



# Automated responses to the coronavirus disease-19 pandemic: An overview

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## Abstract

The pandemic response was a thoroughly mediated phenomenon – one that paired digital information technologies with automated logistical systems to address inter-related crises of circulation. In the logistical sphere, automated media were used to manage flows of people, commodities and even (in the case of ‘smart’ ventilation systems) air itself. In the media realm, automated systems played a role in circulating timely notifications and alerts and in detecting and responding to false information. This theme issue brings together an interdisciplinary group of researchers focused on the analysis of automated control and response systems, including the networked devices and infrastructures that supported them, and the digital forms of data collection and processing they enabled. This introductory essay focuses on some organizing themes that emerge from the theme issue contributions, including the relationship between automation and the temporality of viral contagion, logics of pre-emptive intervention and forms of atmospheric and environmental control.

## Keywords

Acceleration, automation, circulation, contact tracing, COVID-19, pandemic, quarantine

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## Crises of circulation

The coronavirus disease (COVID)-19 pandemic has been mediated and remediated at an unprecedented scale – not simply in terms of the multi-channel, networked, always-on information cycle – but in terms of the role-played by information and communication technologies in managing and responding to viral contagion and its consequences. The anxiety of discussing the meaning of the pandemic while it has raged, smouldered and interminably lingered, has weighed upon many commentators. This anxiety is well expressed in Paul Frosh and Myra Georgiou's editorial in a 2022 special issue on the pandemic for the *International Journal of Cultural Studies*. As they put it, taking a cue from the French historian of the *longue durée* Ferdinand Braudel:

the idea that we can find much of lasting value to say about events as they are happening has been a matter of contention, certainly in the study of history. For instance, the analysis of Covid-19 as an event, while it is still going on, would probably have irritated Fernand Braudel: 'An event is an explosion . . . Amid its deceptive smoke, it fills the conscious domain of today's people, but it doesn't last long, disappearing almost as soon as one sees its flame' (Frosh and Georgiou, 2022: 234).

Nevertheless, this themed issue joins several others – most media studies and cultural studies journals have over the last several years run special issues attempting the slippery task of interpreting, coming to terms with, and conjuring a 'response' to COVID that would be adequate to the moment (see, for example, Athique, 2020; Casey et al., 2022; Davis et al., 2022; Erni and Striphos, 2021; Frosh and Georgiou, 2022; Gruzd et al., 2021; Hesse and Thompson, 2022; Hight, 2021; Leszczynski and Zook, 2020; Levina, 2022; Newell, 2021; Russell and Powers, 2020). Collectively, these studies have produced a compelling account of the tumult of the past several years, as well as providing fascinating 'symptomatic' accounts of the unsettled temporality of the pandemic itself. If French and Monahan (2020) could write in 2020 that they worried that the time scale of academic publishing would be so out of sync with the temporality of the pandemic itself that their editorial might seem anachronistic by the time of publication, then by 2022 a related problematic had established itself – that the pandemic might last indefinitely, that the 'crisis' might become the 'new normal' (Stephens, 2020).

There is something familiar about this temporality: one in which the apparent rupture turns out not to be a discrete break from the usual state of affairs, but its defining characteristic. Even as the current pandemic becomes endemic, we are enjoined to develop the technologies and practices that anticipate the next one. It is no coincidence that Halpern and Mitchell (2022) in their work on 'smart' technopolitics identify this new normal in similar terms: 'smartness assumes perpetual growth and unlimited turmoil' (p. 4). The COVID-19 outbreak has been the first pandemic subject to the 'smart' response enabled by networked digital technology, alongside automated forms of information processing and response. The rapidity of its mutation and transmission combined with its devastating effects took the form of a crisis organized around 'intrinsically unforeseeable events that will necessarily continue to emerge from an always too-complex environment' (Halpern and Mitchell, 2022: 4). In this respect, it lent itself to the type of response enabled by the promise of automated systems – namely, to collect and process data on a

scale that approached the complexity and pace of the ongoing crisis itself. Increasingly, crises are framed as requiring the scope and scale of response that outstrips unaided human capabilities. Sensor systems of various kinds, for example, generate more data than can be made sense of in real time without automation. At the same time, patterns of human interaction and interdependence are rendered increasingly fast-paced and complex by communication and transport systems that operate at a global scale. False information about the pandemic, for example, can spread across Facebook's user base of some 3 billion people in ways that would be impossible in the era of print journalism and broadcasting.

