



Mistrust in Numbers: Regulatory Science, Trans-science and the Crisis of Expertise

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Mistrust in Numbers: Regulatory Science, Trans-science and the Crisis of Expertise

Gil Eyal

Abstract This paper characterizes the crisis of expertise, especially as it manifested during the covid-19 pandemic, as a crisis of trust in regulatory science. The temporal structure of the facts produced by regulatory science differs from Kuhnian “normal science,” while they also contain profound distributional implications. As a result, they suffer from a set of congenital problems that provoke mistrust in a way that normal science facts do not. While “expertise” is often offered as an answer to these problems, the paper shows that it is a symptom of the malaise, reflecting a situation where it is no longer clear how to decide between competing claims to authority as experts. The current mistrust in experts and regulatory science during the pandemic, therefore, is part of a longer and systemic crisis of expertise provoked and sustained by multiple factors. The paper then offers an unsystematic set of rules of method to observe when addressing the thorny issues involving trust and mistrust: 1) trust is not a subjective attitude that can be measured by a survey; 2) mistrust is not the opposite of trust; 3) trust is a social skill involving a set of ethnomethods for distinguishing between responsible and “blind” trust; 4) attention to temporal framing is key to these methods; 5) disruption of this temporal framing – as routinely happens with regulatory facts, and especially during the pandemic – destroys trust.

I want to start with a brief exchange conducted on the online forum, *Covid-19 Together*, early in the pandemic:¹

Ghost3333: Why are people still believing the CDC and their guidelines? They have consistently delivered misleading and reckless advice that has been disproven and that goes against common sense. [...] I would just treat it as Schrödinger’s virus. Everyone including myself both have it and is contagious and also doesn’t have it and is immunocompromised and act accordingly. Stay

¹ Covid-19 Together is an online community started in mid-March 2020, where those who tested positive for Covid-19, were presumed positive, or had family members who had Covid-19, share their experiences. The forum is a part of a general-purpose social media site where anyone can start a new discussion board. The forum has no formal ties to any medical, scientific, or pharmaceutical organizations. Over four months until mid-July 2020, it had over 24,000 users who contributed to the forum by posting. Most users, but by no means all, were from the US. *Covid-19 Together* is focused on being “a space for folks who tested positive for Covid-19 to share your experiences, resources, and let off some steam!”. It is moderated by a small team of users who remove irrelevant posts and attempt to uphold community standards, guarding the forum against trolls. Consequently, it was far more civil than many other forums. For more details, see L. Au and Gil Eyal, “Whose Advice is Credible? Claiming Lay Expertise in a Covid-19 Online Community,” *Qualitative Sociology* (2021).

in quarantine until we know more. Don't risk further spread until we have antibody tests and have peer reviewed studies that tell us how long viral shedding goes on for.

OnTheVerge: What are you talking about Ghost3333? The CDC is one of the only reliable sources of guidance, it's the public officials that don't listen to them that has been causing harm. What misleading/reckless advice have they been delivering? They have been releasing information as they learn more and constantly updating the public with their constantly evolving understanding of the virus.

Ghost3333: "Covid-19 isn't airborne". This was wrong. "Don't wear masks they're not effective". This was wrong. "Just wash your hands and don't touch your face". This was wrong. "Asymptomatic people can't spread the virus". This was wrong. "The virus can't spread on packages". This was wrong "Just quarantine for 14 days if you start feeling sick then you can pop back to work and be around you grandparents again when your symptoms have gone". Whoops you've been symptom free for a week but you are still testing positive, our bad... Those blindly following official guidelines and not using *their own common sense* are endangering everyone.

This hits close to home. I suspect we all found ourselves in a similar debate at one point or another over the last year and a half. Maybe, like Ghost3333, we were profoundly mistrustful and cynical; maybe, like OnTheVerge, we rose indignantly to the defense of the CDC, Fauci or whoever; or maybe, we can now bashfully admit, we played for both teams at different times?

So let's get some things out of the way: vaccines work, the planet is warming (and it is round, by the way), the evolutionary record is overwhelming, most people (if you ask them) say that they believe in "science". This is not the issue. The issue is mistrust in *regulatory science* of the sort that is conducted in the CDC, FDA, EPA, OSHA, the National Academy of Sciences, their sister agencies in other liberal democracies, or by academic and industry scientists responding to the Agencies' regulatory mandates. This mistrust is neither surprising nor new, though it has intensified of late.

