Science in the Real

Joseph Strassman

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Introduction

For Americans of the 1990s, national crises appeared to be a thing of the past. The fall of the Soviet Union left many looking forward to a future of bright possibilities. Much of this sentiment is visible in perspectives seen in Francis Fukuyama's work on the "end of history" and also those writings surrounding the reception of the internet and the democratic powers held within: a space of complete decentralization, real anonymity and, thus far, the apex of free, open discourse. We are keenly familiar with the epoch shattering effects of 9/11. What we were not familiar with or expecting was the extreme civic toll exacted by the COVID-19 pandemic. The crisis took nearly seven million lives globally and demanded constant social attention on the part of states and societies alike for the better part of three years. In the United States, such an event harkens back to what were thought to be things of the past: Vietnam, the World Wars, and the Spanish flu of 1918. Such national crises require national responses, lockstep institutional trust, legitimacy, uniform messaging, national distribution networks of knowledge and expertise, and politically legitimate channels for both.

Argument

The unique stresses placed on science set in times of crisis draw the more problematic aspects of its intellectual character out into the light. In this text, I argue that a clear recognition of the interdependence between facts and values and their involvement in every step of scientific research is crucial, and that this intermingling warrants integration of science with

processes of political oversight. Leaving these value-steps unrecognized results in these decisions being made extra-democratically. This causes a host of consequences that are caustic to trust in both political and scientific institutions and alienates the public. While the project of integrating science and political oversight is warranted under the operating principles of democratic systems, all proposed solutions to enacting this integration process are extremely civically expensive. Representative processes leverage extreme costs on infrastructure and populations, requiring ample stretches of time to execute, and the tenability of productive deliberation is not guaranteed. This creates irreconcilable tension between the needs of democracies for representative processes and the immediate, urgent needs of crises for solutions. This forces questions about the worthiness of democracies at large and their capacity to quickly deal with crises. It is outside the scope of this text to argue between democratic and autocratic systems at large, but what can be taken from this argument is that even in autocratic systems, values permeate scientific research efforts and "solutions" to crises necessarily involve judgment calls about what assortment of costs and benefits is best. The only differences between democratic and autocratic systems in this case would be who is making such an assessment, the citizenry versus an autocrat or a league of intellectuals. Needless to say, autocratic systems have no (formal) obligation to grant their citizens oversight of the development of a solution to crises and, thus, do not incur the extreme costs that democratic systems do, and, thus, may hypothetically "solve" (democratic outcries aside) crises more quickly

and with much fewer obstacles. Thus, we may expect to see this difference in the character of COVID-19 responses among more highly centralized nations.

In the case study of the COVID-19 pandemic in the US and UK, it is found that while epidemiological models are ideally modeled over months to years, policy is often needed in days, and scientific practice is forced to run on similar timescales. Forcing science into the political contexts of crises results in rushed science that requires iterative updating, creating uncertainty and instability in the public. States have much to gain from offloading their own responsibility to legitimate policy onto scientists, but scientific practice is not an institution meant to legitimate policy and the conditions of crises exacerbate this problem. This dynamic takes blows that should be targeted at states and misdirects them at scientists. Politicians and states alike need to own the responsibility of legitimating policy to the public, communicating in full the levels (or lack thereof) of maturity and uncertainty in current scientific knowledge being used to inform policy decisions. Given that democratic citizens are owed the right to determine exactly what balance of costs and benefits they wish to pay as a society, states need to facilitate this process to manifest representation or at least stave off political instability.

Many of the scientifically limited perspectives that see political oversight of science as an overstep of political institutions are induced by faulty assessments of the fact-value[1] distinction that create a fictitious,

[1] The fact-value distinction is an often referred to device that serves to distinguish between rational/empirical "facts" and political/aesthetic/ethical "values." The distinction is often best seen in Max Weber's vocational lectures. See: Weber, Max, *Science as a Vocation* and Weber, Max, *Politics as a Vocation*.

“apolitical” conception of science. This entire body of work can be oriented around the necessary consequences of upholding or problematizing the fact-value distinction as it applies to science. The cultural split regarding trust in science can also be attributed to two opposing responses to the fact-value distinction, though this work focuses on institutional dynamics at the cost of deeper sociological study.

Apolitical conceptions of science blind themselves to value-laden decisions made at every step of the scientific method with disastrous political consequences. Democratic societies entitle their citizens to representation in and power over decisions concerning both ends and means of policy decisions that affect them as constituents. Thus, the proper identification of these value-laden steps gives warrant to integrating science and political oversight. Autocratic societies do not have these provisions and suffer less from this incongruity. It should be stressed that they do not escape these costs completely, as popular uprisings and protests still occurred in centralized nations throughout the pandemic, resulting in policy changes on the part of autocratic states. In democratic societies, however, leaving these value-laden steps unaddressed risks a number of politically caustic consequences. Lack of political oversight concerning these judgment calls induces greater alienation between the public and the state. Given that democracies are assembled around political cultures of checking state power through popular representation, an apolitical conception of science risks an ad-hoc creation of a science-state cultural amalgam that executes value-judgment laden policy decisions over and above aforementioned democratic principles. Purely apolitical conceptions of science, thus, at

best uphold a fictitious fact-value divide that then mistakenly forces discussions surrounding value-laden scientific advisory processes into a frame limited to expertise and knowledge. At worst, purely apolitical conceptions of science can be advantageous to states wishing to shield their policies with purely "factual" scientific language. A striking imbalance of power is created in which common citizens are woefully lacking, a fact that many are keenly aware of. This risks the use of expert knowledge as a cudgel with which to bludgeon political opponents through "apolitical" means. This effectively makes disagreement on political grounds impossible.

Apolitical, purely factual conceptions of science naturally find the impossibility of value-based deliberation with scientific advice to be nonsensical. The thrust of this text is to show that though this deduction might reasonably follow, it follows from mistaken premises. This grave mistake in the premises is instrumental in democratic backsliding and the erosion of trust between citizens and institutions. Thus, it is a primary burden of this work to show that through the accounts being inspected as well as the case study, the fact-value distinction cannot be upheld.

Accounts that attempt to sketch the integration of scientific practice and political oversight do so with varying degrees of success and actionability. This sliding scale largely depends on how adequately they assess the fact-value distinction. The primary accounts in question within this work are Naomi Oreskes' *Why Trust Science?*, Zeynep Pamuk's *Politics and Expertise*, and Philip Kitcher's *Science, Truth, and Democracy*. These three accounts will help sketch the consequences of differing responses to the fact-value distinction. Pamuk's account influenced and contributed to my own

argument the most by far. It most successfully represents a clean warranting of the integration of scientific research with democratic oversight. However, all three accounts of this integration, especially Pamuk's, as mentioned before, prove to be extremely civically expensive, leveraging extreme tolls on infrastructure, population, and timescales. Crisis situations make proposals like Pamuk's "science court"[2] nearly impossible to implement, something Pamuk recognizes. This induces the aforementioned deeper questions about the worthiness of democracies, the consequences of individualist political theologies versus collectivist ones, and the inherent trade-offs made between autocratic and democratic systems. None of these concerns are reasons to throw out my own or Pamuk's account, or democratic systems altogether. The first requirement to even arriving at any of these conclusions productively at all is the problematization of the fact-value distinction that comprises the foundation of my argument. Questions surrounding the capabilities of democracies aside, dealing with "apolitical" conceptions of science can greatly advance discourse on the subject by making visible the immediate risks present in crises like COVID-19.

[2] Pamuk's science court is a model of expert-layman deliberation in which scientific research and findings are fielded before randomly selected "juries" of public citizens in order to bring experts and nonexperts together to unite the former's power of expertise with the latter's democratic entitlement to process value judgements. See Pamuk, Zeynep, *Politics and Expertise*.