Against the background of this crisis of the 'real-time' response (Stiegler, 1998), another way to approach the question of the mediated nature of the pandemic is as an event revealing and remediating the legacy of modernity itself. This is, in a sense, the way that disasters have been conceptualized in the anthropological field. In their classic account, Oliver-Smith and Hoffmann (1999) write:

Disasters disclose in their unfolding the linkages and the interpenetrations of natural forces or agents, power structures and social arrangements, and cultural values and belief systems. The many socially constructed facets of disasters form the basis for the idea that disasters disclose fundamental features of society and culture, laying bare crucial relationships and core values in the intensity of impact and the stress of recovery and reconstruction. (p. 26)

Rather than a sharp disjuncture from the normal state of things, or a moment of 'punctuated equilibrium' (Dawdy, 2006: 720), such an approach would emphasize the place of disaster as revelatory – as laying bare the suppressed significance of the nature-culture nexus and of the vulnerability of the modern infrastructures we rely upon for the support and reproduction of life itself (Dawdy, 2006: 723). Such an approach would encourage us to consider the misery and suffering of the pandemic, if not simply as business as usual, then as laying bare the inequities and liabilities of the prior state of things, and so leaving us with no option (or reason) to return to the way things once were. The philosopher Slavoj Žižek (2020: 12), for example, took the pandemic response as evidence of recognition of the inadequacy of market solutions and the necessity of collective health-care and economic support, writing at the outset of the crisis that

[a]s the world-wide epidemic develops, we need to be aware that market mechanisms will not be enough to prevent chaos and hunger. Measures that appear to most of us today as 'Communist' will have to be considered on a global level.

Such claims foreground the rapid mobilization of state assistance during the pandemic but underestimate the enduring power of the social to reproduce itself in its inertia, to recognize suffering without meaningful intervention or amelioration.

The question of what, precisely, the crisis discloses invokes the multifarious role of the media in the ongoing pandemic response. Thanks in part to the proliferation of news and information outlets, COVID-19 was the most comprehensively mediated pandemic in history. It took place during a time when more than half the world's population owned or had access to a smartphone (Turner, 2018), and relatedly, were on social media (Dixon, 2023). Thus, one of the media's biggest concerns in their coverage of the pandemic was, perhaps

unsurprisingly, the role of the media itself. The pandemic lent itself to 24-hour coverage – but also to increased use of social media, with attendant concerns about the spread of misinformation and efforts to undermine trust in legacy, ‘mainstream’ media. At the same time, pandemic response measures including lockdowns and social distancing restrictions boosted the use of online platforms for work and entertainment, generating record profits for online conferencing services – as well as online shopping and entertainment. Networked communication devices came to play a central role in strategies for contagion management, including contact tracing, quarantine enforcement, and automated check-in and verification of vaccine status. COVID-19 was the first pandemic many people could access via their smartphones. Apps were also developed to diagnose possible COVID-19 cases based on the sound of a cough or the user’s voice (McCarthy, 2022).

The circulation of accurate information and the detection of false information raised key concerns that paralleled the spread of the virus. Fast changing pandemic restrictions relied on constant connectivity to keep track of the real-time imposition of lockdowns and other restrictions. These measures were, in many cases, simultaneously confronted by false information and conspiracy theories that challenged the credibility of health authorities and the efficacy of pandemic containment measures. Managing the pandemic response became as much a matter of managing communication and information flows as it did the movements of the infected or potentially infected. As Packer et al. (2023: 12) observe in their recent work on digital governance,

[t]here is no sense in which we can think of the circulation of people, populations, intercontinental ballistic missiles, currencies, and ocean tankers without understanding that they are guided, monitored, or stood in for by the circulation of electrical currents and pulses of light.

Something similar might be said about the ways in which we keep track of the circulation of air, information and viruses. The mediation of circulation is a matter not just of optimization and efficiency, but of risk management, harm reduction and, thereby, the securitization of circulation (of information, air, people and commodities).

Unsurprisingly, the logics of platform media and the surveillance economy upon which they rely had an important role to play in the technological response to the pandemic. Always-on communication enabled comprehensive forms of tracking that could be used to target information, notifications and restrictions at the individual level. Real-time tracking supported the targeted rapid response measures that became the hallmark of COVID-19 interventions in some jurisdictions where quarantine measures targeted specific office buildings and apartment complexes. As in other realms of social life, the digital mediation of the pandemic combined granular monitoring – down to the level of the individual – with flexible, real-time response. It also provided automated ‘solutions’ to social distancing mandates via platforms for shopping, working, studying and socializing remotely. As the wave of restrictions rolled back, they left in their wake a landscape reconfigured by the widespread use of Zoom, Microsoft Teams, and other meeting platforms, as well as reconfigured forms of remote proctoring, shopping, and employee monitoring.

