On July 24, 2020, Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases and the public face of the White House Coronavirus Task Force, spoke publicly about his decision not to travel by plane within the United States. Declaring that his age as well as his work-related exposures put him “in a risk category” for contracting Covid-19, Fauci proclaimed that infection was “a risk when you’re getting on a plane, particularly with the amount of infection that’s going on right now” (Oliver). At the time, public health officials and researchers had spoken with caution about air travel. One of the most widely reported stories of the summer involved claims by virologist Joseph Fair, who claimed that it was likely he contracted Covid-19 on a flight and attributed the infection to a failure to wear goggles in addition to his mask (Fieldstadt). Speaking amidst the second spike in confirmed US coronavirus cases, Fauci warned about the risk of flying at a time when domestic air travel was beginning to rebound from its low point on April 14, when some 87,534 passengers flew within the United States—down from the prior year’s daily total of 2.5 million passengers (Glusac). In contrast to the line drawn against air travel by Fauci, a flurry of subsequent news reports detailed airline safety procedures and ventilation systems, contending that the indoor air environment of modern commercial flights was safer than that of hospitals.
This included reports on a preprint study quantifying infection risk on a two-hour flight at 1 in 7,700 when middle seats are empty (Barnett)—likely lower than the risk of travel in enclosed car or other passenger vehicle with persons outside the household (Jayaweera et al.). These reports suggested that Covid-19 transmission in the air is possible but, in the words of Harvard public health professor Joseph Allen, “not the hotbed of infectivity that people think it is” (Kim; see also Le Page; Flam). As such, with growing numbers of people returning to the air and experts seeking pragmatic ways of navigating everyday life as the reality dawned that pandemic restrictions would constrain public contact over the course of multiple years, digital media turned to weighing different types of travel and contact risks. Consumers sought forms of prophylaxis for shared indoor air environments: air purifiers, K95 and N95 masks, elastomeric respirators, face shields, goggles, and even fully enclosed helmets and jumpsuits resembling Hazmat suits (see fig. 1).\(^1\) And although masking had already been common in a number of other countries following the SARS outbreaks in the early 2000s, the rapid proliferation of experimental forms of indoor air prophylaxis reflected the failure of a coordinated public health strategy.

These events in the United States signal some broader transborder developments that press scholars to analyze the linkage of environmental, public health, and medical thought and technology with crisis governance. If the government of risk in this instance is clearly part of a broader set of neoliberal rationalities to secure capitalist circulation of people and goods against the uncertainty of the environment itself (Beck; Collier et al.; Massumi), the emergence of prophylactic consumer cultures during the Covid-19 pandemic involves a particular attempt to problematize air space as a fluid medium of pandemic surveillance and management. As such, the dissemination of scientific research about the dynamics of airborne viral transmission involves public spectacles in which the scale of viral life and mobility “undoes,” in the words of Ed Cohen, the phenomenal orientations of biopolitics and institutes transitional “‘scalar narratives,’ stories that temporally bind up different ways of construing space” (Cohen 17). In this case, the consumer of commercial flights is conceived as an individual whose airflow may be managed through consumable prophylaxes that privatize air space in such a way as to decrease exhaled flows from other passengers. This reworking of public space ensures the filtering of air in such a way that it does not preclude either sight of or undistanced passage alongside others outside of the household. Privatizing airflow allows for mobility without distance, enabling group boarding, but comes at the cost of externalizing risks to airline and
manufacturing employees who form the chains of labor enabling prophylactic mobilities.

Thus, among the many challenges that the current Covid-19 crisis poses for theorizing power and inequality is the manner in which the production of air as a medium of viral transmission requires specific forms of media signaling that remake public space. In the intersection of medical and environmental knowledge, the current pandemic suggests transformation in the phenomenological productions of space and scale, coincident with the proliferation of forms of scientific knowledge and public surveillance that suggest emergent ways in which bodies are sorted and mobilized as infrastructure comes under increasing pressure to modulate viral transmission through interspecies interface among humans. As such, this short essay argues that indoor air flow dynamics constitute one major arena of biopolitical

