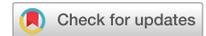




COMMENT



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# Pandemic politics—lessons for solar geoengineering

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Responses to the COVID-19 emergency have exposed break-points at the interface of science, media, and policy. We summarize five lessons that should be heeded if climate change ever enters a state of emergency perceived to warrant stratospheric aerosol injection.

The response to the COVID-19 pandemic is a standout example of rapid and drastic action worldwide. Faced with a global emergency, many countries responded in an anticipatory manner, based on predictions from computer models: lockdown implementations in the United States and the United Kingdom followed policymaker briefings on projections of millions of deaths from the Imperial College epidemiological model, which relied on assumptions from the limited data available early in the pandemic.

Up to the present, the response to threats from climate change has been much slower in aggregate, despite some recent progress. However, as the effects of climate change become more severe, it is possible that rapid action will be deemed desirable. Stratospheric aerosol injection has been proposed as a fast means of cooling the Earth: a release of reflecting aerosols into the upper layer of the atmosphere is expected to block a fraction of the incoming sunlight<sup>1</sup>. Stratospheric aerosol injection is often framed either as an emergency measure or as an (arguably cheap) stopgap approach to buy time for mitigation. But awareness is low among the public as well as policymakers, and there are uncertainties in the simulated climate response to the technique, as well as uncertainties around potential impacts and governance challenges<sup>2</sup>.

If the concept of stratospheric aerosol injection leaves the realm of modeling, it will be thrust into a multi-societal science–media–policy interface that operates in ways that are not currently anticipated—at least not in idealized model simulations or unitary rational actor governance scenarios<sup>3</sup>.

The world's responses to COVID-19 provide an opportunity to study how the science–media–policy environment both responds to and shapes the politics of novel risks and emergency measures. COVID-19 and climate change are very different challenges, and they happen on different timescales. Nevertheless, responses to both crises must navigate the same political terrain and the same media ecosystem.

Here, we argue that five important insights from the COVID-19 response can guide efforts to tackle an emergency scenario in climate change: (1) maintain a broad scope of desirable outcomes; (2) negotiate fractured governance on the global scale; (3) take into account the volatilities of new media technologies; (4) be alert to policymakers' ulterior motives; and (5) ensure bought time is well spent.

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**Five lessons:****1. Narrow metrics seem user-friendly—but can create new problems.**

Using narrow metrics to define a problem, or the success of a policy, can obscure other important goals. The response to the pandemic has been guided by calculable parameters, such as case count, or the reproduction number,  $R_0$ . This bears the danger that the metric becomes the target of policy, and thereby the metric starts to define the solution. With the pandemic, we could have weighed the public health effects of lockdown measures themselves, including missed screenings and treatments, delayed vaccinations, mental health impacts, and food insecurity, as well as the economic and social impacts. In addition, the blanket strategies aimed at particular metrics missed the equity dimensions of who bears the harms from the measures: much of the burden of lockdowns falls upon the global poor<sup>4</sup>. Moreover, longer-term aims of dealing with root causes of zoonotic disease transmissions were eclipsed.

The media's interest in trackable metrics may exacerbate such narrowing of policy goals. But the challenge of translating model knowledge into real-world actions also contributes. For example, the reproduction number has been mobilized in policy as a population-wide metric in some jurisdictions<sup>5</sup>.

Climate policy too has become focused on a single metric, global average temperature<sup>6</sup>. This number is merely a proxy for a multitude of desired outcomes including human security and sustainable development, biodiversity, inter-generational justice, etc. If this metric begins to define the solution, a strategy that is measured in terms of global mean temperature, like stratospheric aerosol injection, looks attractive. However, for climate change as for the pandemic, whole-of-society strategies that take in a broader range of goals are also needed. We must strive to understand the second-order effects of various measures, from mitigation and adaptation policies to climate engineering. And the root causes must not be forgotten.

We are in the early days of understanding complex socio-ecological interactions. But the remedy here is not simply to perfect a single, dominant methodology. Rather, multiple methods are needed to inform whole-of-society responses to wicked problems—complex social problems that are inter-dependent on other problems and have no single or final solution<sup>7</sup>—such as climate change.

