PAR PUBLIC ADMINISTRATION REVIEW

Wouter Van Dooren
University of Antwerp

Mirko Noordegraaf
Utrecht University

COVID-19 Viewpoint

Staging Science: Authoritativeness and Fragility of Models and Measurement in the COVID-19 Crisis

Wouter Van Dooren is full professor of public administration at the University of Antwerp and Antwerp Management School. His research studies how information is used in decision-making, with an emphasis on indicator-based governance, accountability, citizen-state interaction, and policy conflict escalation.
Email: wouter.vandooren@uantwerpen.be

Mirko Noordegraaf is full professor of public management in the Utrecht School of Governance, Utrecht University. He studies public management issues, with a particular emphasis on institutional and organizational reform, public managers, managerial action, professionalism, expertise, and ambiguity.
Email: m.noordegraaf@uu.nl

Public Administration Review, Vol. 80, Iss. 4, pp. 610–615. © 2020 by The American Society for Public Administration.
DOI: 10.1111/puar.13219.

Abstract: *In the COVID-19 crisis, society pins its hopes on science to play an authoritative role in reducing uncertainty and ambiguity. But is science up to the task? This is far from self-evident. The demands on science in times of crisis run counter to the values of good, normal science. Crisis science needs to be fast, univocal, personalized, and direct, while normal science is slow, contentious, collective, and sensitive to complexity. Science can only play its atypical role if it is staged in the public arena. Some patterns of staging stand out: personalization, visualization, and connection to lived experiences. So far, the staging of science has been successful, but it is fragile. The COVID-19 crisis shows the potential of well-staged forms of alliance between science and policy, but when the general assumption is that scientists will "solve" societal "problems," the staging of science has gone too far.*

Evidence for Practice

- The COVID-19 crisis shows that science matters, despite populist tendencies, "fake news," and "post-truth" leadership.
- The normal functioning of science is different from what is expected in crisis mode.
- The role of science in a crisis is fragile; science can inform, but it cannot solve societal problems.

"Sober, reassuring, nuanced." These were the words of Paul Waugh of the Huffington Post on March 3, 2020 (Waugh 2020). "When the chief medical officer… and chief scientific adviser flanked Boris Johnson at Number 10 today, they did an impressive job of calmly and professionally setting out the factual framework behind the government's coronavirus strategy." That strategy was founded on the scientific concept of "herd immunity": when a sufficiently high percentage of the population has developed antibodies, the spread of the virus can be stopped. Waugh sees the scientific approach as "a welcome contrast to the overheated rhetoric that often passes for much political debate in parliament." Science triumphs over politics.

Two weeks later, a model from Imperial College London came to different conclusions (Barker, Bruce-Lockhart, and Burn-Murdoch 2020). If the United Kingdom did not adjust its mitigation approach, the model predicted overwhelmed intensive care units (ICUs) and 250,000 deaths. In the days following the release of the Imperial College study, the U.K. government changed course. Again science steered the course of policy making, but in a different direction. The "herd immunity" episode is just one in a continuous stream of science-policy interactions (Newman, Cherney, and Head 2016).

The purpose of this article is to analyze how science can be authoritative and impactful in times of crisis (Newman, Cherney, and Head 2016). The classic role of science is to describe, explain, and predict. "Enhancing awareness" and "legitimizing decisions" are additional roles for science during crises. In that way, science contributes to "governance capacity" as well as "governance legitimacy" during crises (Christensen, Lægreid, and Rykkja 2016). However, for science to be impactful, it needs to be actively staged (e.g., Hajer 2005). Science needs to claim and take its place on the stage of political decision-making—both literally and figuratively. Scientists need to perform public roles, aimed at presenting evidence, legitimizing (far-reaching) measures, and changing social behavior. However, doing so goes against some of the core values of good, normal science: the value of disagreement, the value of slowness, the value of impersonality and objectivity, and the value of sensitivity to complexity. We analyze how scientists are operating during the COVID-19 crisis and how they are dealing with the dilemmas of "being on stage." More specifically, we analyze how scientific models and measurement are used to perform societal roles and how this affects policy processes. We primarily make reference to practices in our home countries, the Netherlands and Belgium.