The mediated hyper-communicativity associated with the pandemic response was only possible on a scale enabled by automated systems. The goal, in a sense, was to counter the communicability of the virus with that of information – to prevent and

pre-empt viral spread. As McQuillan (2022) puts it, 'AI is a technology of anticipation and pre-emption' (p. 45). The necessary level of tracking is only conceivable in the era of networked digital devices and the burgeoning surveillance economy they help support. If 'to circulate is to measure' (Mattelart, 1996: 39), the acceleration and the securitization of circulation rely on increasingly comprehensive and standardized modes of measurement. Mobile devices enable the generalized subsumption of mobility to processes of datafication, thanks to their widespread distribution and penetration, and to the built infrastructure that supports them. Communication technologies and the management of circulation go hand in hand (see, for example, Beniger, 1992; Foucault, 2007). The pandemic response recalls the fact that media, mobility, and transport develop in tandem: the rise of telegraphy played a central role in the management of rail transport, that of the radio in air travel, and networked media in coordinating emerging circuits of increasingly complex and, in some cases, individualized movement (ranging from ride-sharing to city scooters, to prototypes for self-driving cars) (Carey, 1989). The pandemic moment helped reveal the role of post-mass media in the disaggregation and individuation of the management of flows. Building on this insight, the contributions to the theme issue consider the role-played by automated systems in responding to the pandemic along the axes of time and space. In so doing, they approach the pandemic as an event that sheds light on the relationship between automated-decision-making systems and logics of circulation. We are concerned with the hyper-mediation of the pandemic response: not just the saturation coverage, but the imperative of always-on connectivity for managing informational and viral spread. With this approach in mind, we offer the following reflections on three key themes highlighted by the mediated response to the pandemic: temporal disjunction, automated pre-emption and atmospheric mediation.

### **(Temporal) disjunction**

Much has been made of the temporality of the COVID-19 pandemic. The virus spread faster than any recent previous contagion, in turn, producing the most rapid deceleration of the economy in world history – an economic shock comparable to 3 years' downturn in the Great Depression or the Global Financial Crisis played out across just 3 weeks in March 2020 (see Murray and Lauerman, 2020; Roubini, 2020). Both effects are routinely attributed to the consequences of what Hartmut Rosa (2017) has described as social acceleration. While rapid transport and circulation enabled the global spread of the virus, disruptions to the supply chain, combined with lockdowns across the globe, resulted in an economic contraction amplified by the increased reliance on just-in-time logics of stocking and shipping. An economy dependent upon the accelerating circulation of goods, people and information is hit hardest by the forms of stasis imposed by pandemic restrictions. For Rosa (2017), 'a society is modern when it is in a mode of dynamic stabilization, i.e. when it systematically requires growth, innovation, and acceleration for its structural reproduction' (p. 439). Increasingly complex systems of both transport and communication necessitated the development of automation in ways that underwrite this process. As circulation accelerates there is a growing danger of what Rosa describes as temporal desynchronization – a process he discerns at the root of contemporary crises at both the micro and macro levels, ranging from individual burnout to ecological catastrophe. One

way to think about global warming, for example, is by comparing the de-synchronization of the temporal scale of the consumption of fossil fuels with that of their creation. A pandemic is another form of de-synchronization: between the temporality of viral replication and mutation, for example, and that of vaccine creation; or between the pace of circulation and the period of incubation. The promise of automated systems more generally was to remediate temporal disjunctions: to ensure, for example, that up-to-date information about changed conditions, possible exposure and even diagnosis could approach simultaneity. The temporal gap between exposure and the detection of symptoms, for example, was one of the targets of automated forms of contact tracing and symptom detection.

The underlying imperative of such systems was to avoid the alternative solution to temporal disjunction, the one that pushed it to its extreme: stasis. As Foucault (1977) notes, the classical response to the plague was to produce a ‘segmented, immobile, frozen space [where] each individual is fixed in his place’ (p. 195) – an intolerable if not wholly unsustainable response to the impact of disease in a hypermobile world. If information about the virus could keep up in real time with its circulation, then other forms of circulation might possibly be secured. Some individuals may be taken out of circulation to enable the circulation of others. Disjunctions would remain, but these could be minimized via systems of alerts (see, for example, Sarah Pink, Yolande Strengers and Hannah Korsmeyer’s contribution to this issue), detailed tracking, and selective application of restrictions. The creation of new sets of boundaries and checkpoints might create friction points for circulation, but automated check-in systems could reduce the friction while enabling ‘touchless’ forms of transaction and access. Similarly, lockdown restrictions might thwart some vectors of circulation while enabling compensatory forms of acceleration: meeting schedules, for example, no longer needed to factor in the time to move from one location to the other, work time could expand to fill the minutes formerly devoted to commuting, and so on (Sotirova-Kohli, 2022: 153).