Theoretical Responses to Facts and Values

Problematizing the Fact-Value Distinction

Differing responses to the fact-value distinction send theoretical approaches to the question of trust in science down one of two distinct paths. The fact-value distinction can be upheld or problematized to varying degrees. Problematizing the fact-value distinction motivates the need for integrating democratic processes of representation into the stages of scientific research and policy implementation. Without this oversight, democratic principles will be openly and consciously disregarded, alienating the public from scientists and the state alike. This assessment of the fact-value distinction also puts a responsibility on scientists to be conscious of their formative role within social and political developments. Such calls for conscientiousness are found throughout the accounts of Pamuk[3], Oreskes[4], and Kitcher[5]. These calls for conscientiousness vary in intensity from calls for scientists to simply be more aware of judgment calls made in the research process and the uses of their research (Pamuk) to more overt calls for scientists to become public spokespeople and activists to bring their unique expertise to the public (Oreskes and Kitcher). The latter prescriptions should be wielded carefully, as the relative success of such a mission highly depends on the receptive culture's orientation around intellectualism, its respect for expertise and most critically, the compatibility of the political-theological value spheres between the expert and public

[3] Pamuk, *Politics and Expertise*
[4] Oreskes, *Why Trust Science?,* pg. 151-152
[5] Kitcher, *Science, Truth, and Democracy*, pg. 193-197

communities. This will be elaborated on further after relevant accounts are examined against the pressing issues at hand.

Roots and Risks of Scientism

Upholding stronger versions of the fact-value distinction induces lines of thought that seek to justify trust in science based on its epistemological rigor. This arises from a tighter association between science and apolitical facts. Thus, if science behaves as such, trust ought to be merited based on reliability and confidence in the rigor of scientific facts[6]. These accounts are also primarily interested in upholding the fact-value distinction so as to crucially avoid having to answer political charges of competing value systems in science. Oreskes' *Why Trust Science* aligns with this view best, though its final coda, "Values in Science," addresses many of its inherent issues.

So-called apolitical accounts of science, not exactly Oreskes', but accounts normally given by scientists aspiring to neutrality that fully support a lockstep version of the fact-value distinction between science and politics, should be understood in two ways. First, sympathetically. Blindness to the intermingling of values into scientific practice and the ever-present question of utility surrounding scientific findings is at best a product of the inherent limitations of scientism[7] as a school of thought and, at worst,

[6] Oreskes, Chapter 1-2

[7] Scientism is commonly understood to be a school of thought that grew out of positivism. Both schools of thought claim that knowledge is limited to that which can be measured, quantified and empirically detected. In short, scientism shrinks the boundaries of inquiry to the limitations of the scientific method. This both de-legitimizes anything "un-scientific" and also creates the conception that science is

an avoidant response to a political mess in which scientists may want no part. Second, suspiciously. This is especially true on the part of states seeking to bypass rights owed to their constituents. Noble scientists seeking to avoid embroilment in value-debates surrounding the uses of their findings and the value-framings of their research choices may innocently choose to point to the fact-value distinction to plead that they only discover facts, not use them. States, however, have much to gain from "scientizing" policy platforms behind an imagined clean fact-value distinction. Policy can never be purely factual, as policy is necessarily the *action and implementation* of a particular ideal or state of affairs. However, if policy is successfully *scientized*, then apolitical conceptions of science may be trotted out from labs of hapless, well-meaning scientists in order to render policy immune to disagreement on all channels aside from those of expert knowledge, which citizens conveniently cannot be expected to possess.

Accounts that uphold maximal versions of the fact-value distinction induce epistemologically (as opposed to socially) based accounts of trust. These perspectives are functionally limited to trust between elite intellectuals and constitute egregious misunderstandings of the social and political nature of trust in the public sphere. The consequences of this oversight reach a fever pitch in crises situations like the COVID-19 pandemic where snap judgments must be made about what conditions are worth preserving and what costs should be paid to actualize these ideals. Such costs are paid on the part of society as a whole, not solely on the part of elites.

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epistemologically exhaustive. Needless to say, it is not. Both consequences are dangerous for reasons that are explained throughout this text.

Expertise is certainly required to study complex mechanisms that make this calculation intricate, but the work done by Pamuk shows that even this mode of study is value driven. More obviously, the allotment of costs and benefits to be paid and collected via the choosing of one crisis response plan versus another is plainly a question that implicates the entirety of society, and democracies entitle their citizens to be the voice that determines what balance of costs and benefits constitutes a solution. One might argue that representatives may do this job effectively, but there are a number of issues with this charge, most notably, that such issues as in this case study are much too complex for representation to adequately serve.[8]

Successful *scientization* of policy boxes out the possibility of democratic representation in value-based domains. Thus, it should not be surprising that *scientized* policy campaigns engender extreme distrust on the part of citizens of democracies who expect to maintain the right to popular oversight of their government. This observation is only intelligible if the fact-value distinction is broken apart. Accounts that see political oversight of scientific practice as nonsensical are intelligible only if we understand that such a reaction is necessarily induced by thinking that scientific

[8] Common Republican – as in, favoring representative republics over more direct democracies – accounts would likely argue that representatives perform the task of mediating the relationship between the public and other distant institutions such as science, foreign states and foreign militaries effectively, negating my concern. While this instinct might follow the natural responsibilities of the act of representation, I would argue that the immensity of the science-politics integration project makes this extraordinarily difficult. The minute details involved in what kinds of valuations and decisions must be made on a case-by-case basis of determining the blend of costs and benefits a society is willing to pay. Especially in crises like COVID-19, these complexities are far and above the power of individual representatives to process. In more simple cases where both technical and value-based minutia are relatively streamlined, such as deciding where to place a road, a representative may have an easier time representing the dynamic interests of the public across the different civic variables road-placement may affect. However, in a crisis like COVID-19, its multi-variate breadth is much too wide for representatives to adequately express, and the only consequence of a representative method in this case would likely be an extreme shrinking of the resolution of popular decision-making surrounding the process, though this is a common critique made by advocates of direct democracies of representative processes at large.

practice limits itself only to discernible facts. Thus, the burden of my argument lies on proving the insolvency of the fact-value distinction. It is to this we now turn.

Pamuk's "Significant Knowledge"

Pamuk's *Politics and Expertise* best articulates the warrant for integrating science and political oversight. It also necessarily follows to show exactly where and how values interject themselves into the stages of scientific research. Generally, scientific research is thought to follow the sequence of concept, hypothesis, modeling, and evidence. Pamuk's account sketches the intermingling of values into these steps. "Thick" concepts – a term taken from the social sciences – necessarily blend factual and value-based phenomena such as "damage" or "harm"[9]. These terms guide the development of concepts that precede the formation of hypotheses. Per Thomas Kuhn's "paradigmatic" sketch of how scientific practice is organized[10], hypotheses are only considered viable under guidelines of what possible outcomes are significant to research, and publishing efforts are centered around studies that produce findings. While still intellectually worthwhile, studies testing hypotheses which ultimately do not find anything once the evidence is examined neither get attention nor continued funding.

Models constitute an undeniable case of value admixture. Scientific models are used to render prohibitively complex phenomena more intelligible

[9] Pamuk, *Politics and Expertise*, pg. 32
[10] Kuhn, *The Structure of Scientific Revolutions*

via sets of simplifying assumptions. Higher fidelity models mimic phenomena more closely, have fewer assumptions and are more complex in nature. Thus, they require more time to develop, more types and quantities of data to run, and longer timelines to produce results. Lower fidelity models tolerate greater amounts of error with more generous assumptions and lower demands for data and time. The spectrum of model fidelity is normally a spread of options from which a particular modeling approach is selected based off of what level of accuracy is acceptable and what relevant data needs to be projected.[11] Both of these categories are either determined by "scientific tradition" – a category Kuhn shows to be unscientific[12] - or overtly non-scientific needs created by states for specific types of predictions. Some amount of error is a permanent fact with modeling efforts as opposed to analytic solutions. As Pamuk writes, all models are wrong, but some are useful:

> "Models simplify features of the actual system to render it more workable, especially where using the actual numbers would be too complicated, or the underlying data are unavailable or incomplete… But the correctness of assumptions cannot be tested, and approximations are inaccurate by definition."[13]

Similar dynamics exist in determining what evidence is significant or not and what does or does not count as a finding that will be published and garner additional funding. Each step of the scientific process implicates the layered growth of consequences of value-judgments concerning the significance

[11] Pamuk, pg. 38-41
[12] Kuhn
[13] Pamuk, pg. 39

of hypotheses, relevance of findings, and tolerance of certain kinds of error over others.[14]

In the most ideal case, these extra-scientific pressures are limited to mild concerns about receiving further funding. This would most naturally fit in the case of scientific research both outside of crises and relatively isolated from immediate social needs. The examples which come to mind are fields which are relatively remote from social needs such as cosmology and condensed matter physics. These extra-scientific pressures, however, amplify themselves and become more overtly value-laden in nature when said research is immersed in crisis situations in which lives are at stake. Decisions about what data counts as "significant," what types of predictions models should produce, what amount of error is tolerable, *and what research ought to be done and why,* crucially form the resolution and character of scientific advice given to states. This specific dynamic is fleshed out in more detail later in the case study where the dominant early epidemiological models in the US and UK are discussed, their value-steps revealed, and their consequences shown. Judgment calls permeate scientific advising at every stage of the process. This warrants the call for democratic oversight of the process central to my own and Pamuk's argument.