When we speak about the "scientists" who are taking a central role in the COVID-19 crisis, we are mainly referring to academics employed by universities and academic medical centers and experts employed by government agencies that provide evidence for policy (as well as specialists employed by the World Health Organization). The Dutch and Belgian centers for disease control are seen as scientific instead of administrative institutions. Academic networks between academia and government agencies are generally strong. Here, we highlight differences between the Netherlands and Belgium, but we do not really explain them. Comparing *crisis responses* in different countries (Lodge 2011) and cities (Noordegraaf and Newman 2011), not least by linking them to governance cultures, is important, but it is not the main goal of this article. Despite cultural differences, we see many remarkable commonalities as far as the staging of science and its effects is concerned.

In this article, we first highlight the role of science in addressing the uncertainty and ambiguity that are typical of a major crisis. Next, we discuss how this role leads to a "science and crisis" paradox. In a crisis, science is of crucial importance, as it allows us to get a grip on uncertainties and ambiguities. Yet the conditions in a crisis are not conducive to doing good science. To make science authoritative and impactful, we argue, it needs to be staged. We describe how science has been staged during the COVID-19 crisis and how scientific authority has been enacted. Scientific models and measurement, we show, are used for staging science. At the same time, staging processes appear to be fragile. Finally, we discuss the impact of the staging of science on policy processes. We argue that politicians, policy makers, and scientists are codependent and form alliances. There are benefits of these new interactions, but at the same time, risks are involved.

Science, Uncertainty, and Ambiguity

Boin et al. (2016, 2) define a crisis as "a serious threat to the basic structures or the fundamental values and norms of a system, which under time pressure and highly uncertain circumstances necessitates making vital decisions." It goes without saying that the COVID-19 crisis involves many vital decisions that affect the foundations of society. These decisions need to be taken in uncertain circumstances and under time pressure. The decision context is not only uncertain and time pressured, it is also ambiguous. We lack shared interpretations and understanding (Cairney, Oliver, and Wellstead 2016; Weick 1995). In the COVID-19 crisis, the recourse to science to cope with uncertainty and ambiguity is remarkable.

Let us focus on *uncertainty* first. To cope with uncertainty, decision makers are closely following insights from science. In the first phase of the crisis, evidence is found mostly in the medical sciences. Virologists and epidemiologists produce impactful studies on, among other things, reproduction rates, the impact of the disease across populations, the reliability of testing, and the development of immunity. These insights are visualized by way of graphs, figures, and tables showing the spread of the virus, its effects on people and populations, and the effects of the measures taken. Additional graphs and figures visualize our "capacities to cope." Health care scholars produce numbers on hospital admissions, ICU beds, and mortality rates, and the provision of materials and tests are closely monitored. In the second phase of the crisis, with exit strategies in sight, other academic disciplines are entering the arena. Economic modeling is expected to guide recovery. Social research is monitoring welfare, learning, and mental health. Legal scholarship is consulted to assess the legality of lockdown restrictions and the building of tracing apps.

The use of science is not merely rhetorical. Scientific expertise is institutionalized in decision-making procedures. The public health agencies, Sciensano in Belgium and the RIVM (National Institute for Public Health and the Environment) in the Netherlands, play their roles visibly and independently. Their representatives are omnipresent at press conferences, parliamentary meetings, and public debates. Epidemiologists and virologists from academic hospitals are also strongly involved. Together, they are members of the outbreak Management Team in the Netherlands and the Risk Assessment Group in Belgium. The Dutch and Belgian expert advisory bodies advise ministerial decision makers, who explicitly look to scientists for guidance.