The disjunction between those who could avail themselves of the technology to work and meet remotely and, however, those who found themselves sidelined and unemployed by the lockdowns, highlights what Sarah Sharma (2016: 20) describes as ‘the multiple temporalities that compose the social fabric’, and in particular the vicissitudes of ‘temporal privilege’. The temporal disparity was reflected in the economic disparity worsened by the pandemic, which, in turn, reflected the economic and racial inequality that conditioned mortality rates in many countries. As the International Monetary Fund noted,

[t]he pandemic has . . . exacerbated pre-existing inequalities in the labor market, largely because the ability to work remotely is highly correlated with education, and hence with pre-pandemic earnings. Despite all the talk of ‘essential workers’ and everyone being ‘in this together’, the stark reality is that job and income losses are likely to have hit lower-skilled and uneducated workers the hardest. (Ferreira, 2021)

The widespread use of QR codes to facilitate social distancing, for example, offloaded work formerly done by paid service staff onto customers, displacing paid labour. Technologies for remote shopping similarly shifted work from in-person retail outlets to warehouses and shopfronts equipped with digital systems to support item- and grocery-picking for delivery services (as discussed in Lauren Kelly’s contribution to this issue).

One result was the displacement of the risk of contagion away from consumers and onto warehouse workers – who were, in turn, subjected to automated forms of monitoring, not just for workplace efficiency, but to ensure compliance with pandemic protocols of social distancing and mask wearing as well as to enforce labour discipline and workplace efficiency. Security and stasis for some was counterbalanced – via automated information and communication systems – by new forms of risk and mobility for others.

## **Automated pre-emption and viral media**

The use of automated systems for securing economic circulation against that of the virus relies on the acceleration of informational processes. In this respect, Brian Massumi's (2007) reflections on the logics of pre-emption in warfare are also relevant to the battle against the 'unseen' foe of viral contagion: 'Pre-emption also sets a race in motion. But this is a race run on the edge of chaos. It is a race of movement-flushing, detection, perception, and affective actuation' (p. 7). The attempt to enlist smartphones and other networked devices and platforms was animated by the attempt to match the progress and speed of viral contagion. It was not enough, of course, to keep pace with the spreading symptoms because of the lag between exposure and illness. Accordingly, some self-tracking devices were repurposed for use in detecting signs of COVID-19 in advance of recognizable symptoms. Users of the Oura ring (a sleep tracking device) were invited to participate in a study to see whether changes in their average body temperature and other biometrics might provide early warning of the onset of COVID – potentially shortening the time during which people would unknowingly be contagious (Savvides, 2020).

Further strategies of pre-emption included the attempt to determine who, if exposed, would be likely to become both contagious and symptomatic by applying machine learning to databases of health records (Yang et al., 2023). Taken to the limit of pre-emptive logic, such a system might identify the most vulnerable to take them out of circulation. In both cases, the goal was to derive insights from the automated processing of large amounts of data to overcome the temporal disjunction between the viral spread and lagging symptoms. At the same time, automated information processing systems play an increasingly important role in drug discovery and testing and were used by Pfizer to accelerate the findings of clinical trials by automatically analyzing, processing, and 'cleaning' the data (Sharma et al., 2022).

Paralleling the spread of the virus was the rapid circulation of false and misleading information about it – a process enabled by digital media and commercial platforms, and by the high volume of information flow about the pandemic. No other pandemic in history has had anything comparable in terms of the pace and scale of mediated information, disinformation, and misinformation that circulated about COVID-19. The 'race' to detect and respond to false information relied heavily on automated systems, such as those developed by Meta to flag pandemic disinformation (Sumbaly et al., 2020). As in the case of the response to viral contagion, automated responses like Meta's seek to narrow the gap between the viral circulation of false information and its deleterious effects. In keeping with the logic of pre-emption, the goal is to respond in real time – that is, to defuse or confront false information when – or even before – it emerges, as in the case of so-called 'pre-bunking' or 'inoculation' (van der Linden et al., 2021).

The concern about false information is analogous to that regarding the spread of the biological virus: even if it can be countered after being received, it may already have been passed on, and the initial impact on those who have not been inoculated might leave a lasting impression that is difficult to dispel. Suggestively, some approaches to pre-bunking rely on providing exposure to a ‘weakened strain’ of false information to bolster readers’ informational immune systems. Jon Rozenbeek and Sander van den Linden have created an online game called *Bad News*, where players compete to become a ‘fake news tycoon’ – they theorize that by providing potential targets with versions of disinformation that are relatively easy to debunk, players will build the conceptual tools for defending against more robust forms (e.g. by noticing typical disinformation strategies, such as false inference and logical fallacy) (Rozenbeek and van der Linden, 2022).

We dwell on this point because it highlights one of the defining attributes of pre-emption: as opposed to prevention or deterrence it relies on the continual regeneration of the threat it ostensibly addresses. In this respect, it enlists approaches based not on stasis (as in the case of deterrence, which freezes action), but on the continual and repeated activation of the imperative of intervention. As Massumi (2007) puts it, pre-emption relies on a ‘unique ontology in such a way as to make present a future cause that sets a self-perpetuating movement into operation . . . It assumes a proliferation of potential threats, and mirrors that capacity in its own operation. It becomes proliferative’.