The very term "regulatory science" was invented by these agencies in the 1970s. The emphasis was on the "science" part of the compound word. They wanted to impress upon their critics that what they are doing is "science," that they are merely translating regulatory goals mandated by law (e.g. "clean air") into objective, neutral, scientific measurements and tests. But this was never quite convincing. The facts produced by regulatory science are very different from the facts produced by "normal science" a-la-Kuhn.² Their temporal structure is different. Normal science facts are open-forward in "reversible time." At least in principle, one can always roll time back and run the experiment again, modifying another element. Consequently, in the small core-sets of similarly skilled and similarly equipped scientists, nobody, however iconoclastic, is ever told to "believe the science" or "follow the science."

Regulatory science facts, in contrast, take the form of cutoffs, thresholds and "acceptable levels" that trigger a *decision* about how to act in the present. This action often carries irreversible distributional consequences. For example, the pH-level at which a lake is considered "acidic" is one of these cutoffs.³ The Americans set it at five

² Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962).

³ Michael Oppenheimer et al., *Discerning Experts: The Practices of Scientific Assessment for*

and the Canadians (and most others) set it at 6. The choice of this convention may be justified by a probabilistic risk/benefit calculation, but it is not value-free. What's built into the convention is the value concept of "damage" – when is damage "real" and when is it just "change" or "natural variability"? When is it damage that we care about? If the lake is considered acidic, polluters must pay and retool. If it is not considered acidic, adjacent communities suffer the consequences of depleted fishery without recompense. If they protest, they are told to "follow the science." Closer to present concerns, consider this little number that has come to rule our lives during the pandemic - the positivity rate. This too is a regulatory cutoff. It triggers a decision whether schools and businesses must close. Not only does the number incorporate value choices, it is also a probabilistic forecast, extrapolating scant data from the past based on all sorts of untested assumptions about how people will behave in the future. The distributional consequences are profound. Is it surprising that people, even though they are told to "follow the science," reverse-engineer the calculations and express mistrust in the stated and unstated assumptions that went into the cutoff?

Such regulatory facts suffer from a set of congenital problems and provoke mistrust in a way that normal science facts do not. The cutoff converts uncertainty into calculable risk. The assumptions necessary in order to do so create ignorance about everything that was left out of the calculation.⁴ For example, if you assume – based on past data – that only symptomatic people can infect others, you remain profoundly ignorant about the spread of the virus in the asymptomatic population.

The cutoff triggers reactive adjustments in those it purports to measure, and thus genuine indeterminacy of the relevant parameters.⁵ The calculation of the positivity rate assumes that everybody plays the part assigned to them in the model, but the people affected by school and business closures respond by attempting to game the calculation.

Finally, Ghost3333's litany of wrong guidelines underlines that change in regulatory facts, this "constantly evolving understanding," to which OnTheVerge alludes, is not perceived as "progress," but as evidence of failure and dangerous misguidance.

The answer that is usually given to these concerns is "expertise." Despite the uncertainties and indeterminacies, the value choices and occasional misguidance, decisions must be made, and so isn't it better that they would be made by people with the right knowhow and experience?⁶ Unfortunately, "expertise" is not a panacea, but a symptom of the malaise. This word too has a history, and a fairly recent one. It was only adopted into English in the late 19th century, and only came into wide circulation in the 1960s.⁷ The historical pragmatics of "expertise" – who uses this word? In what context? When? Saying what to whom? To what purpose? – demonstrate that the need for this

Environmental Policy (Chicago: The University of Chicago Press, 2018), 42-45.

⁴ Brian Wynne, "Uncertainty and Environmental Learning: Reconceiving Science and Policy in the Preventive Paradigm," *Global Environmental Change* 2 no. 2 (1992): 111-127.

⁵ Ibid.

⁶ Harry Collins and Robert Evans, *Rethinking Expertise* (Chicago: The University of Chicago Press, 2007).

