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# Anthropocene: technical and social dimension

## Introduction

We have entered the Anthropocene. We are no longer simply passive observers of the natural world (Lewis & Maslin, 2015). Instead, we live in a human-dominated geological epoch in which we can no longer maintain a separation between Human and Nature (Latour, 2015). Increasingly we are seeing that human interventions can have far-reaching effects on nature, including the problems of global pollution such as microplastics (Kvale, Prowe, Chien, Landolfi, & Oschlies, 2021); global ecosystems changes such as the sixth mass extinction event (Barnosky et al., 2011); and extreme heat events that are already rendering parts of the world uninhabitable [Mora et al. (2017); Baker2019]. Other instances of human interventions that can be used to mark the start of the Anthropocene include the industrial revolution, nuclear weapons detonation, or the global diffusion of industrial chemicals (Lewis & Maslin, 2015). The most evident example of the need to attend to the Anthropocene is climate change, the consequences of which are becoming hard to ignore (Sterner et al., 2019). Yet, the widely anticipated “eco-modernist” (Hajer, 1995) response has not materialized. Rather than technocracy, there is business-as-usual, complacency, and environmental indicators that are still on the rise (e.g., Tollefson, 2021). The short-sighted mode of intervention on nature continues: we treat symptoms–if even that–be it with regard to droughts in California (AghaKouchak, Feldman, Hoerling, Huxman, & Lund, 2015); the Great Barrier Reef bleaching event (Hughes et al., 2019), or dwindling insect bio mass (Hallmann et al., 2017).

In more than one way, attending to the Anthropocene upsets our longstanding understanding of progress in science and technology. Our hopes for progress usually depend on advancing our scientific and technical understanding. It is an old story that taps into two themes in organizational research. One theme is the faith we place in formal institutional structures, following the logic of rationality in a modern society. ***>>Did I interpret this correctly when fixing the sentence?<<*** This rationalized myth allows us to decouple structural responses from organizational activity (Meyer & Rowan, 1977). ***>>I am with you, but for some this might be quite the leap.<<*** The second theme is the tendency to focus on how the material effects of a technology shape social outcomes rather than on how social frameworks shape technologies. Our understandings of progress therefore focus on technical, not social advances (Barley, 2020). This trust in rational and technical solutions has allowed some communities to ignore even severe local climate impacts (Boudet, Giordono, Zanocco, Satein, & Whitley, 2020). Yet as climate events have become increasingly difficult to ignore, climate scientists are beginning to doubt that the solution is strictly technical and come to realize that they must confront the social and the political (Heffernan, Thorpe, & Brown, 2011; Latour, 2015). In response, they are beginning to turn activist (e.g., Cavicchioli et al., 2019; Ripple et al., 2017; Vogt et al., 2021). ***>>Added one and think it’s clear now that it’s not a mischaracterization, but there are some alternative wordings: political action, social something.<<***

This kind of activism at the halfway point between science and civil society challenges our existing understanding of the relationship between the technical and social–it calls for a new framework. Our stylized scientific world view presumes that the task is to take new technical understandings and turn them into effective policy and action. Hence the standard story ***>>My intuition is to ask ‘which standard story,’ but I cannot think of a good synonym.<<*** focuses on the validity of the technical knowledge: to what extent can that knowledge be used for understanding, prediction, and control (March, Sproull, & Tamuz, 1991; Rerup & Zbaracki, 2021). But in dealing with the Anthropocene, valid knowledge is a necessary but not sufficient condition for effective interventions. We also need to take into account the reliability of knowledge—the extent to which knowledge is public, stable, and shared (Rerup & Zbaracki, 2021). Our existing theories usually take reliability of knowledge for granted. Even when we focus on the social, we typically create a technical model of the social realm first, and then populate it with examples–for instance of organizations–to represent our constructs (e.g., Hoffman & Jennings, 2018) ***>>I think this makes it more clear<<***. More often, though, we simply assume that technical understandings are sufficient. As a result, we don’t take into account the range of possible ways that people and organizations may respond to a problem like climate change.