Pre-emption perhaps anticipates the shift taking place as of this writing: the becoming endemic of the virus. The World Health Organisation may have ended its emergency declaration for COVID-19, but this is not the same as declaring the ‘end’ of the virus as a threat to global public health. Moreover, thanks to the rapidity of its mutation, it is unlikely to completely disappear. Even if it does, we are repeatedly warned (in the register of pre-emption) that other similar viruses are likely to emerge in the near future to pick up where it left off, perhaps with even greater devastation. The ‘becoming endemic’ of COVID-19 was, in certain respects, implicit in the mobilization of automated systems to respond to the pandemic with the promise that some circulation could continue. In his analysis of modes of governance, Michel Foucault (2007) already discerns something similar to this shift in the inoculation practices tracing back to the 18th century – practices that relied on detailed forms of measurement and tracking that responded to the,

problem of knowing how many people are infected with smallpox, at what age, with what effects, with what mortality rate, lesions or after-effects, the risks of inoculation, the probability of an individual dying or being infected by smallpox despite inoculation, and the statistical effects on the population in general’. (p. 10)

The response was no longer exclusively one of exclusion or quarantine, but that of active medical campaigns to address an endemic affliction.

## **Atmospheric mediation**

The deployment of automated media during the pandemic literalized the link between ideological and material atmospheres: between the regulation of the circulation of air and that of information (Sloterdijk, 2014). Monitoring systems spanned both air quality and



message quality, thanks to automated sensors used to regulate airflow, to track the movement and interactions of individuals, and to monitor online messaging. As John Durham Peters (2015: 32) puts it, '[t]he question of media arises against a background of biological crisis and communication overload'. In the era of virtual reality, augmented reality and related apparatuses for information capture and display, media expand to fill the environment and shape our physical and informational atmospheres. In this context, the pandemic response invites us to consider the expanding strategies of atmospheric regulation and control enabled by automated systems. Consider, for example, the 'Respira' smart HVAC (heating, ventilation and air conditioning) platform designed by the Spanish Council for Scientific Research to monitor and adjust airflow in ways that minimize conditions for contagion. In response to the pandemic, the platform's developers sought to 'identify the risk of contagion from Sars-CoV2' [the virus that causes COVID-19] by integrating into the system, 'an indicator . . . which estimates the risk of contagion through aerosols in enclosed spaces' (International Railway Journal, 2021). The promise of systems like Respira, in turn, is to modulate the atmosphere in real time so as to minimize the risk of contagion (and to maximize the efficiency and sustainability of the monitored environment). As a press release for the Respira platform put it, the system relies on sensors and artificial intelligence (AI) to

predict the environmental conditions (depending on the weather forecast, the service to be provided and other factors) and then apply a mode of operation to the ventilation units in order to ensure the air quality and lower the heat index, while also minimizing electricity consumption inside the structure'. (Algorithm Watch, 2021)

The metaphor of viral contagion has come full circle. Data-driven techniques developed to stem information contagion can be repurposed to predict and pre-empt the spread of biological viruses. Data-driven forms of anti-virus protection are similarly injected back into the biological realm. This back-and-forth movement between the biological and the informational highlights the ways in which, as Peters (2015) puts it, 'media are infrastructures that regulate traffic between nature and culture' (p. 12). Never has this formulation been truer than in the case of the pandemic, during which the media atmosphere became so highly charged that simple social distancing protocols were caught up in high-stakes ideological battles. The biological status of the virus itself became a key point of political contestation – framed by some as nothing more than an information virus, a strategic meme. As Dutton (2022) puts it there was an 'affective epidemic running parallel to COVID-19's microbiological one, exemplified by [highly mediated] violent exchanges in restaurants, on public transport, and over toilet paper' (p. 155).

Both scenes of viral contagion were caught up in automated systems of information circulation. Digital mediation endowed the 'traffic between nature and culture' with the characteristic logics of automation: pervasive passive sensing, high volume data processing, and AI-driven decision-making. Controlling the environment at scale meant treating it as a medium of automated control, combining the functions of sensor, display, and sorter – a process enabled by automated systems for collecting data and responding in real time by sending alerts and notifications, managing the flow through checkpoints, and modifying material conditions ranging from airflow to population density.

It is perhaps one of the paradoxes of the pandemic that a virus which Žižek (2020) describes as a ‘stupidly repetitive’ ‘sub-layer of life’ would invoke, in response, the most advanced forms of ‘smart’ technology and AI (p. 52). The promise of automation made it possible to envision the prospect of matching the speed of the virus – although there were high-profile instances in which the failure of this promise led to more familiar strategies of lockdown and quarantine. Still, the scare quotes around the term ‘smart’ and the qualifier ‘artificial’ highlight the affinity between the thoughtlessness of the virus and that of automation. The price of speed is the eclipse of thought. As Dutton (2022) argues, quoting the work of Bernard Stiegler, the ‘automization’ of human knowledge results in its ‘divestiture by technics’ (p. 156). This is not to downplay the significant role-played by automated systems in reducing simultaneously both mortality and the economic cost of the pandemic. Rather it is to invite reflection on the extent to which the response to the virus highlighted the role-played by automated systems in responding to the imperative of acceleration.