Deeper concerns also lie underneath the social consequences of scientific research itself. As advancements in research develop, technical possibilities and new scientifically-coded "thick" value systems fill the

[14] Pamuk, pg. 42

space of possibilities that decision-makers – politicians and citizens – use to exercise their political power:

> "From a democratic perspective, it is crucial to understand how different practical pressures influence the design and conduct of scientific inquiry because these choices influence the political decisions that are possible to pursue on the basis of the existing body of scientific knowledge, and solutions to social problems that are even conceivable."[15]

Scientific findings possess a unique character that inherently shapes the space surrounding decisions made by non-scientists. New scientific findings imbricate their value-judgments – think of "harm" or "benefit" as seen in scientific findings that claim certain dynamics are malignant in biology, or environmental diseases in ecology[16] - into statements that are coded as facts and require expertise to dispute, something most decision-makers do not possess. Pamuk writes, and I would agree, that "this gives scientists considerable power to set the basic normative terms for public debate on an issue."[17] Thus, even the most putatively harmless, purely factual findings open up possibilities and shape the landscape political actors, politicians and citizens alike, act within. Thus, upholding democratic principles requires that decisions about both what research is done for what reasons and how it is executed must be integrated with the citizenry. Many of these arguments work in theory, and are reflected against examples in Pamuk's, Oreskes', and Kitcher's own work. Thus, we now move to concretizing my

[15] Pamuk, pg. 32
[16] Pamuk, pg. 35
[17] Pamuk, pg. 34

argument by investigating the case study of COVID-19's development from January to July 2020 in the US and UK.

Case Study

Case Selection

The case selection process first sought to capture the stress between scientific advisory committees and states in times of crisis and to see how crises exact differing tolls on both institutions. The cases independently point towards situations in which scientific standards of legitimacy and knowledge are applied to political decisions and equally as many cases in the reverse direction. Second, the case study selection process also sought to sketch exactly how these stresses contribute to alienation between citizens and elites, politicians and scientists alike. Thus, the case study was chosen as the developing relationship between scientific advisory committees, states, and citizens of the US and UK in the first six months of the COVID-19 pandemic. The US and UK were hotspots of suspicion and outcry around science's place in relation to political institutions, thus providing much material for reflection against my argument.

A handful of dynamics are analyzed in the theory that are then fleshed out against historical examples in the case study. Key steps in which value judgments had to be made in short order are revealed in the three dominant, early epidemiological models in the US, UK, and Austria. These value judgments are shown to implicate themselves in the development of each model as well as exactly what specific types of projections were required by states responding to the COVID-19 crisis. Many of these projections were strictly focused on quantifying infrastructural load on hospitals and human capital. These projections were made at the cost of leaving many other social factors

unquantified, such as plummeting mental health, increases in domestic abuse, and losses in education. While these "social" tolls were not the priorities of modelers or the type of information required by states, the costs induced by scientifically advised policy are paid by society at large, not just experts. The act of superseding the public's right to have a voice in exactly what costs are paid and benefits collected, however temporary, according to states, constitutes a violation of the democratic principles to which the public are entitled. Thus, this constitutes a case of politics being "*scientized*," creating immense distrust in what appears to be a state-science amalgam over and above democratic processes.

Scientizing politics can explain parts of democratic backsliding and alienation between the public and institutions, but to act as if scientists are the aggressors by which politics is stifled is myopic. Much of the case study analysis finds that crisis timelines heavily compress the environments in which scientists are allowed to work, resulting in rapidly produced science that is soft, underdeveloped, and requires regular updates. Regular updates to scientific findings are expected of scientific practice even outside of crises, and regular transparency about dissensus and the state of current knowledge ensures that science is done in good faith. However, states spearheading crisis responses suffer from much higher demands for certainty and immediacy of policy, and constantly evolving scientific developments create uncertainty and doubt in the eyes of the public. This is seen in real time via the regularly evolving messaging surrounding mask-wearing policies where, first, KN95 masks were advised against out of concerns of a mask

shortage, resulting in the support of wearing cloth masks.[18] Cloth masks were then found to be less effective than had been thought, and KN95 masks were recommended by virtue of their effectiveness. Such a case constitutes an admixture of economic and scientific concepts in state messaging that creates a lack of clarity and uncertainty in the public, further reducing trust in institutions and faith in the solidity of their policies. Expecting science to produce certain and immediate findings in crises like COVID-19 is absurd, but what the aforementioned dynamic does indicate is that governments have much to gain from "scientizing" their policies and offloading their responsibility to legitimate policy onto the scientific community. This necessarily creates friction, especially in times of crisis, for the reasons mentioned above. Distrust, which is fittingly deserved of the state, often gets misdirected towards scientists who, in crisis conditions, are consciously working against the standards of their practice and being forced to provide non-scientific services such as the legitimation of policy to states. This is the first site of tension between science that cannot operate well on short notice and states which require legitimate, immediate, and certain advice by which to inform snap policy decisions to handle crises. Such demands often force scientific advisory committees to close ranks[19] when producing advice that they tellingly call "consensus statements." This reaction to political pressures points towards an explanation for such a monolithic term as "the science," though no such monolith exists within the scientific community. Thus, "trusting the science" is a misconception created

[18] Netburn, Deborah, "A timeline of the CDC's advice on face masks," *Los Angeles Times*, July 27th, 2021
[19] Pamuk, pg. 85

by political demands of the scientific community, even if the scientific community can never operate as such.

The analysis in this paper points towards a conclusion that forcing together political trust and scientific fact is a dangerous combination that erodes faith in democratic principles. Though STS – Science and Technology Studies – literature sometimes pushes an increasingly constructivist conception of science as a reaction to perceived attacks on non-scientific spaces by the natural sciences, ample accounts of political forces invading scientific processes can be found.

Case Study Details

The UK's Scientific Advisory Group for Emergencies (SAGE) serves as the locus for scientific advising of crises and the bridging of the gap between scientists and politicians. Within SAGE, SPI-M-O (scientific pandemic influenza group on modeling, operational subgroup) serves as the group that focuses on transmission dynamics of infectious diseases at all stages of a pandemic crisis. Graham F. Medley, chair of the SPI-M-O organization, collected an assessment of the challenges that SPI-M-O faced while seeking to advise decision-makers throughout the early and middle periods of the COVID-19 pandemic in which the conditions of the crises evolved daily.[20] The overwhelming sentiment reported by many scientists under immense pressure was frustration. Scientific practice was forced to produce clear and enduring

[20] Graham F. Medley, A consensus of evidence: The role of SPI-M-O in the UK COVID-19 response, Advances in Biological Regulation, Volume 86, 2022, 100918, ISSN 2212-4926, https://doi.org/10.1016/j.jbior.2022.100918. (https://www.sciencedirect.com/science/article/pii/S2212492622000586)

facts while immersed in a timeline that prohibited any thorough peer-review, testing of replicability and scientific deliberation. Medley's own response was to stress that "Epidemics are Dynamic:"

> "Perhaps the single biggest problem, especially in the first few months of the pandemic, was the apparent lack of appreciation that pandemics are dynamic, and interventions change their shape, but cannot stop them other than through global eradication which was not possible without extensive international coordination and cooperation."[21]

The Royal Society also released a similar article expanding on "the constantly evolving situation and rapid turnaround of modeling evidence… [which proved to be] incompatible with the majority of current publishing mechanisms:"[22]