The role of science goes beyond the reduction of uncertainty. Science also helps us cope with the ambiguous context that COVID-19 crisis has created (Noordegraaf and Abma 2003; Weick 1995). Ambiguity in a crisis triggers processes of "*sensemaking*" (Boin et al. 2016). Sensemaking refers to the societal struggle to understand what is and what will be happening. How problematic is the crisis? Who are the victims? Who is responsible? What are the second-order effects of government measures? How will things go back to normal, if at all? What "exit strategies" are realistic? What will be the so-called new normal? Although the public debate on such questions is deeply political in nature, it also relies on scientific sensemaking.

In addition to sensemaking, scientists also contribute to what Boin et al. (2016) call "*meaning making*." Science communication generates symbols and symbolic language, which subsequently are used by political leaders and policy makers in their crisis communications. Symbolic language accentuates political leadership (Bligh, Kohles, and Meindl 2004), and, in turn, political leadership might privilege science. Behavioral guidelines rest on expert advice: "wash your hands," "keep 1.5 meters distance." This inspires political rhetoric: "we will move towards a one-and-a-half-meters-society," as Dutch prime minister Mark Rutte stressed on April 7. Yet scientists also use symbolic language to emphasize that measures are of crucial importance. A Belgian scientist, for instance, claimed that "We have the virus by the scruff of the neck, we cannot loosen now." War metaphors are omnipresent in both scientific and political language (see also Nerlich 2020). The "front lines" of the "fight" against the coronavirus—general practitioners, ICUs, and elderly homes—are shown. In "combating" the coronavirus, we have to go into "lockdown." Medical personnel are "heroes." The "fight" will be long and potentially put a "bomb" under our economic foundations. Metaphors create meaning (Stone 1997). War metaphors that pit "us" against the virus, for instance, convey unity and stress the need for obedience, but they may also obscure disproportionate impacts of the epidemic in different strata of the population (Ribeiro et al. 2018).

The "Science and Crisis" Paradox

Science is the compass that has to guide us through the uncertainty and ambiguity of the COVID-19 crisis. However, crisis and science make strange bedfellows. The demands on science in times of crisis

run counter to how good science is practiced in ordinary times (Baekkeskov 2016). Four incompatibilities of science and crisis can be distinguished (Gerring 2011; McElreath and Smaldino 2015).

- First, good science thrives on *disagreement*. Science is skeptical by nature. Scientific models are constantly contested. Contestation leads to more robust science. In times of crisis, contestation may confuse processes of collective sensemaking and affect the reputations of experts. Scientific argument may even enhance uncertainty and ambiguity. Scientific disagreement on the effectiveness of masks, for instance, has led to confusion and disagreement within public opinion.
- Second, good science tends to develop *slowly* and cumulatively. Theoretical expectations are confronted with empirical observation, and only in the long run will better theories prevail (McElreath and Smaldino 2015). In a crisis, there is time compression. Uncertainty needs to be reduced quickly, and people are grappling to make sense. Science has a hard time delivering on this task. Scientific opinion on, for instance, the contagiousness of the disease, the effectiveness of masks, the feasibility of getting to herd immunity, and the effectiveness of medical treatments is constantly shifting.
- Third, good science tends to be *impersonal*. Science is a collective endeavor. Of course, some scholars originate scientific agendas. For public administration, think of Christopher Hood at the vanguard of critical research into New Public Management or Michael Lipsky leading work on implementation. Yet even giants in a field can only shine thanks to the work of the numerous lesser giants who read, cite, and discuss their work. Scientific progress is a collective enterprise of research communities. In times of crisis, however, science needs a face to convey authority.
- Fourth, good science acknowledges *complexity* and the multiplicity of perspectives. Different types of measurement might be used, coming from different disciplines. Multiplicity typically results in more nuanced and complex recommendations for practice. The quintessential "it depends" of science communication. During crises, however, advice needs to be clear. Strict and preferably simple measures have to be taken. Schools, shops, and restaurants need to stay open or not. Children must be allowed to play outside or not. Gatherings of a certain number of people may be held or not. For scientists who acknowledge uncertainty, such simple recommendations are difficult to endorse.