⁷ "Books Ngram Viewer," Google, accessed June 9, 2021.

https://books.google.com/ngrams/graph?content=expert%2Cexpertise%2Cprofession&year_start=1800&year_end=2019&corpus=26&smoothing=3&direct_url=t1%3B%2Cexpert%3B%2Cc0%3B.t1%3B%2Cexpertise%3B%2Cc0%3B.t1%3B%2Cprofession%3B%2Cc0

word first arose in contexts where it was unclear who the experts were.⁸ As long as it was fairly clear who the experts were, nobody needed a word to interrogate what makes them into experts, or to rank who is more or less of an expert. We have need for this word now, however, because we inhabit a world in which there are multiple claims to be recognized as experts, intense competition between claimants, and no established way of deciding between them. This resonates with our pandemic experience. Who has the relevant expertise to deal with the pandemic? Who should be, as OnTheVerge says, “our reliable source of guidance”? Should it be infectious disease specialists, like Fauci and Birx and the ones at the CDC, even though they don’t always agree with one another,⁹ and have given contradictory messages, as Ghost3333 recounts? What about virologists? They know a lot about how viruses work, but very little about how *people-with-viruses* work. Epidemiologists construct models to forecast the course of the pandemic, taking into account how people behave, but whose models should we believe? Some models were clearly wrong.¹⁰ A large contingent of epidemiologists came out vehemently against what they considered to be an over-reaction based on weak data. This begun with John Ioannidis at Stanford and ended on the other coast with the “Great Barrington Declaration”.¹¹ Physicists look down with disdain on the modelling skills of epidemiologists and their attempts to calculate under conditions of radical uncertainty and indeterminacy. In Israel, the physicists ousted the epidemiologists and led the pandemic task force advising the Prime Minister. Politicians, governors, mayors, and generals have made the case that the pandemic is, first and foremost, a political, governmental, logistics challenge, about which they know much more than the experts. Openly scornful, Andrew Cuomo, the Governor of the State of New York, said that he does not trust “the experts” (insisting on the air quotes). Nine of the state’s top public health officials resigned in protest.¹² And of course, there’s the social media voices, the “coronavirus influencers,”¹³ who have their own opinions and advice, following their “own common sense,” as Ghost3333 admonishes.

This situation is not unique to the pandemic, nor is it the product of malevolent

⁸ Gil Eyal, *The Crisis of Expertise* (London: Polity, 2019).

⁹ Mark Mazzetti, Noah Wieland and Sharon La Franiere, “Behind the White House Effort to Pressure the C.D.C. on School Openings,” *New York Times*, September 28, 2020, <https://www.nytimes.com/2020/09/28/us/politics/white-house-cdc-coronavirus-schools.html>

¹⁰ Sharon Begley, “Influential Coronavirus Model Uses Flawed Methods and Should Not Guide US Policies, Critics Say,” *STAT*, April 17, 2020, https://www.statnews.com/2020/04/17/influential-covid-19-model-uses-flawed-methods-shouldnt-guide-policies-critics-say/?utm_source=STAT+Newsletters&utm_campaign=1460a88749-Daily_Recap&E2%80%A6

¹¹ “Great Barrington Declaration,” accessed January 25, 2022. <https://gbdeclaration.org/>; John P. A. Ioannidis, “A Fiasco in the Making? As the Coronavirus Pandemic Takes Hold, we are Making Decisions Without Reliable Data,” *STAT*, March 17, 2020, <https://www.statnews.com/2020/03/17/a-fiasco-in-the-making-as-the-coronavirus-pandemic-takes-hold-we-are-making-decisions-without-reliable-data/>

¹² J. David Goodman, Joseph Goldstein and Jesse McKinley, “9 Top N.Y. Health Officials Have Quit as Cuomo Scorns Expertise,” *New York Times*, February 5, 2021, <https://www.nytimes.com/2021/02/01/nyregion/cuomo-health-department-officials-quit.html>

¹³ Ryan Broderick, “I am not an Epidemiologist, but...: The Rise of the Coronavirus Influencers,” *Buzzfeed News*, March 18, 2020, <https://www.buzzfeednews.com/article/ryanhatesthis/im-not-an-epidemiologist-but-the-rise-of-the-corona>

forces seeking to confuse and distract us from the clear scientific message (though there are definitely some bad actors out there). The reasons were summed up in Niklas Luhmann's supremely cynical aphorism: "an expert is a specialist to whom one can put questions that he is unable to answer."¹⁴ The scientist in her laboratory is a specialist. She knows more about her research topic than almost anybody else in the world. But once she steps outside the laboratory to play the role of an expert, she will be asked questions about which she knows much less. The virologist will be asked if 4, 5 or 6 feet of distancing is necessary, or if 3 feet suffice for children under 12? She will have to resort to judgment, estimation and assessment to address these. Hers will be an educated guess, no doubt, but has she considered the ventilation in inner-city classrooms, kids' tendency to leave their seats, and the relevance of their parents' occupations? The questions we ask experts "overflow," as Michel Callon says, the strict parameters of their specialism. Few of them respond by saying "I don't know."¹⁵ Instead, they are tempted to offer educated guesses and value choices camouflaged as "risk analysis."