**2. Global governance is fragmented or missing.**

The diverse responses to COVID-19 in different countries sharply illustrate that we do not have a single global society. Different societies have different priorities, interests, and cultures of knowledge and policy, and game-theoretic modeling is not sufficient to explain them. As a result, the COVID-19 responses have been a mosaic of different strategies and controversies. The rush to compete for vaccines, medicines, and equipment, along with attacks on the World Health Organization—the only international organization available—show that global governance and common interests are ideals to aim for, but cannot be assumed to be in place<sup>8</sup>.

By cementing nationalist response patterns, the reactions to the pandemic have arguably left the world (even) less well prepared for dealing with climate change. Much modeling of stratospheric aerosol injection assumes a singular global aim and comprehensive global governance that approximates this world-aggregation. Yet the fractures of the international system mean that such a global

planner, whether it be an institution or an algorithm, does not exist.

**3. Media technologies create new volatilities for science and policy.**

Technology platforms are affecting societal debates in new ways, with emerging dynamics around both the sense of emergency and the perceptions of what constitutes an appropriate response. These dynamics vary between countries. In some countries, technology platforms offered an opportunity for jurisdictions to tighten social surveillance related to COVID-19 as well as an opportunity to try to improve their image globally. In other countries, social media platforms like Facebook, Twitter, and YouTube, along with new and established media organizations, created both cohesion and divergence. For COVID-19 in the US, one set of social norms, encouraged by established media organizations and promulgated through social media platforms, emerged around a singular idea of what “the science” dictated. At the same time, polarization and divergence emerged around key elements of the response. Compounding these dynamics is the affective dimension of social media use: for example, a study in China found that anxiety and depression during COVID-19 were associated with exposure to social media platforms like Weibo and WeChat<sup>9</sup>.

If the debate around responding to climate change by stratospheric aerosol injection enters a similar dynamic, a single narrative of what “the science” on the technique says could cohere and dominate the mainstream media outlets, while simultaneously, public views could become polarized. This could be dangerous if the mainstream media position emerges as a blanket votum, regardless of whether it is for or against stratospheric aerosol injection: for any narrative to become unquestionable dogma is against the core idea of scientific inquiry. In addition, like for COVID-19, a sense of anxiety around the idea of climate emergency could influence decision-making on stratospheric aerosol injection in unexpected—and potentially unhelpful—ways.

What remains to be studied is how the dynamics of social media are feeding back into the conduct of the science itself. For example, the high-profile retraction<sup>10</sup> at *The Lancet* of a paper indicating that hydroxychloroquine was not effective provoked questions in the media about the politics of the journal. The decision to publish the article in the first place highlights the structural question of how media and political implications might influence research in unhelpful ways. Consider the case of a model, published<sup>11</sup> in *Science*, which suggested a herd immunity threshold for COVID-19 at 43%. The editors were concerned that the finding would be used to downplay concerns about COVID-19, and discussed whether publishing the results was in the public interest<sup>12</sup>. In this feedback loop, journal editors are grappling with the anticipated media response to findings.

When it comes to stratospheric aerosol injection, this is a dangerous place to be. On one hand, scientists might be incentivized to perform modeling on questions with a strong narrative appeal; on the other hand, they might face pushback from the community if their results challenge what is seen to be in the public interest. Such feedback loops are detrimental to the pursuit of science, but if we identify them, we may be able to change them.

**4. Politicians may take action for the sake of action—or worse.**

Politicians may use performative measures to advance unrelated goals. For example, with COVID-19 in China, it was important to demonstrate that the outbreak was under control. The allure of performative measures potentially

includes democratic regimes that may find themselves under pressure to demonstrate doing something, especially if they are constrained from taking other actions by vested interests. For example, in the US response to COVID-19, the lack of a response from the federal government led state governments to turn to mask mandates, which were a highly visible, universally experienced, and low-cost precautionary measure. Strict mask mandates led to debates about the evidence base for them, with the risk that extensive debates on masking policies may draw attention away from more complex and less visible social and policy challenges, like how to protect people in care homes.