In sum, science has an important role to play during a crisis like COVID-19. We depend on science for the reduction of uncertainty and the creation of meaning. Playing this central role is far from evident for scientists. The institutionalization of knowledge use in decision-making practice is slow (Kislov et al. 2019) and context dependent (Jennings and Hall 2012). Authoritative science takes time. A crisis such as COVID-19 does not allow for taking time. We need science now. A shortcut for authoritative science can be found in the way science is staged in the public arena—an institutionalization spurt, if you like. But such a shortcut is not without risk. Next, we analyze how science is staged, how its staging has evolved during the crisis, and how this impacts politics and policy making, as well as science itself.

The Staging of Science

Although the governance of COVID-19 clearly values evidence and expertise, evidence and expertise are not automatically privileged in a crisis. It is difficult to maintain the role of science during the governance process. In this section, we argue that scientific impact needs to be actively manufactured and that science has to be actively *staged* (Hajer 2005). Staging is done by political leaders and policy makers, as well as by the media and by scientists themselves.

The staging of science seems to follow some patterns. First, a few scientists become leading figures who "perform" publicly. A remarkable feature of the COVID-19 crisis is the *personification* of science. Think of Anthony Fauci in the United States, Christian Drosten in Germany, or Jérôme Salomon in France (Henley 2020). In the Netherlands, Jaap van Dissel from the public health agency RIVM has become the leading scientist. In Belgium, Marc Van Ranst in the Dutch-speaking community and Marius Gilbert in the French-speaking community represent science in the public arena. In the second phase of the crisis, after the first shock, more scientists as well as some leading medical professionals have become COVID-19 media personalities. The COVID experts make good impressions. Polling evidence suggests that trust in expertise is high. The personification of science may also bear risks. The need for a univocal message from a trusted messenger may lead to the exclusion of scientist that disagree with the dominant perspective. Not every scientist is allowed on stage.

Second, a few distinctive models and measurements have become dominant in the debate, most specifically, the "contamination/capacity" ratio. The core graph with the number of contaminations in relation to the number of hospital admissions, and specifically the number of intensive care patients, was and is widely used to check whether hospital systems can cope with the rising number of COVID-19 patients. This communication fuels the visualization and more specifically the "*graphication*" of politics and policy making (see Isett and Hicks 2018 on the impacts of data visualization). The Dutch and Belgian health research agencies announce daily facts and figures on these key parameters. The "flatten the curve" storyline is actively tagged to those scientific data. Although some political parties, especially populist parties, tried to criticize cabinet policies, they quickly changed their tone. The graphs act as political artifacts, which set a (apolitical) tone in political debates.

Finally, there is a continuous stress on real experiences to link scientific data to *lived experiences* and the emotions they embody. In newspapers and on television, "messages from the front lines" are portrayed. Medical doctors, nurses, and patients tell about their COVID-19 experiences. Unlike other episodes in policy making, during which expertise and experience are plotted against each other, reports of experiences with COVID-19 reinforce the need for evidence and expertise. In this crisis, science is not accused of living in an "ivory tower." Medical doctors and nurses speak about the seriousness of the disease, the pressures they feel, and the effects of the lack of medicine and materials. Patients and their family members express their anxieties and talk about dramatic situations in hospitals, nursing homes, and homes for the elderly. Witnesses report on how it feels to pay their last respects in small circles. Images of overcrowded ICUs in other countries are used to convince people of the gravity of the crisis and the science behind the policy.