Figure 1. Screenshot of Bloomberg News internet article on Covid “Hazmat Suits,” taken by author on September 22, 2020 from Jen Murphy, “Hazmat Suits for Air Travel Are Here,” Bloomberg, July 15, 2020, https://www.bloomberg.com/news/articles/2020-07-15/biovyzr-hazmat-suits-aim-to-make-flying-safer-during-coronavirus. Fair use: creation of image and transformation of underlying images through screenshot.
experimentation conjoining medical and environmental knowledge during the pandemic, demonstrating that the management of different scales of interspecies movement and connection is central to the lived experiences of pandemic surveillance and attempts to securitize some bodies and objects at the expense of others who serve as sinks of risk. The essay explores how fluid dynamics research in the virology of airborne disease recasts consumer air travel as a chain of fluid environments that may be surveilled, generically modeled, and securitized in order to ensure mobility of a bourgeois consumer–passenger, while externalizing air flow risk to more precarious bodies inside and outside of the plane. While environmentalists have already detailed the massive carbon footprint of air travel, intensified by policies in wealthy countries that have encouraged flying over high-speed ground transport, the pandemic presses environmental humanities scholarship to also consider the manner in which this “transportation utopia” advances forms of class-based inequality of mobility that link air travel to broader structural inequalities evident in the spread of Covid-19 along routes of capitalist production and distribution (Salvatore). Placing the rescaling of onboard viral management within the context of pandemic consumption practices and governance, the essay suggests that the intimate scales at which viral transmission is visualized in scientific and journalistic representation should cause environmental humanities and medical humanities scholars to engage with both intimate phenomenologies of air flow and dispersed cartographies of capitalist circulation and state border management that they enable.

Covid-19 and the Inequalities of Pandemic Mobility

Media attention to the risks of different forms of travel during the pandemic draws upon a long history of forms of environmental surveillance that link epidemics to public discourses and stereotypes about technology, race, nation, class, and gender. These forms of surveillance and social difference have been widely analyzed in social science and humanities works that analyze how epidemics are sites for governing the intersection of health and environmental phenomena (see Shah; Wald; Anderson; Cohen; Chen; Ahuja). Although many of the xenophobic discourses on diseases ranging from yellow fever to syphilis to Ebola involve a bourgeois, colonial fear of the outside of the home environment and a concomitant racialization of borders, cities, and/or wilderness as sites of emergence, by the 1980s and 1990s there was also growing attention to how the oversanitized, bourgeois indoor environment in first world settings was reconceived as a potential hazard. Airborne risks were increasingly conceived as a problem in indoor
air environments. In a key feminist technoscience analysis of the phenomenon in the United States, Michelle Murphy describes how feminist health activism, attention to radiation, microbes, and chemical exposures, and emerging scientific and regulatory rationalities converged to enable the creation of the epidemiological category “sick building syndrome.” The emergent surveillance of indoor air, ventilation, and air purity also involved the expansion of markets for air filters and funding for scientific research on the dynamics of airborne transmission of hazards. As environmental scientists, deploying physical science approaches to understanding airflow dynamics, developed models for tracking plume dispersal, microbial migration, and ventilation dynamics for understanding indoor air risk; this research was deployed by public health officials, transportation safety officials, and airlines to understand how planes might become transmission sites for airborne viruses—especially during the dramatic efforts targeting Chinese passengers and environments during the 2003–04 SARS outbreak (see Braun).

As such, by the onset of the Covid-19 outbreak, state and corporate surveillance of disease risk combined a very long set of historical technologies for border surveillance, environmental intervention, and epidemiological tracking with emerging technologies for assessing airborne risk, especially in enclosed air settings. Such technologies go beyond the problem of air flow, as they link disease emergence, environmental risk surveillance, and geographies of circulation in new pandemic narratives. In dramatic fashion, the pandemic spread of the novel coronavirus has brought about a series of state policies to burnish the surveillance and containment national space at borders, adding to the cascade of transnational forces—ranging from the breakdown of supranational organizations to post-9/11 militarization, from new refugee flows to the rise of a fascistic, anti-immigrant global right—that militate against popular metaphors of globalization that predominated in the social science approaches to space in the 1990s. The breaking up of atmosphere into the networks of indoor air environments connecting buildings and transport vehicles signals a form of pandemic mobility that securitizes flow in part by managing the exchange of air across the indoor/outdoor barrier as well as across differently populated indoor spaces.