Similarly, being seen to carry out an adequate or even aggressive response to climate change may become a part of maintaining regime legitimacy. Stratospheric aerosol injection may be a similarly performative measure that a politician can introduce before there is a strong evidence base supporting or detracting from it. In a limited attention economy, stratospheric aerosol injection may then distract from a regime's failure to adapt or mitigate, as well as draw focus away from other climate goals.

#### 5. Buy time only with a plan in hand.

Stopgap measures to buy time for longer-term action carry the particular risk that the initial objective is forgotten, and eventually maintaining the stopgap becomes the goal. Alternatively, there is a risk that the time that is bought is not used efficiently, which makes it necessary to perpetuate the stopgap. The definitions and conditions of ill thought-out stopgaps can morph as time passes. With the pandemic, lockdown measures were introduced as a way to “flatten the curve”. They were intended to buy time to scale up testing and contact-tracing capacity, procure protective equipment, and learn how to treat the virus. This strategy was effective in some nations. However, in the US context, the time that was bought with the lockdowns in March and April of 2020 was not used well, and by the summer of 2020, the US faced a strong resurgence in cases.

When it comes to climate change, stratospheric aerosol injection has been discussed as a stopgap measure that can buy time for more systemic solutions<sup>13</sup>. Experience with COVID-19 illustrates how, especially under poor leadership, publics may misunderstand the goal, duration, and nature of the stopgap measure, and politicians may not be held accountable for failing to make use of the time. For stratospheric aerosol injections, ideally, the bought time could be used to decarbonize, bringing emissions to net-zero and developing capacities to remove carbon from the atmosphere. But the mechanism for holding politicians accountable to those goals has yet to be developed, and future politicians may decide to change the goals. With stratospheric aerosols, widespread public discussion well in advance may help mitigate some of the risks of it becoming an interminable stopgap.

#### Towards anticipatory research

COVID-19 has been a stress test for the interactions between science, media, and politics both nationally and globally, and it has revealed complex and potentially harmful dynamics in the links between these spheres. The pandemic response further highlights the need not just for anticipatory governance, but for transdisciplinary, anticipatory research ahead of an actual emergency.

For the case of stratospheric aerosol injection in a climate change emergency, we need research that is reflexive about how its implementation may be attempted by real-world (instead of imagined) policymakers in sub-optimal situations, for example, as

a performative measure or as a shifting stopgap. Some of the open questions and governance challenges identified here cannot be addressed by scientists alone. Others, however, are well within the influence of individual research groups and institutions. We need a very broad range of expertises, including psychologists, sociologists, economists, development practitioners, International Relations experts, and others working together to produce this reflexive research.

It would be desirable to have a pre-developed policy tool that helps foresee complex socio-economic consequences, can be employed by a transdisciplinary network and is legible to diverse publics. Such a process cannot be summoned at will during a crisis. Given the centrality of scenario analysis in the climate discourse, international, transdisciplinary scenario research (combining climate science, impact assessment, and integrated assessment) would be highly desirable<sup>14</sup>. It is important to have a diversity of thought within—not only between—disciplines, to avoid groupthink and bandwagoning. Researchers can inoculate against this risk by using what's been called a “red team/blue team” approach, where some research groups work on best-case use scenarios while other teams systematically look for failure modes, as David Keith and others have discussed<sup>15</sup>.

Despite what COVID-19 has revealed about the dysfunction of the science-media-policy ecosystem, it also contains a hopeful lesson: people are willing to take radical action to save the lives of the vulnerable. Around the world, there has been wide compliance with social distancing during the first months of the pandemic even though many groups bear little risk from the virus themselves. The experience with COVID-19 suggests that the possibility of an altruistically motivated climate intervention should not be discounted.

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### Author contributions

H.J.B., O.G., M.S., and O.C. contributed to the conceptualization and writing of the manuscript.

### Competing interests

The authors declare no competing interests.

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