> "Policy advice is often needed within days. During an epidemic emergency, scientific results must be shared immediately and widely, and during 2020, pre-print manuscripts, not yet peer reviewed, became the *modus operandi* for communicating the latest findings."[23]

Communications between SPI-M-O and decision-makers are achieved by "consensus statements" published by the organization. The utility of SPI-M-O consensus statements is dependent on the highly structured and consciously managed approach by which they are processed by the modeling group:

> "Modellers are encouraged to develop their own independent approaches to avoid groupthink and at least two (but often more) independent analyses are provided for each policy question to aid discussion, explore sensitivity to structural model assumptions

[21] Medley, pg. 1-2
[22] Brooks-Pollock Ellen, Danon Leon, Jombart Thibaut and Pellis Lorenzo 2021Modelling that shaped the early COVID-19 pandemic response in the UKPhil. Trans. R. Soc. B3762021000120210001 http://doi.org/10.1098/rstb.2021.0001, pg. 4
[23] Brooks-Pollock et al., pg. 4

> and identify inaccuracies, thereby increasing the robustness of SPI-M-O consensus statements… This plurality of opinion was key to generating robust and reliable advice."[24]

It goes without saying that SPI-M-O operated under hellish conditions to produce scientific advice at breakneck speeds to the British state. Such conditions make it impossible for scientific practice to advocate for itself effectively, and the caustic consequences of "*politicizing*" science are plain to see. Whereas epidemiological models are normally produced in months or years[25], "advice is often needed within days."[26] Science produced in such an aggressively accelerated timeframe will necessarily be soft, underdeveloped, and require regular updates as new findings come in. Figure 1 shows exactly how the frontier of

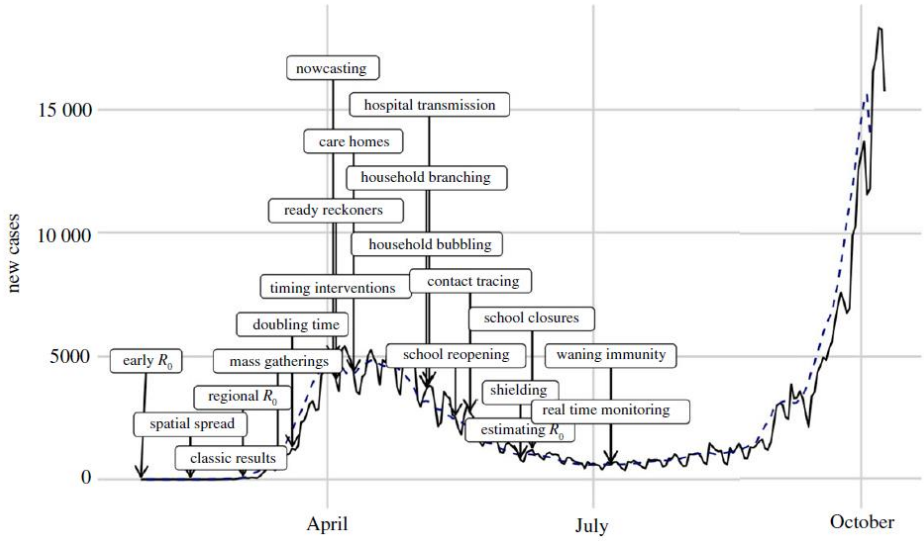

Figure 1: COVID-19 epidemic curve with Special Issue papers marked on, indicating when the work was developed.[27]

[24] Brooks-Pollock et al., pg. 4-6
[25] Brooks-Pollock et al., pg. 4
[26] Brooks-Pollock et al., pg. 4
[27] Brooks-Pollock et al., pg. 5

scientific knowledge developed as the pandemic progressed. Estimating the reproduction number R_0 as well as real-time monitoring only came to the forefront of scientific knowledge by mid-June and early July, respectively.

Faith in science will expectedly waver given such a rapidly evolving and often changing state of scientific knowledge. Outside of crises, science prides itself on seeking out dissensus, contesting new findings and battering new publications with any number of alternative accounts. However, crisis situations create demands by both the state and the public that are orders of magnitude higher. This makes science's reception by nonscientists all the more punishing by virtue of science's inherently time-consuming and highly iterative nature. Good science with maximal certainty and few iterative developments cannot be produced immediately. Thus, scientific practice should not be forced to take the blame for consequences induced by the needs of states.

"*Politicizing*" science may be an unavoidable consequence of crises like COVID-19, but further damage between states, scientists and the public can be created if "*politicization*" takes the form of scapegoating. A key example is found in Pamuk's reference to the 2012 earthquake in L'Aquila, Italy, which resulted in seven seismologists being sentenced to six years in prison for manslaughter.[28] The city had been experiencing a "seismic storm: two or three low-level tremors daily [with an]… additional fifty-seven tremors [that] took place in the five days before."[29] The official scientific advice was that "it is unlikely that an earthquake like the one in 1703 could occur in the short-

[28] Pamuk, pg. 1
[29] Pamuk, pg. 1

term, but the possibility cannot be totally excluded."[30] This assessment included a necessary amount of uncertainty, but the Civil Protection Department subsequently produced a statement with *no* uncertainty stating that that the situation was "certainly normal:"

> "The scientific community tells me there is no danger because there is an ongoing discharge of energy."[31]

The seven earthquake seismologists involved were then charged with manslaughter for producing "misleading assurance by a group of respected experts that there was no danger."[32]

It should be immediately clear that the certainty that was ultimately communicated to the public was inserted into the scientific advice by the political apparatus seeking to manage the crisis. Similar dynamics occur with organizations like SPI-M-O and their "consensus statements." Scientific advisory committees are well aware of cases such as L'Aquila and how scientists have been made examples of before. Thus, aiming for consensus within scientific committees is often, as Pamuk writes, "standard practice."[33] Another common theme exists between the L'Aquila case and COVID-19 concerning the position of scientists. "Trusting the science" was a common slogan in and throughout the COVID-19 pandemic. Such a term should immediately concern any professional scientist, as no monolithic concept of "the science" exists. This is further evidenced by the fact that consensus on scientific committees

[30] Pamuk, pg. 2
[31] Pamuk, pg. 2
[32] Pamuk, pg. 2
[33] Pamuk, pg. 85

is often forced as an after-the-fact desire for scientists to meet the needs of states.

Apolitical conceptions of science that arise from upholding the fact-value distinction serve states in a unique way by absolving them of responsibility for the consequences of being involved with value judgments or uncertainty. With this in mind, it is intuitive that states will seek to offload their own responsibility to legitimate policy onto scientists who are neither qualified nor deserving of the burden. Naturally, scientific practice is not built to legitimate policy on a state's terms, and this mismatch in knowledge-types reaches its fever pitch in times of crisis like the COVID-19 pandemic. This is visible particularly in the consequences of iterative, rolling updates on the effectiveness of mask wearing which often created contradictions and induced confusion in the public. These contradictions were created through a mix of both economic and scientific factors that were not clearly delineated. Initial policy advice on mask-wearing in the US advised against wearing masks citing mask shortages. In a tweet on February 29th, 2020, US Surgeon General Dr. Jerome Adams published an extremely reductive statement that made few of the multi-variate influences behind the complexity of the situation clear:

> "Seriously people – STOP BUYING MASKS! They are NOT effective in preventing general public from catching #Coronavirus, but if healthcare providers can't get them to care for sick patients, it puts them and our communities at risk!"[34]

[34] Netburn

Adams' statement went so far as to say that masks are plainly "NOT effective in preventing [the] general public from catching #Coronavirus," a decisive and certain claim of a supposedly scientific fact that had to be contradicted later. The US Centers for Disease Control and Prevention more properly advised that "facemasks may be in short supply and [that] they should be saved for caregivers."[35] This line of thought rapidly changed "in response to a growing body of evidence that people who do not appear to be sick are playing an outsize role in the COVID-19 pandemic."[36] By July 14th 2020, the CDC was advising that masking was likely to be a "contributing factor" for preventing infections[37]. It was at this point that the director of the CDC, Dr. Robert Redfield openly contradicted Dr. Jerome Adams' statement:

> "I think we're being very clear now. Now's the time to wear a mask."[38]

Scientific practice, when allowed to work optimally, strengthens itself through repeated bouts of dissensus, testing findings, and providing alternative explanations to popular questions. The conditions of crises cannot be changed and bemoaning them is largely a moot point. Scientists will necessarily have to work under extremely cramped and scientifically unfavorable conditions. This cannot be helped. What can and should be helped, however, is the preservation of what basic division of labor *can* be acknowledged between science and politics. That is to say that science cannot solely be expected to legitimate policy on the part of states and on their terms. One of the primary caustic consequences of this undue burden is most

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notably the association of scientific practice with fictitious monolithic terms such as “The Science.” Such misleading terms conveniently serve politicians and states seeking to escape their own occupational hazards of legitimating policy. The ultimate result of such forced terms is the degradation of trust in science’s capabilities, but this is ultimately because science is being judged under the standards of political needs and being made to provide a public good it cannot produce.