The virus provided a focused and justified site for the urgency of this imperative – but it also revealed how pre-adapted our automated systems were to addressing this urgency, precisely because it long predated the virus. It is tempting to say that the urgency will outlast the virus, but the virus is itself a manifestation of the imperative of acceleration. That there will be more such viruses, we are told, is all but inevitable, because of the pace and scale of human intercourse, enhanced via technological means. The virus becomes not so much a site of exception as a potentially recurring symptom of the same logics and strategies of acceleration mobilized to defend against it. Reflecting on this relationship requires what Stiegler describes as a necessary resource for critique: ‘a stop, a break, a pause: the leisure of intermittence’ (in Dutton, 2022: 156). The contributions to this theme issue seek to carve out the time and space for such a break – one the virus has not so far conceded. Each reflects on aspects of automation that, while not reducible to the pandemic response, have been foregrounded by it.

For example, the figure of the pandemic drone, elaborated in Anna Jackman et al.’s contribution, ‘Where are the Pandemic Drones’, literalizes the theme of atmospheric mediation. Given the tendency towards ‘drone solutionism’ – the promise that drones are flexible and portable enough to perform a growing range of services – it comes as no surprise that the technology’s promoters envisioned a range of potential functions for the devices, from detecting symptoms to providing up-to-the minute alerts to dispersed populations. The figure of the drone offers to keep pace with the need for distributed, flexible, real-time response, and its military antecedents align with the framing of the virus response as a battle. However, as Richardson’s article makes clear, the fantasy of ‘droning’ the virus remained just that – the wide range of pandemic drone applications failed to materialize, with the exception of a few viral anecdotes (of people responding to lockdown by walking their dogs with their drones or socializing remotely via drones). However, even in its failure to materialize, the figure of the pandemic drone highlights the logics of spatial governance boosted by the pandemic response – but not limited to it. The drone offers the prospect of the permeation of lived space by two-way sensor systems. In military terms, the weaponized drone defines a space of exception designated the ‘kill box’ that constructs a temporary virtual battlefield wherever it goes (see Chamayou, 2015). But this same space can be multi-purposed, serving as a space for

disinfection, for monitoring the flow of people and things, for providing both goods and information. The goal of monitoring and customizing space gives rise to the figure of the 'drone enclosure' – a multi-purpose action space defined by the range of the drone.

The automated customization of space is taken up in more detail by Andrejevic et al. in their article on 'Granular Biopolitics', which explores the use of biometric technology for monitoring and tracking human circulation. Their article considers the ways in which automated forms of identification and biometric monitoring are linked to systems that reconfigure the lived environment in real time. For example, facial recognition systems were linked, in some jurisdictions, to remote symptom tracking (such as the automatic monitoring of surface body temperature) to block access to particular individuals at automated checkpoints. Facial recognition technology also played a role in securing circulation by enforcing quarantine restrictions and monitoring adherence to social distancing and masking requirements. The goal of such systems is to link spatial and temporal strategies via automated systems for identification and response. In both cases, automated systems supplement messaging and human tracking by acting directly on the lived environment. The article draws on research conducted at security trade shows during the pandemic to demonstrate that automated technologies for governing circulation predated the pandemic, which nevertheless spurred on their further development. The authors identify a novel form of mass customized biopolitics associated with the ongoing development of augmented and virtual reality. We might describe these automated forms of mediation as not just atmospheric but also environmental, insofar as the built environment becomes sensor, interface, and actant.

The regulation of mobility and circulation had differential effects for the disabled and the precariously employed, as contributions by Lauren Kelly and by Georgia van Toorn and Lloyd Cox demonstrate. In, 'Rapid Grocery Delivery and "Dark Jobs"', Kelly focuses on circulation in the workplace: specifically, the rapid transformations that grocery and delivery logistics made to address the spatial and temporal disjunctions of the pandemic. Kelly examines the way that the massive growth in online supermarket patronage during the pandemic reshaped both the consumption practices of Australian shoppers and the working conditions of Australian grocery warehouse workers. She argues that the pandemic offered an opportunity for the supermarket industry to experiment with the established logistical order, an experiment which cohered around three significant trends – the intensification of the bond between consumption temporalities and working temporalities mediated through digital shopping apps as interfaces; a growth in the number of precarious and casual workers absorbed into what have been traditionally relatively stable (if low wage) professions, and a blurring of the distinction between retail and logistical spaces, as 'personal shoppers' enter into consumption spaces to perform labour that would have traditionally been hidden in the space of the warehouse. Kelly argues that the shifts portended by the pandemic reveal and intensify existing inequities in the logistics space, with profound implications for workers' rights and the capacity to organize.