Here we invert the order and situate the technical in the social. We propose to begin with what Latour (2005) calls matters of concern–climate change, or more specifically in our case oil pipelines and all their environmental impacts. Our analyses does not begin with the validity of the knowledge about those matters of concern, however.***>>I did not want ‘focus’ to be construed as us not caring about what is valid.<<*** Instead, we focus on reliable knowledge–knowledge that is public, stable, and shared–whether it is valid or not. We consider how actors construct social representations of the natural environment and decide on appropriate actions given that reliable knowledge. Given our interest in the Anthropocene, we want to understand how actors use their social representations to decide how we should act on both the social world and the natural world. While valid knowledge–that is, knowledge that can be used for understanding, prediction, and control***>>deliberate repetition?<<***–is always in the background of our study, we do not limit our analysis to this knowledge that can be used for understanding, prediction and control. Instead, we are interested in the social dynamics around contestations about what constitutes valid knowledge. To understand these social dynamics, we draw on the approval and construction of new oil pipelines in the US. We chose that phenomenon as it places us in the context of the fossil fuel industry, and because the public discourse on pipelines conveniently draws on the climate change discourse as well as other themes related to the Anthropocene. In particular, we use the public discourse on the Keystone XL and Dakota Access Pipeline projects to map out the emergence or creation of reliable knowledge.***>>This is a suggested setup to anchor this more into pipelines. To make that work, I need to clarify below the connection to the scientific discourse on fossil fuels that are supposed to stay in the earth, and to the UN policy that the US/Canada have signed and decoupled.<<***

We proceed in four steps, beginning with our standard assumption of valid knowledge and moving increasingly far away from it:

1. The scientific community develops knowledge that is valid–that is useful for understanding, prediction, and control***>>deliberate repetition I assume<<***–within a community of scientists or technology experts. That knowledge is not necessarily reliable–that is, public stable, and shared beyond the community of scholars(and in the case of truly novel findings, even within the community);
2. We describe the political act of turning that valid knowledge into ***>>deleted ‘effective’ here as foreshadowing<<*** policy, which requires taking new valid knowledge and making it public, stable and shared;
3. When we include the public in our analysis, we encounter understandings that are not necessarily valid–that is, useful for understanding prediction and control–but reliable–that is, public, stable and shared. The relevant actors includes actors such as activists and advocates for industry, commerce and development, but also conspiracy theorists and those opposed to action;
4. The set is completed by skeptics–fringe actors who are not interested in valid knowledge, for example because they have a vested interest in invalid knowledge.

## The Anthropocene as a technical problem: at the vanguard of new knowledge ***>>Not sure this header is still up to date<<***

***>>I think this section needs subheadings<<***

Scientists have begun to turn activist because the existing valid knowledge offers increasingly incontrovertible evidence that we are headed towards catastrophe. If the quality of knowledge generation is measured by our ability to predict outcomes–for instance how much an object heats up when it lies in the sun for an hour, or the change of climate after carbon concentration in the atmosphere reaches 350 parts per million–then we have plenty of valid knowledge (knowledge that can be used for understanding, prediction, and control). For example, our knowledge of the atmospheric system of the earth is pretty good, and has been for decades (Edwards, 2011; Forster, 2017). Indeed, even Exxon knowledge possessed a solid understanding of climate change concerns back in the 1980s (Barron, Vivian, Heintz, & Yim, 2020; Supran & Oreskes, 2017). Hence with regard to some problems–for example, in models of our atmospheric system–understanding, prediction, and control are no longer significant problems. Moreover, problems are so significant that the UN has began to advocate for action even under conditions of uncertainty around science or absence of knowledge. “In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (Rio Declaration, 1992).***>>Need to anchor this paragraph into step one of the list above. Otherwise it just reads like a recap.<<***