Science produced in crises is necessarily soft, underdeveloped, and bound to be updated, even contradicted. Extra-scientific factors like mask shortages can and do often implicate themselves as well, as seen in the CDC’s claim on March 24th, 2020, that “healthy people who do not work in the healthcare sector and are not taking care of an infected person at home do not need to wear masks.”[39] Though the Center for Disease Control functions both as a scientific and governmental institution, the responsibility of mediating uncertainty and communicating the complete story, with both scientific and non-scientific (as in the case with mask policy) factors clearly identified falls on state and media organizations, not the scientific community. Forcing this task onto scientists who are in no way equipped to do the job results in science as an institution sustaining wounds that are owed to political institutions, not scientific ones. Thus, ample cases of science being *“politicized”* exist. The study of cases in modeling, however, point to the reverse in which political variables can be flattened down to scientific

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terms, effectively being "*scientized*" and depriving citizens of the right to define exactly what constitutes a "solution" to a crisis.

Model Development in Crisis

The development of the science-policy relationship in the UK during the early months of the COVID-19 pandemic serves as a locus for modeling efforts in which value-laden judgments were made for the sake of providing "useful" predictions to states. Decisions concerning exactly which phenomena to study, which to parameterize, and what types of predictions to make under specific needs made clear by states need to be recognized as political more than purely scientific. Such decisions amount to what phenomena are and are not measured. These decisions ultimately shape the space of possibilities decision-makers can act in. The thought process used to make these decisions also necessarily implicates exactly what variables are worth preserving, how this ought to be accomplished, and to what extent. As stated before, costs and benefits of policy are paid and collected by society at large, not only by experts. Democracies entitle their constituents to a say in how and where these costs and benefits are allotted. These dynamics are visible in the cases of the three dominant epidemiological models in the US, UK, and Austria in the early months of the COVID-19 pandemic.

Pivotal Models in the US, UK, and Austria

The US, UK, and Austrian models mentioned above are thus[40]: the MRC (Medical Research Council) Center for Global Infectious Disease Analysis at Imperial College London, the University of Washington's Institute for Health Metrics and Evaluation (IHME), and the Austrian COVID-19 model based on the generic agent-based population model produced by DEXHELPP (Decision Support for Health Policy and Planning). The first two are firmly "prognostic statistical models" that are "inherently short-term forecasting tools."[41] The Austrian model is decidedly a "descriptive simulation model," "where each individual in the society and various contact places, such as schools, kindergartens, leisure places, are explicitly modeled."[42] This approach distinguishes itself from the Imperial and IHME approaches in that the root dynamic of transmission, contact and association, is directly modeled through atomized behavior of individuals within the society. This approach has the best capacity of the three models to interface with social factors like class, age, and ethnicity, which political scientist Sibel Eker later calls "nonlinearities."[43] Pamuk stresses that these nonlinearities are critical to a thorough understanding of transmission dynamics yet are also highly speculative and value-laden.[44] This also makes them cumbersome phenomena to study from a scientific perspective and also motivates the need for the evaluation of nonlinearities to involve some amount of democratic oversight. The Austrian model stands as the most comprehensive and "accurate" model

[40] Eker, S. Validity and usefulness of COVID-19 models. Humanities & Social Sciences Communications 7, 54 (2020). https://doi.org/10.1057/s41599-020-00553-4pg. 2-4
[41] Eker, pg. 4
[42] Eker, pg. 4
[43] Eker, pg. 1
[44] Pamuk, pg. 196

insofar as it grasps a higher resolution of epidemiological phenomena. It is also equally more complex, more demanding of greater amounts and diverse types of data, required much more time to develop, and consumes more time to produce predictions. Thankfully, the Austrian COVID-19 model was able to leap off of previous progress made from the forerunning Austrian population model. It should be clear that though the Austrian model was the "best" one, it was also extremely consumptive of resources, and crisis situations often prevent science from being able to put its best foot forward through idealized projects such as these.[45]

The Imperial and IHME models are designed to fit more immediate, short-term timescales in order to approximate loads on medical infrastructure. The Imperial model functions based on a narrow scope fundamentally organized around the most popular method of quantitative epidemiological modeling approaches, the SIR - Susceptible, Infected, Recovered – framework. The SIR framework takes a given population of a certain size and models epidemic progression as a shift of given portions of the population into and out of the susceptible, infected, and recovered categories. Thus, the upshot of the method is to create reasonable expectations of case number surges, peaks, and declines. The SIR framework also describes epidemiological phenomena as relational properties between the three categories. For example, relative properties between the S, I, and R, categories can tell modelers if conditions are underneath a critical point where infections may exponentially grow or fall, and whether herd immunity has been achieved. The evolution of

[45] All three modeling efforts and associated vaccine development projects also benefited considerably from the fact that COVID-19, or more specifically, SARS-CoV-2 (Sever Acute Respiratory Syndrome Coronavirus 2), drew from already present scientific knowledge concerning other preceding SARS viruses.

these three categories can then be derived to estimate infection, transmission, recovery, and death rates. It is important to stress that these models were limited by a focus on advising decision-makers exactly how to field scarce resources, such as hospital infrastructure, medical equipment, and human capital in the most efficient possible ways.[46]

Economists Christopher Avery et al.[47] point us to a dichotomy of epidemiological modeling purposes, the first being to predict and the second being to understand. While the Austrian model could possibly sit closer to the latter purpose, the Imperial model is expressly within the former. This creates problematic consequences. Lacking the means to interface with common non-linear forces that shape transmission dynamics creates a tightly narrowed bandwidth over which the model can claim mastery. This reduces its explanatory power and also shrinks of the boundaries of what phenomena are in question or can be studied:

> "The model focuses on the epidemical process of transmission, infection and casualties, therefore the nonlinearities caused by social behavior, healthcare system capacity and treatment choices are not explicitly taken into account. The authors justify this choice by arguing that the death data is the most reliable one to reflect the actual situation, since the actual number of infections is highly uncertain beyond the reported cases."[48]

The US model produced by IHME operates similarly, focusing strictly on "determining the extent and timing of deaths and excess demand for hospital

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[46] Eker, pg. 3
[47] Avery, Christopher, Bossert, William, Clark, Adam, Ellison, Glenn, Ellison, Sara Fisher. 2020. "An Economist's Guide to Epidemiology Models of Infectious Disease." Journal of Economic Perspectives, 34 (4): 79-104.
DOI: 10.1257/jep.34.4.79
[48] Eker, pg. 2-3

services in the US, later extended to different countries."[49] Much like the Imperial model, it also "does not capture the epidemic's transmission dynamics."[50] It is clear that SIR modeling approaches narrow the receivable bandwidth of epidemiological phenomena. What is less clear is that creating a model that universally orients itself around creating a "death curve" is identical with exhaustively reflecting the "actual situation."[51] Identifying a limited prediction of the death curve with the "actual situation" is a clear case of science executing a judgment call concerning what is worth modeling and what policies are worth advancing by furnishing them with advice. Though "the actual number of infections is highly uncertain beyond the reported cases," this only describes a limit of current modeling methods, not of an absence of worthwhile information. Conflating the two privileges limited, and contingent scientific practices with establishing a rule for what is and is not worth quantifying. Also, limited testing oversight and poor death certification practices may have created dangerous amounts of leeway between doctors on the ground and modelers in their labs. This dynamic manifested itself based on Gill and DeJoseph's work showing the "known training gap regarding proper death certification,[1,2,4] which leads to improperly completed death certificates [such as deaths due to "acute respiratory infection"]… If the death certificates are inaccurate, local and national responses may be adversely affected."[52] These adverse effects involved in the model development process had widespread social consequences according to Pamuk:

