is to lower the peak of the epidemic curve in the meantime so that the epidemic does not peak early and never has a high number of cases at a time that would overwhelm hospitals and their surge capabilities (“Gottlieb, AEI’s Michael Strain…,” Mar. 12, 2020; Chow & Abbruzzese, Mar. 11, 2020).

And finally, to the research issue, social media platforms are critical for a variety of reasons in a time of crisis: information sharing, mutual encouragement, social support, social intimacies (while being socially distant or even “quarantine”), productivity in collaborative work, research, coordination, and monitoring
various facets of human life. It is a foremost source that people use to receive news and to filter news for their own usage and decision making. However, for those who want to know about the actual risks and actual defenses, going with headlines and social imagery is insufficient alone and highly misleading. Social imagery and social video may raise alarms but need to be bolstered with facts and ongoing real-time knowledge and support for making the right decisions. There is a visual way to illustrate this. In terms of related tags for images shared on the Flickr social image sharing site, the folk tags applied to the shared images show mass-scale associations of the broad public to the idea of “virus.” (Figure 11) There are a variety of mental associations, including to “pandemia” and “epidemia” and “sick” and various “swineflu” and “birdflu” and “h1n1” and “h5n1”. But alone, these lighter forms of awareness are insufficient to keep people as safe as possible. [This network graph was acquired from Flickr through a third-party application enabled through the NodeXL application, an add-on to Excel.]
This network graph shows some high level evocations of “virus” in shared social imagery on the Flickr social image sharing site.

Figure 11: “Virus” Related Tags Network on Flickr (1.5 deg.)

The risks of infection—through aerosolized particles, through sneezes, through viral particles left on surfaces and inadvertently carried to a person’s face by unconscious facial touching, and other means—are real and present. An infection control study found that study participants (medical students) touched their faces 23 times per hour, with 44% involving “contact with a mucous membrane, whereas 56% of contacts involved nonmucosal areas” (Kwok, Gralton, & McLaws, 2015, p. 112). The team writes: “Of mucous membrane touches observed, 36% (372) involved the mouth, 31% (318) involved the nose, 27% (273)
involved the eyes, and 6% (61) were a combination of these regions” (Kwok, Gralton, & McLaws, 2015, p. 112). There are warnings for social distancing, too, across the population range but with a special focus on the “vulnerable,” those who are older and with underlying health conditions (Kamisar, Mar. 8, 2020). There are suggested changes for workplace rules, such as for those who are ill to remain home and to optimally still earn a salary. There is a sense that societies are working the edges of feasibility. This knowledge can help people take some reasonable precautions while science efforts continue towards potential therapeutics and interventions.

Note: This work was drafted in February 2020 and was submitted for consideration on March 1, 2020; a few revisions and updates were included in the first week of March. The reliance on mass media depictions mean that the concepts are mostly excerpted as “mental models” (of non-experts) and not conceptual models (of experts), which would be more common in the academic literature. Several research-based academic works addressing the novel coronavirus were available at the time of this publication, but these may be a little too complex for inclusion in a work about the uses of social media imagery to understand an unfolding pandemic outbreak. Follow-on work will include more systematic social image analysis, with direct counts, instead of summary gists alone (Hai-Jew, 2018). This was submitted in part because of the speed of events and the sense that it would have value in a faster publication cycle than is typical with an academic publication. Thanks to Dr. Floribert Patrick C. Endong, editor of this publication, for being willing to consider this last-minute submittal.

At the time of publication, the author’s long-term former stomping grounds of Seattle became a hotspot for COVID-19, with multiple deaths and many infected.
Disclaimer: None of this work is advisement. The information is initial and from published sources, with full citations. As in any early emergency, information may be inaccurate—even prior published information with on-the-fly vetting in the so-called “first draft of history.”

Dedication: This work is dedicated to all those on the many frontlines to address this SARS-CoV-2 outbreak.

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**Key Terms**

**2019 n-Cov:** The initial and unofficial name given to the virus that leads to COVID-19

**Biosafety:** The state of safety of people, animals, and the environment from unintentional release of disease-causing microorganisms and other biohazards

**Biosecurity:** The state of security of people, animals, and the environment from intentional release of biohazards by people

**Case Fatality Rate:** Number of deaths from a disease divided by the total number of people with the disease in a certain time period (as a measure of disease severity)

**COVID-2019:** Official name of the disease from SARS-CoV-2

**Coronavirus:** A group of RNA (ribonucleic acid) viruses that may be pathogenic for humans and animals

**Density Reduction:** The conscious and purposeful separation of people from each other’s personal space (six feet in all directions) in order to lower the spread of a pathogenic agent spread via air

**Domestic Containment:** The stopping the spread of an infectious disease within a country
**Fomite**: Materials “likely to carry infection, such as clothes, utensils, and furniture” (Oxford English Dictionary online)

**Hot Agent**: A colloquial term for viruses that can only be handled safely with Biosafety Level 4 methods

**One Health**: A concept of the intersection between human, animal, and environmental health requiring collaborative and multi-disciplinary approaches to solve health issues

**Pandemic**: An occurrence of disease prevalence around the world (with local community transmission that is not traceable to an origin)

**R₀** (pronounced “r-nought”): Basic reproduction number, the average number of people infected by one infected person in a population during the infectious period

**SARS-CoV-2**: Name of the virus that leads to COVID-19

**Self-Isolation**: The act of cordonning oneself off from others because one is presumed or confirmed to be infected with a contagious disease agent

**Self-Quarantine**: The act of “sheltering in place” to avoid interacting with other people to stop or slow the spread of an infectious disease, including home-quarantine (the individual may or may not be “positive” for the infectious disease agent)

**Zoonotic Spillover**: The transmission of a pathogenic agent from a vertebrate animal to human