For these very reasons, Alvin Weinberg, at about the same time when "regulatory science" was coined, offered a different compound word for what the Agencies were doing – "trans-science."¹⁶ The compound emphasizes not the "science" part, but the "trans" part. The point of the compound is to say that what the agencies are doing, these numbers they are producing, is not exactly the same as "science" proper. Weinberg wanted to protect science from the feedback effect that was likely to follow from scientists playing the role of risk experts. Calling it "trans-science" was meant to remind scientists not to stick their necks out too far, to recognize "the limits to the proficiency of their science," and thus keep science buffered from the chaos that was likely to erupt on the other side of the boundary. If "regulatory science" confirmed the critics' worst fears about the scientization of politics,¹⁷ "trans-science" anticipated a recursive *politicization of science*¹⁸ as its boomerang effect. This is the predicament we still find ourselves in, 40 years later. The crisis long preceded the pandemic and even the rise of right-wing populism. It is a systemic crisis and not the product of this or that event. Nor is it due to the rise of the internet and social media (though they probably aggravate it).

The image I use for the crisis is of a "vortex."¹⁹ The idea behind this imagery is that there are several different "engines" supplying the process with energy, but their vectors point in somewhat different directions such that while they seldom cancel one another, they lock each other into this self-sustaining circular movement. The imagery also means that any of these engines operating by itself would not have led to a protracted crisis. It is their interaction and mutual amplification that drives the process. In the preceding, I listed several of these engines: the growth of regulatory science and the multiplication of demands for protection directed at it; the intensifying jurisdictional

¹⁴ Quoted in Gotthard Bechmann and Imre Hronszky, *Expertise and its Interfaces* (Berlin: Edition Sigma, 2003).

¹⁵ Michel Callon, Pierre Lascoumes and Yannick Barthe, *Acting in an Uncertain World: an Essay on Technical Democracy* (Cambridge, MA: The MIT Press, 2009).

¹⁶ Alvin Weinberg, "Science and Trans-Science," *Minerva* 10 no. 2 (1972): 209-222.

¹⁷ Jürgen Habermas, "Technology and Science as Ideology," in *Towards a Rational Society* (Boston: Beacon Press, 1970): 81-127.

¹⁸ Peter Weingart, "The Paradoxes of Expert Advising," in *Expertise and its Interfaces*, eds. Gotthard Bechmann and Imre Hronszky (Berlin: Edition Sigma, 2003): 43-89.

¹⁹ Eyal, *The Crisis of Expertise*.

struggles between different groups of experts; the rapid pace of economic and technological development, which overflows their specialisms; the interplay between risk, uncertainty and indeterminacy. There are still several others, but I'd like to dedicate the rest of this short intervention to only one of them, which has to do with the nature of the most important commodity in this whole story – namely, trust.

Trust is like the ether of 19th century physics: it is a necessary assumption in all theories and accounts of the current crisis, but nobody knows what it is or how to measure it. Nobody knows what it is, but everybody is sure about one thing – trust is what we lack. The crisis, we are told, is one of mistrust in science, mistrust in experts, mistrust in institutions, in the news media or the state. This is all true to some extent, but also wrongheaded in another sense. In what follows, therefore, I'd like to offer not a definition or theory of trust, but an unsystematic set of “rules of method” to be observed when one considers the thorny issues surrounding trust and mistrust.

I said before that nobody knows how to measure trust. This would seem to fly in the face of the fairly large industry of surveys and “barometers” purporting to measure trust. This industry is the source of the periodic moral panic about decline of trust in institutions. I would argue, however, that trust is not a subjective attitude that can be measured by a survey. Surveys employ a commonsense meaning of trust as a subjective attitude of an individual. To trust is to believe in someone or something, and this belief provides reassurance. To study trust, you simply need to ask people. The problem is that what people say and what people do can be worlds apart. Odds are that even the most mistrustful do not think twice before they take their FDA-approved medication twice a day, or before they get into their car or board an airplane, all products of behind-the-scenes expert systems. Even as they mouth mistrust, their actions betray profound trust. Once you take stock of this fact, the results of surveys seem to reflect not an underlying attitude, but the context and wording of the survey questions, and the political position-takings they activate. Trust in the Coronavirus vaccine in the US, for example, was at a low point in Summer 2020, especially among democrats, yet picked up when vaccines became available and Trump lost the election. As is evident in the subtext of the angry exchange between OnTheVerge and Ghost3333, whether one expresses trust in the CDC or not is a political statement, often taken as political signaling, a litmus test of where one stands in the polarized political map. Compared with the behavioral phenomena of trust, however, the subjective attitude is a moving target, a frail reed swaying in the winds.