[49] Eker, pg. 3
[50] Eker, pg. 3
[51] Eker, pg. 3
[52] Gill JR, DeJoseph ME. The Importance of Proper Death Certification During the COVID-19 Pandemic. JAMA. 2020;324(1):27–28. doi:10.1001/jama.2020.9536

> "Moreover, they [the IHME and Imperial models] studied short-term health outcomes, and entirely neglected the economic and social impacts of policies. This meant that they failed to take a holistic approach to health outcomes overall, and left out the mental and physical health toll of social isolation and a severe economic downturn, increased domestic violence and substance abuse rates, delayed treatments for other diseases, and missed vaccination schedules for children."[53]

Equating a narrow projection of the death-curve with reflecting the "actual situation" erodes democratic principles in two ways. First, it leaves much of the social reality outside of consideration by claiming that the death-curve view is exhaustive, which it is not. Second, it extra-democratically decides the framework within which political actors are allowed to voice themselves. Thus, Pamuk's list of social ills which were induced by lockdown policies were, from the apolitically scientific view, at best not within the field of consideration and at worst unscientific complaints from uneducated laymen.

The similarly limited scope of knowledge that these models allowed was one of their only similarities, however, as they produced highly different projections: 2.2 million total deaths in the US from the Imperial model and 200,000 from the IHME model. The Imperial model focused on approaching a wide range of possible cases depending on different policy interventions: complete lockdowns, banning of public events, closing schools, self-isolation, and social distancing. However, reception by the decision-makers, the UK government, and thus necessarily their imaging and communication to the public, was oppositely focused on one possibility: the projection in which

[53] Pamuk, pg. 196

absolutely no policy change was enacted and the virus was allowed to spread like the common cold.[54] The state of knowledge on the crisis at the time effectively became dominated by what we can call the control of the study; what amounts to a scientific disaster.

The IHME model suffers from an even tighter scope and limited approach isolated to curve fitting. This resulted in its projected number of 200,000 total deaths from the pandemic in the US. The incongruent relationship between the IHME and Imperial models "led to criticisms that the modeling enterprise had largely failed."[55] Both models were developed by rigorous, credentialed scientific institutions but under different premises. Within the scientific community, this spread of findings is commonplace, especially in the case of science produced under crisis. However, the models were evidently not received by the public as they should have been according to a scientific perspective.

Scientific models are necessarily oriented towards predetermined uses that idealize certain goals as solutions to crises as opposed to others. In addition to the idealized type of advice that modeling efforts are designed to support, defining what amount and type of error is acceptable and what types of data are significant constitutes the execution of value-laden judgment calls. Democratic systems promise their constituents a say in exactly what costs and benefits they wish to pay and collect as a society. The act of superseding this promise is manifested by the move to adopt widespread lockdown measures as the only systematic solution the COVID-19

[54] Pamuk, pg. 195
[55] Pamuk, pg. 194

crisis. Of course, in light of this discussion, it should be noted that lockdown policies were implemented with varying degrees of national coverage and effectiveness ranging from lockstep protocol to near nonexistence. Such is attempting to govern social behavior with such precision in a nation as disparate as the US.

This said, citizens in democratic systems are entitled to have sovereignty over the act of determining what constitutes a "solution" to the crisis. Thus, they are owed a say in exactly what balance of death, mental health deterioration, increases in domestic abuse, losses in education and other social costs that they are willing to pay under lockdown policies. Similarly to Pamuk's account, this democratic right encounters issues with extreme civic expense. Successfully modeling a crisis response after a democratically reached "solution" means acquiring this solution through democratic means that is immensely unwieldy, infrastructurally expensive, and time demanding. This opens questions attacking the worth of democracies in general and particularly the ability of democracies to respond to crises in a timely manner. While this may be worth considering, recognizing the inherent problems with the fact-value distinction comprises the core burden of this text. Regardless of the issues with the costs of democratic solutions to crises, none of these materials can even be rendered intelligible unless this distinction is successfully problematized. Now that this has been accomplished, and some of its initial consequences have been manifested through the case study, we must move on to the general insights of the project and larger questions the project induces.

Discussion Looking Forward

Many of the inherent sources of friction between scientific practice and political administration have made themselves clear in the unraveling of COVID-19 in its early months. Uncertainty was maximal, deaths were mounting daily, and both publics and states globally clamored for advice. Sometimes this advice stepped away from trying to focus on "facts" and leaned into proposing solutions. The gap between facts and solutions necessarily implies a problem to be solved according to a predetermined ideal. Democracies necessarily come out of nominalist backgrounds in which these ideals cannot be scientific and must be popularly determined. With this warrant in place, we should analyze popular responses to this issue and test the effectiveness of their proposals.

Bridging the Gap and Proposed Solutions in Theory

Without democratic oversight, value-judgments will continue to be made ad-hoc by scientists following a mix of their own subjectivities and state-level needs at the expense of the representative methods to which citizens in democracies are entitled. Proposed solutions to integrating scientific practice and democratic oversight vary.

Pamuk's Science Court

Pamuk proposes a "science court" in which the fully value-laden process is laid bare in a deliberative court-like system where citizens, scientists

and politicians alike collectively deliberate the character of scientific findings. Pamuk's goal is to attempt to try and mediate the asymmetrical imbalance in niche expertise between scientists and laymen as well as to provide democratic oversight of the judgment calls made in scientific research. The prescription follows cleanly from the premises of democratic systems, but two concerns immediately arise. First, while Pamuk's science court would hypothetically bridge the gap in question, it is clear that such a process would be extremely civically expensive. Such deliberations between scientists, politicians and citizens would take immense amounts of time and it is not guaranteed that either the gap in niche expertise could be successfully crossed or that deliberative processes concerning values could be successful today. Pamuk's account focuses on trying to bring experts and laymen together and to uphold principles of democratic representation. This is fitting of her background as a political scientist, but not much focus is provided to dissect the tenability of deliberation in the first place. What can initially be said at this point and within my scope of work is that deliberation cannot be taken for granted as bound to be successful or synergistic in nature. These two concerns about civic expense and the tenability of deliberation are common among theorists critical of democracies at large, and it points us to the question of whether democratic systems can coexist with scientific practice at all. This latter question sits at the periphery of this work, but what should be stressed is that even anti-democratic accounts would still have to contend with value-laden steps of scientific practice. Thus, no matter the political system of choice, this is ultimately a political question, not a scientific one. This is ultimately the

most concrete advancement that I seek to put forward. Retaining a strict fact-association with science, per upholding the fact-value distinction, permanently locks the insights of my argument behind a wall that, minus the core issue with the premise, presents itself as intellectually sound.

Pamuk's account is civically expensive, but this should be expected. Democracies are civically expensive systems that require widespread investment to function. In order for this widespread investment to occur, there must be faith that investment produces results, and that spending one's own precious capital, whether it be time or money, on the democratic system is "worth doing." Questions concerning the health of democracies aside, it should also be noted that in crisis situations like the one dissected in the case study, deliberative processes like Pamuk's science court are simply too civically expensive to be put into action. This is something that Pamuk recognizes[56], but it is no reason to throw out Pamuk's account or its support for my argument. The account is crucially valuable for its successful sketch of exactly which types of knowledge reside where within the scientific process and motivating the need to make good on the rights of representation to which democratic citizens are entitled. Without Pamuk's account, an apolitical conception of science could appear as viable by default and many of the caustic consequences would go unnoticed.