But if our knowledge of something like the atmospheric system of the earth is pretty good, what do we do with that knowledge? In theory, dealing with the Anthropocene simply requires new technology, built around new valid knowledge. We can design systems that will control climate and pollution problems. But when it comes to implementing the systems we design, we need to take into account both the validity and the reliability of the knowledge we design. The validity of the knowledge–the extent that technical knowledge can be used for understanding, prediction and control–is important. It is a necessary, but not a sufficient condition. We need to make that the knowledge is reliable; it needs to become public, stable, and shared. And making valid knowledge reliable is a policy problem that raises longstanding organizational issues.***>>This is the transition to the top-right quadrant–need to clarify that. Also, if we go with the pipeline setup, we want to inject pipelines into this. Maybe I could inject the carbon tax example here.<<***

One issue is a dynamic of policy-practice decoupling (Bromley & Powell, 2012). ***>>This needs some context/introduction, coming out of the blue.<<*** Consider two approaches to a simple ideal: the United Nations, having accepted the severity of the risks of climate changes, wishes to limit global warning to 1.5 °C. Such a commitment would have very tangible implications, and given what we know about modelling, the necessary actions are easy to identify:

There are “incredibly tight constraints for present international climate targets, even if no new emitting infrastructure is ever built […]. [W]e would have a reasonable chance of achieving the 1.5 °C target with, first, a global prohibition of all new CO2-emitting devices (including many or most of the already-proposed fossil-fuel-burning power plants); and second, substantial reductions in the historical lifetimes and/or utilization rates of existing industry and electricity infrastructure” (Tong et al., 2019).

“By 2050, we find that nearly 60 per cent of oil and fossil methane gas, and 90 per cent of coal must remain unextracted to keep within a 1.5 °C carbon budget” [Welsby2021].

Yet the character of the 2015 Paris Agreement negotiations have already “eloquently demonstrated the futility of technical negotiations, without political consensus on the core elements and features of the new agreement” (Savaresi, 2016: 16). Any idea of a binding climate agreement with mandatory emissions reductions had already failed in 2009 when delegates merely “took note” of the Copenhagen accord (cf. Schüssler, Rüling, & Wittneben, 2014). It was further undermined when Canada withdrew from the Kyoto Protocol in 2011. This withdrawal added to the dissappointment with the Kyoto Protocol. The protocol had taken effect in 2005. But the US never ratified it, and Australia only ratified it in 2007. In contrast, the Paris negotiations focused on creating consent–effectively through compromise through a bottom-up approach, also called a ‘pledge and review’ approach in which countries submit their emission goals and the United Nations Framework Convention on Climate Change (UNFCCC) act as a notary. Yet current pledges are not in line with ambitions (Rogelj et al., 2016; Schleussner et al., 2016). After the COVID emissions drop and bounce back (Tollefson, 2021), as of 2021 “even [the] most optimistic scenario is insufficient to meet the Paris Agreement goal of limiting global warming to ‘well below’ 2 °C.” (Sognnaes et al., 2021). And herein lies the bind: when we seek to build wider acceptance for valid technical knowledge, we seem to reduce the ground that the knowledge covers. We may have valid knowledge, but making turning it in to policy requires a kind of dumbing down by reducing the content to what everyone is able to understand and accept (Zbaracki, 1998). ***>>Want to hone in on the US here to connect it to pipelines.<<***

A second issue is a decoupling ***>>Again needs some context/introduction.<<*** between means and ends (Bromley & Powell, 2012). A solution that looks obvious or ideal–or even looks like common sense–may fall apart as a course of action when tradeoffs need to be made. Moreover, different groups may come to very different understandings about the problem. Consider first the very reliable, but sometimes invalid, common sense that people might have about climate issues. Intuition is a poor guide on even basic issue like the energy usage of heating and air conditioning (Attari, DeKay, Davidson, & Bruin, 2010), or the emissions associated with a burger vis-à-vis a salad (Camilleri, Larrick, Hossain, & Patino-Echeverri, 2019).