The Fragility of the Staging Process

Despite personification, visualization ("graphication"), and the connection to lived experience, the leading position of scientists is fragile. During the COVID-19 crisis, scientific models and measurement seem to strengthen science but also to weaken it, both directly and indirectly. Especially in the phase after the first crisis response, science was challenged. Part of the fragility is due to science returning to its normal state of a slow, contentious, and collective endeavor with an eye for complexity. Part of it can be attributed to politics (re)claiming its role independent from science.

First, new measurements show the *inadequacy* of the measures taken. Amid a strong emphasis on contamination and capacity, new measurements demonstrate shortages of masks, medicines, and other medical material. Although experts disagree about the effectiveness of specific types of masks, shortages are increasingly clear. These shortages are explained partly by the lack of political action ("politicians acted too late") and partly by the fact that production and distribution channels have been harmed by the crisis. This fuels debate on measures for allocating masks and medicine: who is entitled to receive them? Are hospitals prioritized over nursing homes or homes for the elderly? This not only implies that measures are failing, it also means that measures might obscure trade-offs and choices. These trade-offs and choices, obviously, are political.

Second, new models and measurements show the *relativity* of policy courses. Politicians repeatedly argue that they follow the lead of science. Yet at some points, they diverge from the scientific path. The closure of schools in the Netherlands, for example, was not advised by medical experts. The government nonetheless decided on the closure, arguing that pressure from society as well as from the school system was too strong. The government obtained this insight from opinion polling. Virologists in Belgium (particularly in Dutch-speaking Flanders) also believed that the school closure was premature. The government decided to close schools mainly because the French-speaking community (Wallonia and a majority of Brussels) was looking to France, where schools already had been closed for several days. When the opening of schools in the Netherlands (only primary schools, on May 11) was announced, school leaders and teachers expressed concerns. At the same time, restaurant owners also expressed concerns, as well as owners of fitness clubs, and theater directors, because they were *not* allowed to reopen.

The relativity of policy measures also follows from *contested comparisons*, especially internationally. Although facts and figures are registered at the global level (for instance, in the Johns Hopkins University database), national systems for measuring and registering cases and deaths diverge. National policies to tackle COVID-19, allegedly all based on science, diverge as well. In the Netherlands, the COVID-19 regime is considerably lighter than in Belgium, for example. This fuels scholarly debates on the validity of measurement as well as the effectiveness of national crisis responses, for example, on the varieties of "lockdown." Scientific controversy is ramping up again—as you would expect from normal science. Yet the controversy within science risks the delegitimization of (various) "staged" scientists. In Belgium, the discussion of the effectiveness of masks is a good example of such a controversy within science, with risks for the reputations of public scientists. In the Netherlands, outbreak management team members disagreed over the effectiveness of masks. During the weekly "technical briefing" in Parliament, its chair, Jaap van Dissel, explicitly stated that the obligatory usage of masks would be a "political choice."

Third, new models and measurements coming from different disciplines stress the *complexity* of the crisis. At the same time, they reveal the limitations of single-source evidence (Heikkila 2017). In addition to virology, epidemiology, and public health, other disciplines are starting to send messages. Models from economy, psychology, and educational sciences redirect public attention away from health and epidemiology. This gives rise to other statistical realities, for example, concerning the rising number of bankruptcies and unemployed and increasing number of welfare beneficiaries. International Monetary Fund scenarios on economic developments predict dire economic conditions. As a result, framing conflicts are fueled, backed by scholarly insight and evidence: is public health prioritized over the economy, or should economic interests be more important? Or, alternatively, do public health and the economy go hand in hand? If so, how can political ambitions—such as sustainability ambitions—be linked to economic post-COVID-19 policies? In the meantime, other experts have entered the public and political debate, with models for determining "exit strategies" and with "competing curves," as well as with models for tracing infectious diseases with apps and for determining sector-specific effects, such as in the cultural sector, sports clubs, or schools. All of these models are technical but *open up* a space full of political options.