In 'Digital Citizenship and Disability in the COVID Era', Georgia van Toorn and Lloyd Cox consider the differential experience of disabled people negotiating the mediation and remediation of 'digital citizenship'. Van Toorn and Cox argue that the effect of the pandemic for the disabled was fundamentally ambiguous. The mass lockdowns instituted in

Australia, for example, served to in some sense ‘normalize’ the social isolation to which disabled people are often subject, and consequently spurred the development of ‘solutionist’ approaches to making work and entertainment accessible in a way that many disability advocates had long called for. At the same time, van Toorn and Cox challenge celebratory accounts of this shift – they note that such digitalization also placed these services outside the grasp of those on the wrong side of the digital divide, and that there was moreover a diminution in the provision of specialized forms of care in place of individualized ‘self-service’ approaches to the access of essential services. Drawing upon testimony from Australia’s recent Disability Royal Commission, van Toorn and Cox counsel that in the wake of the pandemic such tools of ‘digital citizenship’ have the potential to empower disabled people, but that there is a need to ensure digital citizenship goes hand in hand with the strengthening of the bonds of social citizenship, rather than serving as a vehicle for the individualization and marketization of state services.

A specific sensor technology for managing circulation taken up during the pandemic is the theme of Wilken & Goggin’s contribution: ‘QR Codes and Automated Decision-Making’. Drawing on two regional case studies of the use of QR codes during the pandemic in Australia and Singapore, the article considers the range of uses to which it was put: contact tracing, vaccination status, and access control. As in the case of other governance technologies mobilized during the pandemic – such as that of biometric access control canvassed in the contribution by Andrejevic et al. – QR codes were already being deployed before the pandemic to track the movement of goods, people and payments. QR codes require the active participation of users, who need to scan the codes and, at least in some applications, enter their information and configure their apps to access their health records (the theme of user participation finds interesting resonance with this volume’s contribution from Pink et al.). Unlike some other systems for access control, the codes are not purely passive – indeed, as the authors point out, pandemic applications reverse the spatial dynamics of their use: the codes remain stationary, while the scanners move along with individual users. The article concludes with a consideration of the political framing of the deployment of automated tracking and verification systems during the pandemic. Wilken & Goggin here highlight the difference between the Singaporean context, in which there was a relatively high level of trust in the government’s deployment of the technology, and the less coordinated and more contested response in Australia. These differences carry over into the transition to the virus becoming endemic, as some uses of the technology fade away while others persist.

The circulation of information is taken up by two news media focused contributions to this issue. Matamoros-Fernández et al.’s study of humans mimicking bot-like behaviour online focuses on the regulation of the information environment during the pandemic, especially the automated enforcement of platform regulations designed to thwart the spread of ‘inauthentic’ content. In some contexts, enforcement means using automated systems to detect and disable or qualify the automated circulation of content. However, there are a range of situations in which human users replicate activities that can be flagged for lack of authenticity – for example, by retweeting the same content in rapid succession. Moreover, the imperative to provide rapid, frictionless interaction with content leads to interface choices that make it easier for users to become bot ‘lookalikes’, rapidly swiping and scrolling through content. As humans behave more like bots (and

vice versa) managing and securing the circulation of information becomes an increasingly complex and, at times, fraught process. Indeed, the commercial imperatives of the platform, which encourage and promote bot-like behaviour on the part of users, contribute to the difficulty of distinguishing authentic from harmful or pathological activity. Thus, behaviour designed to amplify urgent, time-sensitive information about the pandemic may mimic strategies for boosting false information such as fake COVID-19 cures. The authors' detailed analysis of the use of Twitter to boost YouTube videos provides an example of the importance of 'platform observability' as a means of providing accountability for the governance of the circulation of information online, in the context of the pandemic and beyond.

The role of the newsroom in curating pandemic information is taken up in Montaña-Niño and Burgess's 'Beyond the Critical Incident', an ethnographic study of the use of automated tools to keep pace with the pandemic news cycle. Their article describes the pandemic as a decisive moment for the newsroom because of the rapid response it engendered in processes of news gathering and dissemination. The article's ethnographic approach captures the on-the-ground details of the pandemic response, highlighting, for example, the need to develop strategies for real-time updates and comprehensive forms of data visualization. The article usefully outlines the obstacles faced by the automation of real-time response in the newsroom, including the challenge of relying for information on government agencies that are either unwilling or unable to provide complete data sets in usable form. For governments, unsurprisingly, controlling the release of data is a means of controlling messaging, which, in turn, creates structural barriers to data access. While the article focuses on an Australian case study, it outlines similar challenges faced by media organizations globally, as well as the fact that automated systems for responding to fast moving situations like the pandemic remain in relatively early stages. This is an area to which recent developments in generative AI will likely contribute in the near future, highlighting the rapidly transforming temporality of response – and the processes of customization and targeting that accompany these changes.