But consider second ***>>Not sure what structure we’re following with first and second here, since it’s not the quadrants<<*** the emergence of a broad new environmental movements–including activist groups like Extinction Rebellion (ER)–which have identified the lack of attention to environmental damage in the Anthropocene as the critical concern. Their primary strategy is to generate public attention e.g., by disrupting public events, most notably in London, UK. Similarly, other environmental movements have targeted industries—for example the coal industry, coal mining, and coal power plants for the risk to the environment. Fridays for the Future, with notable member Greta Thunberg, is another example. At first glance, there is only a passing connection between the activities of these groups–blocking traffic in London, for example–and radically slashing the carbon emissions before the year 2030. The acts of protest may only heighten the confusion of the common sense understandings of climate change, because the protests are largely decoupled from the physical causes of climate change. ***>>I could either replace all examples with pipeline protests, or do one of each.<<***

Consider finally the problem of climate denial. Social movements can also claim that the problem of climate change is overstated. These groups may be power in a different way than other groups of actors, because their concerns may not begin with climate denial. Instead, the reliability of their knowledge may be built around some form of social cohesion–political affiliation, for example–and common concerns about social issues. These affiliations may lead to reliable, but invalid understanding, and sometimes intentionally, as people seek to demonstrate their commitment to a common cause. The result may be a rationalized invalid understanding, shared across a cohesive social group. For example, people may engage in climate denial based on individual experience (“It’s still cold in winter”) rather than on substantive empirical evidence.***>>I think climate denial is still relevant if we do the pipelines context. There are other examples I could raise but they are much less well accessible and will raise less agreement than these examples.<<***

A third issue shaping the relationship between reliability and validity is the intentional sowing of skepticism. Many of the dynamics behind climate change are driven by contrarian networks of actors–both individual and organizational–who intentionally are sowing doubt about the validity and undermining the reliability of existing knowledge about climate change. The research on these networks has been limited, because the focus tends to be more on individual actors (Farrell, 2016). However, we increasingly know that the public perception of climate change has been actively shaped by think tanks and activist organizations such as the Cato Institute and the Heartland Institute, by industry associations such as the American Petroleum Institute, and by fossil fuel companies (Banerjee, Cushman, Hasemyer, & Song, 2015; Bonneuil, Choquet, & Franta, 2021; Supran & Oreskes, 2017, 2020).

***>>Climate denial may be a poor point to start with the benefits of skepticism, so why don’t we draw on both the top and bottom left for this. For example: ‘It may be tempting to dismiss all non-academic actors…’ And then we leave the issue of reliability open.<<*** It is important to point out that this skepticism is not necessarily about climate denial alone. It also extends to questions about science as an institution. As tempting as it might be to dismiss such skepticism, it is essential to the evolution knowledge. Knowledge progresses as one group challenges the orthodoxy of existing belief—that is, knowledge that is both reliable and valid. Indeed, concerns for environmental issues were themselves considered invalid and unreliable knowledge before sustainability became a big thing. For example, a galvanizing moment in environmental concerns was the deinstitutionalization of DDT (Maguire & Hardy, 2009). What began as the passionate concern of a single industry became the foundation for knowledge that we now recognize as both valid and reliable.

Our overarching point: what it means to encounter the reality of the Anthropocene: that humans don’t just observe the environment, but their social and technical frameworks shape the environment. Our research proposes to reconsider some standard assumptions. First, that progress depends primarily on advancing technical understanding, not the social organization of knowledge. Second that we should focus on the purity of knowledge and avoid the political problems of invalid but reliable knowledge (Latour, 2015). Third, that those who make apparently invalid knowledge reliable are undermining the integrity of our world.***>>Maybe we should reverse this, it’s a bit confusing to advocate for readers to reconsider something–kind of like a double negative.<<*** Here we argue that if both validity and reliability matter, then the social and political are intertwined, and we should attend to the interaction between reliability in the diffusion of knowledge. We therefore propose to begin with the social, the political, and the problem of reliability of knowledge, and then progress to consider its relationship to the validity of knowledge. ***>>It’s a very bold, provocative statement, but I like it.<<***

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