The Impact of Staging Science

The staging of science supports but does not guarantee effective policy processes. The staging does not happen automatically, and there are different ways to stage. Furthermore, the staging of science is difficult to maintain, and the outcomes are uncertain and debatable. In fact, the "scientification" of politics makes crisis responses all the more political. This has consequences.

Policy responses are strengthened when science is invoked. The backing of science *and* the personification of science lead to better acceptance of policy. Both in the Netherlands and in Belgium, scientists have played an important role in securing a general buy-in for strict government policies. The reason citizens adapted their behavior and complied with policy regulations seems to be a mixture of fear of the disease and an understanding of why the measures were taken. Both fear and understanding were driven by science. The widespread publication of exponential curves told a story of imminent disaster and calculations of ICU capacity supported images of overcrowded hospitals in Italy. Discussions of the replication factor and the contagiousness of the disease helped people understand why lockdowns and social distancing were needed. Transparency and openness in policy and administration are vital. Citizens seem to be willing to accept even some of the most drastic measures if they feel that a threat is real *and* they understand the policy logic behind the decision (Tyler 1988). For that purpose, the science behind the policy needs to be shown, connected to lived experiences.

The staging process is dynamic, and the authority of science is easily lost (Newman, Cherney, and Head 2016). The authority of science is also held to account. At the beginning of the crisis, the

gentle Dutch approach was criticized, also by Belgian and German neighbors. With an ICU capacity that is substantially lower in the Netherlands, the soft lockdown was seen by many as a big gamble. But when the Dutch curve "started to flatten," the advantages of the Dutch lockdown came to the fore. In Belgium, on the other hand, high per capita death tolls (a number close to Italy and Spain) challenged both science and policy. The experts (successfully) attributed the high per capita death rate to measurement practices. At the same time, measurement practices also started to fuel criticism within the Netherlands. The fact that a low number of potential Dutch patients were tested for the coronavirus (also postmortem) led to political and public worries. The high number of deaths in elderly care led to questions about "neglected" parts of health care (Booth 2020).

Although political decision-making rests on scientific evidence, such scientific evidence cannot avoid moving measurements, multiple models, competing curves, and contested comparisons. This turns governance into an "experimentalist" affair in a situation that is not really allowing for experimentation (Zeitlin 2016). It also turns governance into a *political* affair. Although political decision-making seems to become technocratic, backed by scientific signals, there is a lot of scientific and emotional noise: unclarity, contestation, emotions, trade-offs. This means there are risks involved in the policy-science alliance.

Political leaders, policy makers, and scientists form strong alliances in and during staging processes to solve problems. But "solving problems" is illusory. When scientific advice and expertise are expected to "get rid" of problems, then science cannot deliver. The staging of science as the savior of society leads to a depoliticization of policy and a politicization of science (Wolf and Van Dooren 2018). It leads to expectations that normal science cannot meet. At the end of April, Dutch scientific members of the outbreak management team made a public appeal to political leaders. They publicly stressed, first, "we disagree over a few issues" (such as masks); second, "we cannot take responsibility for the measures that will be taken"; third, "other disciplines must be involved in decision-making." In other words, "please free us scientists from too strict political and public expectations."

Conclusion

The COVID-19 crisis reinforces the importance of traditional public administration themes such as evidence, measurement, and modeling, *and* it shows the realities of measuring and modeling in (extremely) uncertain and ambiguous circumstances (Hall and Battaglio 2020). Scientific evidence is crucial for getting a grip on uncertainties and ambiguities, but such evidence is hard to provide with respect to scientific standards. This means that scientific authority has to be "manufactured." In case of COVID-19, science is being *staged*, both literally and figuratively. During press conferences and parliamentary briefings, on talk shows and on the news, scientists take center stage. In political and public debates, facts and figures are leading, graphs are privileged, scientific jargon is used.