[56] Pamuk, pg. 98-132

Oreskes' Trust in Science

Oreskes' project starts with a genealogy of science's intellectual texture starting from its beginnings with Boyle and ending in its current state with Kuhn, Feyerabend, Latour and Jasanoff.[57] Generally, Oreskes' historical thrust (fitting for her background as a historian of science) focuses on showing that, yes, science can never be neutral, but that its value lies in its epistemological rigor. This manifests through its slow but steady production of helpful knowledge about the world via regular publication, questioning of findings and its eventual correction of previous claims. Thus, Oreskes sees a lack of trust in science as based on doubts induced by its vulnerability to values. This egregiously misidentifies the nature of trust, and Oreskes' account is limited in utility only to interactions between scientists and other intellectuals or academics:

> "This is an academic problem but one with serious social consequences."[58]

Thus, we can situate Oreskes as an account that leans closer to upholding the fact-value distinction than others, such as Pamuk or Kitcher. Oreskes proposes that this epistemological strength can be maximized if scientific communities are diverse, drawing on feminist philosophies of "strong objectivity" and "standpoint epistemology."[59] Both philosophies recognize the intrusion of subjectivities into politics as well as science,

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[57] The arc from Robert Boyle to Thomas Kuhn, Paul Feyerabend, Bruno Latour, and Sheila Jasanoff largely reveals a move from intellectual conceptions of science as removed from society and politics – and thus purely factual – to a perspective that implicates science's embeddedness in social dynamics, imaginaries and political theologies. See Kuhn, Thomas, *The Structure of Scientific* Revolutions, Feyerabend, Paul, *Against Method*, Latour, Bruno, *We Have Never Been Modern*, and Jasanoff, Sheila, *States of Knowledge: The co-production of science and social order*.

[58] Oreskes, pg. 18

[59] Oreskes, pg. 50-54. Both concepts of standpoint epistemology and strong objectivity are attributed to Sandra Harding and Helen Longino, respectively.

but propose that with the merging of enough subjectivities, a sort of "strong objectivity" can emerge.

There are a few problems with this account outright. Objectivity cannot be a sliding scale. The intrusion of subjectivities necessarily implicates questions owing to the effects of subjective properties, no matter how many subjectivities are involved. This induces the next problem. If science not only becomes permeated by values, but also entirely loses its status as work with a clean subject-object division, as Oreskes frames it, then science becomes entirely at the mercy of the relative success or catastrophe that emerges from deliberation within and between subjectivities. This line of thinking situates the entirety of scientific practice within the domain of political theology.[60] Answering this is firmly outside the scope of this work. What can be reasonably drawn out, however, is given to us by the current state of debates on political theology. Realist versus Liberal perspectives greatly disagree on this topic. Realist perspectives like Carl Schmitt[61] and Chantal Mouffe[62] propose that friend-enemy distinctions underlie all social interaction, making deliberation thus rather impotent unless relative agreement is already present. Liberal perspectives like Hannah Arendt and Jurgen Habermas propose that deliberation can work, and that, as Oreskes says, "social processes of collective interrogation" ensure the arrival at mutual agreement:

[60] Political theology, owing much of its inception to Carl Schmitt's landmark text, *Political Theology*, is a subfield of political theory that seeks to study the dynamics of interactions between value systems and political processes. The use of "theology" in the term owes much of its presence to the field's study of values, often fused with theological concepts, to examine the nature of interaction between value-spheres.
[61] Schmitt, *Political Theology*
[62] Mouffe, *Agonistics: Thinking the World Politically*

> "Of course, within any community there will be dominant groups and individuals, but the social processes of collective interrogation offer a means for the less dominant to be heard so that, to the maximum degree possible, the conclusions arrived at are non-partisan and non-idiosyncratic."[63]

First, it is confusing exactly how the figurehead upholding so-called "collective interrogation" maintains such a state of affairs without becoming a "dominant group or individual."[64] Schmitt would argue, and I would agree, that "social processes of collective interrogation" are tenuously downstream from the friend-enemy distinction. In short, social terms of engagement between parties, such as playing fair[65], is something all parties must agree to, and involved parties can decide to withdraw agreement at any time. That which holds such a tenuous situation together is trust, not in fact, but in character. This would indicate that Oreskes' account of "strong objectivity's" ability to mimic or maximize science's epistemological rigor is woefully optimistic. Once Oreskes opens Pandora's Box of political theology, there is little to no guarantee that what will come out is a healthy, synergistic mixing of subjectivities, as opposed to a warlording, tyrannical regime of one stronger subjectivity that beats out and subdues all others. This is the exact consequence that pure fact-value upholding accounts seek to avoid. The upshot of this, however, is made clear in Oreskes' coda in

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[63] Oreskes, pg. 58

[64] Such a dynamic in which ordered cultures of interaction are simultaneously liberal and also unifying is immediately reminiscent of Karl Popper's "Paradox of Tolerance." Such perspectives must maintain their universality, lest they become tyrannically arbitrary. They must also maintain their authority, lest they become insolvent. For clarity's sake, platforms like Oreskes' should own the fact that they advance an ideal without shying away from the demanding nature of doing so. Regardless, they still functionally bind social organization to a singular philosophy that cannot be privileged as universal above others. See, Popper, Karl R., *The Open Society and its Enemies*.

[65] See, The Geneva Convention and other international agreements surrounding conduct in war. Schmitt is often leveraged in international relations theory to put forward realist accounts that claim that legal theory has little to no place in international dynamics, and that international relations are largely anarchic, effectively being governed by power relations.

which the introduction of subjective involvement means that scientists must be proactive, not reactive, in fielding their values and roles as invested citizens to the public.

Oreskes'[66] and Kitcher's[67] proposals similarly advocate for scientists to immerse themselves in the social setting surrounding science, to be open and honest about their values, and to take public stances involved with the necessarily social/value-laden components of their research. I foresee a few issues with this that may be exacerbated by the nature of crises situations like COVID-19. Efforts to be transparent about the value-laden nature of scientific research as well as present levels of uncertainty and dissensus within the community make for an earnest display of scientific practice. This would likely create greater amounts of trust within the scientific community by virtue of its implied earnestness, but states needing to respond to crises require maximally certain scientific advice as soon as possible. Transparency about the level of dissensus in the scientific community about an issue may increase trust through honesty but decrease faith through uncertainty. Also, it is plain that scientists are not trained to be spokesmen or mouthpieces to the public. This can range from buckling under the pressure of public demands for certainty to rushing unwieldy declarations which must later be retracted, damaging science's reputation and created confusion in the eyes of the public. This is seen no more clearly than in the tweet made by the US Surgeon

[66] Oreskes, pg. 151-152
[67] Kitcher, pg. 193-197

General Dr. Jerome Adams claiming that masks "are NOT effective in preventing general public from catching #Coronavirus."[68]

In light of the immense gap in expert knowledge between scientists and laymen, socially invested scientists taking the role of spokespeople or activists may have the reverse effect and alienate laypeople. Kitcher's counterexample turns this asymmetry in knowledge into a positive point by saying that it is because of experts' advanced knowledge that they have the greatest benefit to offer by being open about the social implications of their research. While this may be true, exactly which of these cases materializes largely depends on the receptive culture in question and how they relate to intellectualism and academic authority. Cultures with greater suspicion of academics and stronger streaks of "anti-intellectualism" will not see learned experts standing next to politicians and sharing their findings, but will instead see unknown, distrusted sorcerers weaving spells of unknown consequence and toying with the society they live in for unknown reasons.

Pamuk is much more cautious in situating scientists within view of the public, and I would side most with Pamuk's assessment of the possible risks. The greatest risk that could be induced is the stepping over and above popular, democratic deliberation of political questions, further alienating the public from scientific and political institutions alike. The most notable question of this sort in this work is: what constitutes a "solution" to a crisis? Thus, Pamuk's proposal for a science court, while expensive, seeks to

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simultaneously bring scientists down and the public up to a middle point in order to collaborate on determining what a solution looks like. It should be stressed that there is possibly a considerable amount of admixture between individualist political-theologies and ones that are also highly suspect of experts. Thus, since Pamuk's project focuses on the US and the UK, it would make sense that, especially in the US, her account critically warns against positioning scientists as spokesmen of truth on high.