Such a reconfiguration of secure mobility—available largely to those capitalized consumers who are able to transit in privatized spaces apart from packed in bodies—signals the barriers to the mythic globalization of space that purportedly brings bodies of different nations and classes together in the supposed postsocialist era. While acceptance of the idea of globalization’s “time-space compression”
(Harvey) was itself controversial among geographers at the time that neoliberals championed the notion of a shrinking world after the collapse of the Soviet Union (Kirsch), the shock to the global airline industry initiated by Covid-19 restrictions in both national and transnational contexts since early 2020 undermines central metaphors of the globalization literature. This literature indicated that the arrival of distance jet travel beginning in the 1960s—supplemented later by new information technologies—reorganized the relation of time and space in fundamental ways. The resulting emphases on speed as an indicator of late capitalism’s transcendence of space by time was, in retrospect, contradicted by pervasive structuring of “time-space expansion” through the establishment of new carceral technologies and forms of accumulation reliant on precarious racialized labor (Gilmore).

Such dynamics are apparent today in the intensification of unequal access to mobility evident in public health guidance focusing on minimizing contact outside the household without a concomitant minimization of consumption itself. The category of the “essential worker” that became prevalent in both journalism and in legal exceptions to stay-at-home and lockdown orders worldwide reflects this disparity, as essential labor is not narrowly conceived as medical labor but generalized to maintain the secure functioning of capitalist systems of circulation. The stories of high rates of infection among airline employees (especially early in the pandemic) and workers in food processing plants suggest the costs of this differentiation of required and expendable labor, as do stories of overwork and exploitation among Amazon employees and other high-volume logistics operations (Yeomans; Weise; Schlosser). In the United States, the costs of this unequal access to privatized air space, reflected in both who is expected to work in unsafe air settings as well as who is expected to be housed in either large institutions or shared airspace (prisoners, immigrant families, nursing home residents, etc.), have resulted in massive racial disparities and higher death rates among racial minorities (CDC; McClure et al.)

Prophylaxis: Narrating the Fluid Dynamics of Airborne Risk and the Rescaling of Space

The inequalities of the air during the pandemic have emerged alongside early confusion about the manner of pandemic spread. As such, there has been widespread public attention to scientific knowledges about airborne disease transmission as health authorities in institutions including the Center for Disease Control (CDC) and World Health Organization (WHO) have been slow to confirm the reality of
the airborne spread of Covid-19 and the necessity of masking as the most widely available preventive technology. Although scientific research about airborne viruses can theoretically be used for a variety of purposes including the development of policies to make indoor air safer across populations, the emergence of the pandemic in a moment of rising right-wing internationalism meant that development of large-scale public health infrastructures for maintenance of safe air—or even for more modest measures like mandated masking—was not adopted in many locations including the United States. Simultaneously, access to scientific research about airborne viral risk was made widely available in ways that attempted to rapidly disseminate information to lay readers. As health researchers increasingly publicized non-peer-reviewed research in preprint papers posted online, journalists began to rapidly comment on their findings, at times airing a confusing flurry of contradictory conclusions about controversies such as whether Covid-19 was subject to significant vector-borne surface transmission. Meanwhile, academic publishers worked to move key studies from behind paywalls into the public domain, most notably in new public archives such as Elsevier’s Public Health Emergency Collection of journal articles available free online (Elsevier).

Of course, such efforts at open access in a time of crisis do not simply increase public understanding of research. In Science and Technology Studies, the politicization of science has long been analyzed not as a simple “mistranslation” of what scientists think but rather as a complex process involving institutional, discursive, and governmental emphases that affect the circulation of scientific knowledge as it crosses publics and is taken up in practice (Latour and Woolgar). Thus, normative claims about the truth or falsity of public understandings of science, for example, in the debates over climate change (see Oreskes and Conway), are perhaps less significant for understanding crisis governmentalities as is tracking how scientific knowledge is inscribed within moral economies of health and liveliness, especially through connection to liberal notions of humanitarian virtue (Redfield). The Covid-19 pandemic has involved such highly ethically charged debates over individual public conduct, as the imperative to physically distance individuals and, later, to mask in public, were instituted unevenly by US states and municipalities. Failure to implement a coordinated public health response externalized pandemic governance to the sites of the household, the family, and the individuated human body, in turn reifying these sites as apparent zones of securitization. My point in critically analyzing this turn from institutional and large-scale responses to the pandemic to the individual is not to criticize masking or distancing as authoritarian moral
imperatives (see, for example, Agamben, qtd. in Dean), but instead to understand the larger context in which the individual, consuming subject becomes the primary speculative agent of pandemic security.