Surveys, especially those that measure trust using some kind of Likert scale, construct it as linear and continuous: whoever trusts more, mistrusts less, and vice versa. This is wrong. Mistrust is not the opposite of trust. As Giddens puts it, every trust relationship necessarily entails ignorance and therefore always “provides grounds for skepticism or at least caution.”²⁰ This means that trust and mistrust come packaged together and what appears as a lot of trust can easily flip into its opposite when conditions change. We all know this experience. The more you trust, the more you feel “betrayed” if you perceive your trust to have been misplaced, and the more mistrustful you become. If, on the other hand, you hedge your bets and trust less (like ghost3333, you treat it all as one big Schrodinger's cat, or you take an attitude of “trust but verify”), you do not feel so mistrustful if something has gone awry. The relation between trust and mistrust is not linear and monotonic. This means that mistrust is not necessarily, and not always, a problem. Some measure of mistrust can be a healthy accompaniment to trust. Ghost3333 certainly scores some good points. There were, at various times,

²⁰ Anthony Giddens, *The Consequences of Modernity* (Stanford, CA: Stanford University Press, 1990): 88-89.

good reasons to question some of the guidance issued by the CDC – certainly early on, when it was “flying blind,” but also now when the relaxation of mask requirements seems to be partly motivated by a clumsy attempt to address vaccine hesitancy.

At the same time, while trust is not a subjective attitude, it is also not merely “tacit acceptance of circumstances in which other alternatives are largely foreclosed.”²¹ There is a line of thinking in social science which rejects the commonsense approach to trust as a sham. If people say one thing but then do another, this must mean that we can ignore what they say. Talk is cheap. In this approach, trust is a collective social fact, produced by and for systems of social relations. Its function is to reduce the complexity of choosing between alternative futures.²² Trust is thus rational from a system’s point of view, but profoundly unfounded and irrational from an individual point of view, akin to religious faith. This approach is contradicted by the fact that we all make distinctions between “blind trust” and trusting responsibly. To treat trust as ultimately unfounded is a scholastic fallacy.²³ Only from the point of view of the scholar, who can stop time in its tracks to examine action in its “frozen” state, so to speak, does trust appear unfounded (“its turtles all the way down!”). In reality, most of the time we do not experience trust as some sort of “leap of faith,” but as well-founded, something that jives with our embodied, experienced routines.

To put it with Bourdieu, trust is a category of practice. Trust is not blind faith, but a “skillful suspension of doubt, an extremely sophisticated methodology of practical consciousness, through which people manage to live with the fact that there are gaps and missing pieces.”²⁴ This is the meaning of the distinction between blind and responsible trust. To live in a society is to share methodologies for recognizing and exhibiting when trust is responsibly given, and when it is blind faith.²⁵ These methodologies are an essential “glue” holding society together. They are an integral part of the “forensic vocabulary” by means of which we hold each other accountable.²⁶ “Civil inattention” is one such methodology we employ in public spaces,²⁷ but in these pandemic days, when we are all supposed to wear masks and socially distance (or do we?), do we know what it means to trust responsibly your fellow pedestrian? Attention to temporality is at the heart of these methodologies. Trust is like music. Duration, sequence, tempo, resonance, repetition, are of the essence. We all know the adage that it takes a long time to build trust, while to destroy it only takes an instant. A note, having been struck, shapes a context in which another note can appear as in harmony with it, trustworthy, or as a “false note.” It can continue a melodic line, or it can appear discordant because it is played too fast, too slow, or out of sequence. This is why “warp speed” was a very unfortunate slogan for a campaign whose success depended on building trust. This is why when the CDC suddenly dropped on us the much-welcome news that the vaccinated no longer needed to be masked, we all gasped. This note was certainly played too fast. Once again, we were asked to revise, on a dime, how we hold each other accountable, what constitutes responsible trust in the public domain.