Christopher O'Neill's contribution, 'Disaster, Facial Recognition Technology, and the Problem of the Corpse', takes up a different issue of temporality – the question of preparing biometric technologies for future pandemics and disasters. O'Neill frames the pandemic as a site of both disaster response and governmental experimentation. Taking the example of the development of facial recognition technologies by the Australian state under consideration, he examines the way that the disaster associated with the pandemic in Australia overlapped with that of the 2019–2020 megafires. During the megafires, facial recognition was used as a way of verifying the identity of disaster relief recipients (who might have lost other forms of ID when fleeing their homes), while during the pandemic several Australian states and territories used facial recognition technology as part of a check-in app that was compulsory for returned travellers. O'Neill argues that the use of the often-controversial facial recognition technology was justified here as promoting disaster resilience and as mitigating the traumatic experience of disaster itself. But he notes that such strategies also involve a mode of pre-emption, describing how Australian researchers are developing 'post-mortem' facial recognition technologies for use in the response to future disasters or mass fatality incidents. He argues that the 'restlessness' of the corpse serves to both undermine and propel these projects – the finitude

and decomposition of the embodied face serves to both limit and challenge forth the biometric apparatus' attempt to produce a singular and coherent trace from the embodied subject.

In 'Future notification: Living and Breathing in Post-pandemic Climate Change', Sarah Pink et al. look ahead to the future uses of automated technologies in ways that provide those who are subject to them with a sense of shared control. Their contribution focuses on the relationship between automated notification and air quality control. Smartphone alerts became prominent in the information landscape of the pandemic response thanks to the proliferation of exposure notifications, restriction updates and automated quarantine enforcement systems. Pink et al. address the question of how to incorporate notification systems into the routines of daily life in ways that allow user participation in meaningful ways. The ethnographic findings uncover shortcomings of fully automated approaches like Spain's *Respira* system. Pink et al. find that at least in the home people want to be part of the processes that regulate air quality by being enabled to respond in real time to notifications, as opposed to simply being alerted or 'nudged'. At stake in this article is the broader question of how automated systems communicate with their users in a range of contexts to enable co-participation in decision-making processes. There are thus lessons in their article for considering how to incorporate automated decision-making systems into the rhythms and practices of everyday life. These lessons might vary across differing environmental contexts: there may be some situations in which users are happy to have decisions fully automated, but when it comes to the home environment users expect to have the autonomy and flexibility to decide how to respond to the information generated by automated sensing systems. As the article suggests, this level of participation might by the same token foster a sense of participation in collective projects of environmental governance, including how best to address climate change or pandemic safety in ways that resist the self-generating and self-fulfilling 'crisis' mode that underlies the 'smartness mandate'.

For Heather Horst et al., the pandemic provided an opportunity to revisit and complicate the framing of the Global South as a locus and target of data extraction. Drawing on detailed case studies of organizations responding to the spread of COVID-19 in Uganda, Jamaica, and India, 'Beyond Extraction: Data Strategies from the Global South', develops a taxonomy of local data practices that challenge a one-dimensional model of data 'extractivism'. The authors develop the themes of specialization, localization and modularization to explore the ways in which data are collected, refined and used to serve the interests of local communities. Some of these practices avoid international circuits of data monetization by limiting the use of the data for circumscribed purposes such as coordinating the pandemic response in refugee settlements. Others, as in the case of India's *Blue Sky Analytics*, generate profits locally by refining available data – and making some of their products freely available. Identifying the shared logic of environmental and biological crisis, the company drew on data about the pandemic to develop insights about the impact of supply chain disruptions that anticipate the potential effects of disasters resulting from climate change – and future pandemics.

The use of automated technologies to respond to the COVID-19 pandemic highlights a crisis of control in the register of circulation. For Beniger (1982), the industrial crisis of the late 19th and early 20th centuries was one of production: the pace of

manufacturing outstripping that of consumption. In the current conjuncture, the crisis is, at least in part, a result of the technologically assisted circulation of information, people and goods. These contributed to the pace and scale of the pandemic, which, in turn, rebounded back upon them. The profound economic, political and informational interdependence of contemporary societies is enabled by the automated systems that govern all three forms of circulation. Their temporality and reach – both physical and informational – underwrite the functioning of the global economy, while also highlighting its vulnerability to forces that operate in a different register: that of the biological, ecological and socio-political. As Pink et al. argue in their contribution, ‘Climate change (and global practices that contribute to it) is plausibly understood as having constituted the very circumstances in which the COVID-19 pandemic was possible at scale’. Taking one step back, we would add that the automated information processing and control systems that helped accelerate the pace and scale of global production, transport and communication contribute to shaping the resulting crises: both climatic and viral. The consequent mobilization of automated systems in response to these crises seems all but inevitable. The intertwined nature of the cause and the response highlights the lesson of the pandemic: not that the technology will somehow end the crisis, but that it will internalize the logic of crisis so that both informational and biological viruses become endemic.

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