My proposal for mediating the relationship between science and the public takes much from Pamuk's account. Transparency about value-judgments made before, during and after research is found and implemented is key in upholding the rights democratic citizens are entitled to. Viewpoints stressing that thorough democratic deliberation cannot be done on crisis timelines may be worthwhile, but maintaining this transparency is key to making good on such promises even if only to stave off political instability in democratic systems. Transparency about levels of uncertainty and the newness of findings could possibly engender trust by showing that science has nothing to hide, but it also necessarily creates instability and possibly a lack of faith in science's ability to create certainty. Even though science is rarely ever completely certain, the public will likely want certainty from science, and this need is maximized in times of crisis. One needed solution to try and bridge this gap would be a greater focus on ethics, values and the political embeddedness of scientific practice. One of the aforementioned possible cases of "*scientization*" was the explanation from lack of exposure. STEM (Science, Technology, Engineering, and Mathematics) pedagogy often leaves these intellectual landscapes unaddressed. Scientists effectively

educated in ethics and science-related political study would necessarily find opportunities for these phenomena to be addressed, whereas otherwise they would go unnoticed as they do now. A healthy coverage of the history of science and its interrelations with political questions would prime most students with the right language to identify key problems. It would also (ideally) reassure the public that scientists have at least some fluency in the types of issues they face and how their own practice relates to them. As stated earlier, democratic systems require widespread investment to function. This is most true of the public, and the case of science-politics integration is no exception. First, we must rid ourselves of the idea that such a project is superfluous, which we have spent thus far proving. That said, this premise could also imply that the public must become better educated. This charge is especially unwieldy in individualist, frontier societies like the US, which pride themselves on self-determination. Of course, the US is not a monolith of libertarian homesteaders, and the nation has been undergoing increasingly rapid changes over the last few decades. It should be stressed that studying this cultural division in full is outside the scope of this work but would make for the ideal sociological study underneath the dynamics in question here. That said, such political spirits raised on national mythologies of discerning the machinations of authority react caustically at top-down commands to "become educated." Such a command is identical to the case of "*scientization*" mentioned earlier in my work where authoritative decrees are masked in scientifically "factual" language. Thus, getting populations such as Americans to meet scientists with an open heart and open mind inside of Pamuk's hypothetical "science court" constitutes the greatest challenge of

the science-politics integration project. Getting scientists and the public in the same room under productive circumstances falls onto the shoulders of politicians, most importantly in the absence of political opportunism, yet another costly ideal. Evaluating the viability of this effort depends on measuring our current state of political-theological fracture as a society, as this is the basis upon which trust is built and deliberation can "function." This daunting work I leave to a particularly zealous sociologist or anthropologist.

Conclusion and Opportunities for Further Research

This entire discussion points to the fact that science *must* be thought about in conversation with values and in reference to the character of receptive political cultures in question if we want to be productive about understanding how science can be effective in politics and society at large. Apolitical conceptions of science created by strong accounts of the fact-value distinction force a frame of view that reduces the dynamic between science and politics to that of an enlightened intelligentsia finger-wagging at an ignorant or uneducated public. The US certainly has no stellar record in public education, but such elitist conceptions necessarily downplay the role of the public and alienate the public from its institutions. It may be tempting to pin these heavily scientistic – as in referring to scientism – languages onto scientists themselves, but there is more evidence to believe that these frameworks come from the pressures states put on the scientific community. Any scientist worth his or her salt knows full well that the bulk of scientific theories, research, and findings are riddled with disagreements, counterexamples, and complications. This is not to say that science never makes advancements – this is not true – but it is to say that scientific practice almost always carries dissensus as a core feature of its intellectual character and it should retain it, much to states' dismay. Thus, one major contribution of this work should be the intuition that scientism at large is not a consequence of zealous scientists but of science being forced to operate outside its domain and under political scrutiny.

States have much to gain from leaning on science to "*scientize*" their policies in order to render them immune to disagreement both on grounds outside of "facts" as well as outside those hallowed limits of niche expertise. However anachronistic the slogan "trust the science" is, one thing is true: trust is earned, not demanded. This may frustrate scientists and politicians alike who would rather simply have the public unquestioningly agree with their platforms through the use of apolitical language. This may be more viable in autocratic systems of governance where laypeople are afforded fewer rights, but democracies center themselves around winning the hearts of the electorate. Failing to do so, even in autocratic systems[69], can and will result in disconnection between states and their constituents varying from simply refusing to take vaccines and wear masks to open protests and riots against policy they feel does not serve them. Individuals confused at distrust in science should take this structuring into account as well as noticing the colored track record the US federal government has in being transparent with its public. While it is improbable that vaccines cause the litany of issues that many conspiracy theorists claim, it is crucial to understand that the burden of trust lies on the state to legitimate such a process. Thus, in the US, the social costs of non-uniform vaccination are to be laid at the feet of the state, not the citizenry.

When tasked with explaining questionable conspiracy theories that overtly read as nonsense, such as the effectiveness of ivermectin, a common horse dewormer, in "curing" COVID-19, we should avoid looking at them as

[69] Shankar, Vivek. "China Protests Break Out as Covid Cases Surge and Lockdowns Persist." *New York Times*, November 28th 2022.

proactive statements of truth and instead as reactive, hastily gathered attempts at alternatives to proclamations by alien institutions that laypeople do not trust. Thus, productively studying such questionable accounts of truth requires understanding them symptomatically. Finger-wagging at democratic populations, especially American populations for whom rugged individualism and frontier self-sufficiency are political-mythological staples, is a recipe for the further fracturing of cultural bases upon which trust is built, making it progressively harder and harder to regain. Something that unfortunately evaded this project was the proliferation of "misinformation" – a dangerously loaded and fickle term – surrounding medical facts and COVID-19. This study focused more deliberately on the details of the relationship between science and politics both in their intellectual character and in terms of their institutions. Distrust in science at large is a much broader topic that implicates deeper cultural studies. This necessitates the act of putting scientific practice in conversation with political theology, religion, science and technology studies, and media studies. For a start, Yaron Ezrahi and Jasanoff's media-studies oriented approach[70] to studying the evolution of information distribution systems from high resolution and low accessibility – written text – to low resolution and high accessibility – social media – would prove ideal as a starting piece. To this daunting work I leave another particularly zealous anthropologist or sociologist.

[70] Ezrahi, Yaron, *Science and the political imagination in contemporary democracies*

This discussion also implicates many of the inherent characteristics that are unique to democratic systems as opposed to autocratic ones. Further research on centralized states' responses to COVID-19, the unique costs they did and did not have to pay, and what advantages they may have had in handling the crisis would provide significant help to this work. One immediate concern should be obvious, and that is the question of what exactly entitles laypeople to determine what constitutes a solution to a crisis. When people are dying in droves, lives upended from death and disease, and worse, why should we spend valuable time deliberating over how many schools to close versus keep open instead of executing a plan as soon as possible? Such questions are forced to the front when we evaluate the strengths of democracies at large. It should be clear that autocratic systems may arrive at "solutions" much more quickly. Conceptions that believe that this necessarily means more lives will be saved by virtue of such autocratic systems having fewer civic costs to pay can be said plainly to have naïve understandings of exactly how fickle and disconnected from the "common good" autocratic "solutions" can be.

These observations may point towards an intuition that democratic societies that acted faster and responded quicker to COVID-19 did so specifically at the cost of temporarily suspending democratic principles. The same may also be true of more collectivistically-cultured democratic societies in which citizens are more than willing to sacrifice their own comfort – by wearing a mask, for example – for the sake of complete strangers with whom they happen to live in the same nation. With these insights in mind, it should guide us to lean towards sympathy to states like the US and

UK in which getting the entire population to simultaneously pull in one direction is a Herculean feat of political-theological strength. The costs induced by democracy are the ones that states like the US must live with. Democratic principles of representation are not just limited to voting. They permeate the types of powers that citizens believe they are entitled to, effectively lowering their tolerance for the potential machinations of authority that may try to simply say that they know better.

None of these questions about the perfect balance of democracy versus autocracy can be answered here. However, what this account does have to offer is the actual possibility of being able to ask these types of questions *in the first place*. Upholding the fact-value distinction cuts science out of the difficult political questions that need answering and demand of us to answer the primordial political question: how should society be organized? Remaining blind to the fact that science is very much implicated in this question does not make this issue go away, and simply castigating justifiably angered laypeople for shrewdly calling the bluff on "*scientized*" policy only creates more polarization and social fracture, making trust harder to regain. STS scholars Stephen Hilgartner et al. put it best:

> "When the key issue is who decides, acting as if disagreements are mainly about evidence is bad politics and bad social science."[71]

[71] Hilgartner et al., "Was "science" on the ballot?," Science, Vol. 371, no. 6532, https://www.science.org/doi/10.1126/science.abf8762

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