²¹ Ibid.

²² Niklas Luhmann, *Trust and Power* (London: Polity, 2017).

²³ Pierre Bourdieu, *Pascalian Meditations* (Polity, 2000).

²⁴ Guido Mollering, *Trust: Reason, Routine, Reflexivity* (Amsterdam: Elsevier, 2006).

²⁵ Harold Garfinkel, “A Conception of, and Experiments with, “Trust” as a Condition of Stable Concerted Actions,” in *Motivation and Social Interaction: Cognitive Approaches*, ed. O.J. Harvey (New York, Ronald Press, 1963): 187-238.

²⁶ Mary Douglas, “Risk as a Forensic Resource,” *Daedalus* 119 no. 4 (1990): 1-16.

²⁷ Erving Goffman, *Relations in Public* (New York: Harper Torchbooks, 1971).

This is why regulatory science is so vulnerable to a crisis of mistrust. The little numbers it produces have worked themselves into our everyday cosmologies, our methodologies for exhibiting and recognizing that we trust responsibly. We stand 6 feet apart; we quarantine for 14 days; we make sure our temperature is 98.6; We check the calories count on the food packaging. At the same time, these numbers are at the interface between two distinct temporalities – the reversible temporality of normal science and the unidirectional temporality of policy decisions. Consequently, every time these numbers, which we have learned to trust, are discovered to be wrong or are disputed, we become even more skeptical regarding expertise and its forecasts, less trusting and more suspicious. And everything depends on time – how quickly these changes follow one another? Are they introduced gradually or abruptly? Do they follow right after a statement expressing confidence in the previous number? Regulatory science agencies have developed frames that dramatize and focus attention on deliberative time. They carefully stage and ritualize their decision-making processes.²⁸ Lord knows, we were all waiting breathlessly for the Advisory Committee on Immunization Practices (ACIP) of the CDC, and on the FDA, to approve the Covid-19 vaccine. But they took their sweet time. President Trump and his minions fumed and threatened and cajoled, but the experts at the FDA found a way to resist the onslaught by leveraging the problem of trust – if we hurry the pace even a little bit, they said, people won't trust the new vaccine.²⁹

Anything that disrupts these temporal frames – official missteps, new leadership, jurisdictional struggles among experts,³⁰ the pandemic together with social media imposing an accelerated schedule and training attention on the backstage calculations – would destroy the careful orchestration of trust. Absent these temporal frames, one will be peering down the abyss of a split second “leap of faith,” not knowing how to recognize or exhibit responsible trust. Parents in the US used to be given a yellow card on which their children's vaccinations were noted. Now, alas, this card has been replaced by electronic health records. Big mistake! On this card, the vaccinations were part of a routine schedule, juxtaposed with other “milestones” like the child's height and weight, head circumference, etc. The vaccinations were thus framed by a routinized narrative of normal, ordinary childhood. The yellow card was a temporal frame that averted the glance from what may be worrisome about the present moment, and emplotted the vaccination within a longer time frame that was grasped as “development”. This framing allowed parents to recognize and exhibit that they were trusting responsibly, while a framing that presents vaccination as a “choice,” as a “decision” to be made as part of an individual calculus,³¹ would leave them peering down the abyss, seeing only turtles and no firm ground.

Despite the dire tone, these observations about trust are actually optimistic. Trust simply takes time. Regulatory science agencies may yet be able to regain the public's trust, gradually, slowly, over time. They are no longer “flying blind” with respect to the pandemic, but when it comes to diagnosing and treating their own congenital defects, especially in how they communicate with the public and involve it in their decisions,

²⁸ Stephen Hilgartner, *Science on Stage: Expert Advice as Public Drama* (Stanford University Press, 2000).

²⁹ Andrew Lakoff, “A Regulatory State of Exception,” in *The Oxford Handbook of Expertise and Democratic Politics*, eds. Tom Medvetz and Gil Eyal (Forthcoming in Oxford University Press).

³⁰ Hilgartner, *Science on Stage*.

³¹ Jennifer A. Reich, *Calling the Shots: Why Parents Reject Vaccines* (NYU Press, 2018).

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they are flying without a copilot. Along the natural scientists and public health specialists, they also need social scientists and even people trained in the humanities, the arts and the media, to craft creative new framings.

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