It is here that the dissemination of scientific literature and journalism about risk of airborne Covid-19 transmission aboard commercial flights takes on a historically and geographically specific form for the pandemic governance. On this point, I give a short reading of a key article in the literature by Sri Lankan environmental scientists Mahesh Jayaweera, Hasini Perera, Buddhika Gunawardana, and Jagath Manatunge entitled “Transmission of Covid-19 Virus by Droplets and Aerosols: A Critical Review of the Unresolved Dichotomy” and published in the journal *Environmental Research* (Jayaweera et al.). I am interested in both the arguments of this article and the visualizations included within, which work to demonstrate the significance of prophylactic interventions within the airspace separating individuals.

Noting the confusion over the dynamics of airborne transmission in research on Covid-19 transmission, the opening of the article explores how the “unresolved dichotomy” between large droplet transmission (theoretically controllable through physical distancing alone) and aerosol transmission (requiring more complex management of enclosed air space). The authors note the uncertainty of the precise pathways of airborne transmission at the time of writing despite widespread evidence that Covid-19 is indeed airborne: “The practice of social distancing and wearing masks has been popular worldwide in combating the contraction of COVID-19. Undeniably, although such practices help control the COVID-19 pandemic to a greater extent, the complete control of virus-laden droplet and aerosol transmission by such practices is poorly understood.” By modeling the spread of cough droplets in three enclosed environments—airplane cabins, passenger cars, and hospital rooms—the authors examine how individuals occupy spaces of potential transmission and communicate aerosolized viral particles across bodies. While each of these settings provides infection risk, the authors contend that airlines combine masking and ventilation interventions that are able to significantly reduce the airborne risk of disease, in contrast with air-conditioned passenger cars and hospitals. Concluding that hospitals especially need significant improvements to ventilation systems even with masking protocols, the article highlights the importance of nosocomial transmission in healthcare settings and demonstrates how a combination of masking and ventilation interventions results in decreased risk of indoor infection.

The authors use droplet modeling to visualize how droplets spread disease. On this point, they offer a polemical critique of the existing
literature on Covid-19 in order to clarify that the *dynamics* rather than the simple *cause* of transmission is vital for public health responses:

Less attention has been focused on the whole in controlling virus-laden droplet and aerosol shedding, their transport phenomena, and plausible methods of their dilution and destruction in different indoor settings. With more COVID-19 cases reported worldwide, evidence-based decisions need to be adhered to in combating the disease, especially for situations in confined environments. The transmission of droplets and aerosols within confined spaces becomes profoundly complex phenomena, and the real trajectories under different microclimatic conditions are poorly understood. The aggressive nature of the disease is directly connected with the transport phenomena of both droplets and aerosols, and the comprehension of such phenomena is vital in controlling the spread of the disease within such confined spaces. Aerodynamic engineers, therefore, need to network with virologists to fully understand the possible trajectories of the viral spread within such confined spaces. In this context, computational fluid dynamics could be made use of, to simulate the trajectories resulting from coughs and sneezes of an infected person within different confined settings.

Noting that “no conclusive studies have been conducted on differentiating between the modes of transmission of viruses via droplets and aerosols,” the authors signal that the article will disentangle the risks of the two in order to gain a wholistic vision of enclosed air transmission.

As such, the authors provide images depicting how exhaled air traverses enclosed environments, carrying with it the potential for infection. I am interested in examining how these images conceptualize index patients and at-risk persons in the shared environment, as well as how the detailing of airborne turbulence, particle force, and environmental conditions affect the risk of transmission. In these images, the intimate connections of bodies and the invisible particles they shed are rescaled (with the droplets and aerosol clouds magnified) in order to visualize airborne viral transmission, in the process configuring stationary figures of risk amidst expanding clouds of fluid and turbulent airborne contact. Even as these figures of risk are visualized in close contact in enclosed settings, prophylactic technologies and ventilation flows become significant actors in the images that control how bodies interface. As such, these images imagine the individuated consumer of

Fluid Pandemic
enclosed air as a navigator of invisible viral turbulence who can effectively manage the potential of Covid-19 transmission in the event that both personal prophylaxis and environmental management are in place. Imagining how air space may be divided up at the site of bodies, and how its flows may be managed through infrastructure, the authors affectively model the potential for the “dilution and destruction” of Covid-19.