The COVID-19 crisis is an extreme case that reveals patterns of science-policy interaction that otherwise would not be apparent. At the same time, it contributes to our understanding of this interaction. The COVID-19 crisis shows that science matters, despite populist tendencies, "fake news," and "post-truth" leadership. It also shows that scientists are respected and that well-grounded and informed policies can arise. This happens when scientists, political leaders, and policy makers join together and form alliances. We can draw lessons for normal times from how science and policy cooperate today.

Science on stage also has a different, more critical side. During the process, scientists perform precarious roles. Their models and measurement are privileged, but how these models are used goes against the traditions of normal science. Traditional academic values are at stake. Moreover, models and measurements cannot suppress the richness of complex realities, which means that contestation and framing conflicts will remain. In fact, expert- and evidence-based policies are strengthening instead of weakening the politics of crisis responses. Scholars have a responsibility to contribute to societal issues, but there are limits. They cannot "solve" them. When the general assumption is that scientists will "solve" societal "problems," the staging of science has gone too far.

References

Baekkeskov, Erik. 2016. Same Threat, Different Responses: Experts Steering Politicians and Stakeholders in 2009 H1N1 Vaccination Policy-Making. *Public Administration* 94(2): 299–315. https://doi.org/10.1111/padm.12244.

Barker, Alex, Chelsea Bruce-Lockhart, and John Burn-Murdoch. 2020. The Shocking Coronavirus Study That Rocked the UK and US. *Financial Times*, March 19.

Bligh, Michelle C., Jeffrey C. Kohles, and James R. Meindl. 2004. Charisma under Crisis: Presidential Leadership, Rhetoric, and Media Responses before and after the September 11th Terrorist Attacks. *Leadership Quarterly* 15(2): 211–39. https://doi.org/10.1016/j.leaqua.2004.02.005.

Boin, Arjen, Paul t Hart, Eric Stern, and Bengt Sundelius. 2016. *The Politics of Crisis Management: Public Leadership under Pressure*. Cambridge: Cambridge University Press.

Booth, Robert. 2020. Half of Coronavirus Deaths Happen in Care Homes, Data from EU Suggests. *The Guardian*, April 13. https://www.theguardian.com/world/2020/apr/13/half-of-coronavirus-deaths-happen-in-care-homes-data-from-eu-suggests [accessed May 14, 2020].

Cairney, Paul, Kathryn Oliver, and Adam Wellstead. 2016. To Bridge the Divide between Evidence and Policy: Reduce Ambiguity as Much as Uncertainty. *Public Administration Review* 76(3): 399–402. https://doi.org/10.1111/puar.12555.

Christensen, Tom, Per Lægreid, and Lise H. Rykkja. 2016. Organizing for Crisis Management: Building Governance Capacity and Legitimacy. *Public Administration Review* 76(6): 887–997. https://doi.org/10.1111/puar.12558.

Gerring, John. 2011. *Social Science Methodology: A Unified Framework*. Cambridge: Cambridge University Press.

Hajer, Maarten A. 2005. Rebuilding Ground Zero: The Politics of Performance. *Planning Theory & Practice* 6(4): 445–64. https://doi.org/10.1080/14649350500349623.

Hall, Jeremy L., and R. Paul Battaglio. 2020. Remember the Foundation, Keep the Faith, Find What Works, and Focus on the Future. *Public Administration Review* 80(3): 345–8. https://doi.org/10.1111/puar.13197.

Heikkila, Tanya. 2017. Evidence for Tackling the Complexities of Water Governance. *Public Administration Review* 77(1): 17–20. https://doi.org/10.1111/puar.12679.

Henley, Jon. 2020. Coronavirus: Meet the Scientists Who Are Now Household Names. *The Guardian*, March 22. https://www.theguardian.com/world/2020/mar/22/coronavirus-meet-the-scientists-who-are-now-household-names [accessed May 14, 2020].