There are four key images that visualize the twin risks of large droplets and aerosols in the article. In fig. 2, the authors differentiate the spread of regular exhalation, coughing, and sneezing. Identifying coughing and sneezing as sources of a “turbulent gas cloud” carrying viral particles, the image measures airborne risk in terms of distance from the index patient, depicting large droplets falling precipitously but aerosol clouds lingering at eye level. Figure 3 depicts how respirators block both the exhaled and inhaled particles, offering a unique

Figure 2. “Trajectories of droplets and aerosols from an infected patient” (in Jayaweera et al.). Public domain.
layer of protection in a face-to-face encounter between two bodies. Envisioning increasingly effective prophylactic measures adopted by the index case on the left, the risk to the potential host on the right decreases. Envisioning the uncovered face as the most amplified risk of airborne transmission by both droplet and aerosol, the different types of masks examined filter out a larger proportion of aerosols even if

Figure 3. “Trajectories of droplets and aerosols from an infected patient in the event of coughing with different masks and respirators” (in Jayaweera et al.). Public domain.
large droplet protection is relatively stable. The authors contrast this in the text with a scenario of uncovered faces (fig. 4), wherein the failure of the index case to appropriately apply facial coverings results in the potential host covered in viral droplets and aerosol cloud, reliant on respirators as the last possible line of defense against airborne

Figure 4. “Trajectories of droplets and aerosols inhaled from a susceptible host” (in Jayaweera et al.). Public domain.
transmission. In this series of images, the fluid dynamics of airborne transmission of Covid-19 reflects a conception of individuated disease citizenship (see Anderson; Ong) requiring a reciprocal relation between individuals. While this envisions technical solutions to the broadly social and environmental problem of pandemic transmission, it also offers a form of representation that encourages the segmentation of air space in ways that underpin the roles of individuals in transmission. Managing both distance and the gaseous expansion of bodily touch in enclosed environments, the images are geared toward magnifying viral particles, sorting them into different types of objects that transit space on a gravitational arc (large droplets) or via cloud turbulence (aerosols), and ultimately bump up against forms of consumer prophylaxis that may segregate bodies sharing air space.

Yet this scene of transmission becomes more complex as the authors consider infrastructural factors and group behaviors. Figure 5 demonstrates that the air space is shared across more bodies, and that the indoor air infrastructure significantly affects the face-to-face interaction
visualized in the earlier images. Interacting the effects of ventilation (using HEPA filters) with the turbulence of cough plumes, the model of airborne transmission once again emphasizes the importance of masking, which can reduce the number of potentially infected rows from the index patient from four to two. Noting the manner in which air is pushed to the side of the plane from the center and replaced by external air, the ventilation pattern is such that the force of the exhalation plume must both overcome the ventilation and any prophylactic devices. As such, the N95 mask appears as the apogee of prevention, requiring widespread adoption in indoor air environments in order to ensure that infrastructural ventilation can truly manage the amplification of aerosolized droplets as well as their turbulent dispersal through coughing or sneezing.

Scientific representation of Covid-19 transmission on airplanes in this case visualizes potentials for infection as a matter of group behaviors tied to an imperative for masking, even as the frame of representation excludes other potentials: that the movement of flight attendants up and down aisles or the use of the lavatories multiplies risk; that the housing of airline employees in indoor hotels may multiply employee risks; and that mask production facilities may concentrate risks for workers. The point of naming such externalities of the visualization of airborne Covid-19 transmission is not to criticize the authors for their important and pathbreaking research into airborne transmission—research that is a vital part of socially just responses to the inequalities of the pandemic. It does instead highlight how the dispersal of risk into the public domain in the absence of adequate public health response tends toward the construction of new forms of consumer citizenship during the pandemic, requiring that some laboring bodies shoulder outsize risk of securitizing the mobile consumer subject, even as investments in ventilation provide a sign that more broad scale measures are on the horizon of the next phase of pandemic biopolitics.

NOTES

1. This set of new consumption practices may soon be supplanted by other organized strategies to restore confidence in flying. By Fall 2020, airlines had joined together to call for rapid antigen tests at airports as a new layer of security screening prior to boarding (CNBC).

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