Isett, Kimberley R., and Diana M. Hicks. 2018. Providing Public Servants What They Need: Revealing the "Unseen" through Data Visualization. *Public Administration Review* 78(3): 479–85. https://doi.org/10.1111/puar.12904.

Jennings, Edward T., and Jeremy L. Hall. 2012. Evidence-Based Practice and the Use of Information in State Agency Decision Making. *Journal of Public Administration Research and Theory* 22(2): 245–66. https://doi.org/10.1093/jopart/mur040.

Kislov, Roman, Paul Wilson, Greta Cummings, Anna Ehrenberg, Wendy Gifford, Janet Kelly, Alison Kitson, Lena Pettersson, Lars Wallin, and Gill Harvey. 2019. From Research Evidence to "Evidence by Proxy"? Organizational Enactment of Evidence-Based Health Care in Four High-Income Countries. *Public Administration Review* 79(5): 684–98. https://doi.org/10.1111/puar.13056.

Lodge, Martin. 2011. Risk, Regulation and Crisis: Comparing National Responses in Food Safety Regulation. *Journal of Public Policy* 31(1): 25–50. https://doi.org/10.1017/S0143814X10000218.

McElreath, Richard, and Paul E. Smaldino. 2015. Replication, Communication, and the Population Dynamics of Scientific Discovery. *PLOS ONE* 10(8): e0136088. https://doi.org/10.1371/journal.pone.0136088.

Nerlich, Brigitte. 2020. Metaphors in the Time of Coronavirus. *Making Science Public* (blog), March 17. http://blogs.nottingham.ac.uk/makingsciencepublic/2020/03/17/metaphors-in-the-time-of-coronavirus/ [accessed May 14, 2020].

Newman, Joshua, Adrian Cherney, and Brian W. Head. 2016. Do Policy Makers Use Academic Research? Reexamining the "Two Communities" Theory of Research Utilization. *Public Administration Review* 76(1): 24–32. https://doi.org/10.1111/puar.12464.

Noordegraaf, Mirko, and Tineke Abma. 2003. Management by Measurement? Public Management Practices amidst Ambiguity. *Public Administration* 81(4): 853–71.

Noordegraaf, Mirko, and Janet Newman. 2011. Managing in Disorderly Times. *Public Management Review* 13(4): 513–38. https://doi.org/10.1080/14719037.2010.525035.

Ribeiro, Barbara, Sarah Hartley, Brigitte Nerlich, and Rusi Jaspal. 2018. Media Coverage of the Zika Crisis in Brazil: The Construction of a "War" Frame That Masked Social and Gender Inequalities. *Social Science & Medicine* 200: 137–44. https://doi.org/10.1016/j.socscimed.2018.01.023.

Stone, Deborah. 1997. *Policy Paradox: The Art of Political Decisionmaking*. New York: W. W. Norton.

Tyler, Tom R. 1988. What Is Procedural Justice? Criteria Used by Citizens to Assess the Fairness of Legal Procedures. *Law & Society Review* 22(1): 103–35. https://doi.org/10.2307/3053563.

Waugh, Paul. 2020. How Boris Johnson's Expert Advisers on Coronavirus Won the Day. HuffPost UK, March 3. https://www.huffingtonpost.co.uk/entry/coronavirus-boris-johnson-waugh-zone_uk_5e5eda7dc5b63aaf8f5ea4f9 [accessed May 14, 2020].

Weick, Karil E. 1995. *Sensemaking in Organizations*. Thousand Oaks, CA: Sage Publications.

Wolf, Eva E.A., and Wouter van Dooren. 2018. Conflict Reconsidered: The Boomerang Effect of Depoliticization in the Policy Process. *Public Administration* 96(2): 286–301. https://doi.org/10.1111/padm.12391.

Zeitlin, Jonathan. 2016. EU Experimentalist Governance in Times of Crisis. *West European Politics* 39(5): 1073–94. https://doi.org/10.1080/01402382.2016.1181873.