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Information Infrastructures and Understanding of Global Warming

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Edwards, P. N. (2010). A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming.

For several years, a diverse group of researchers from science and technology studies (STS), computer science, and business schools has focused on information infrastructures. Their efforts have advanced our understanding of large IT systems substantially: the entanglement of the technical and the social, the complexity of their management, how they evolve over long periods of time, and the inherent limitations of what designers can foresee as outcomes of their attempts. Those scholars brought reflexivity into a socio-technical domain which has been considerably affecting societies all around the world, since decades. Edwards’ latest work represents a quantum leap in this research domain: he moves from understanding infrastructures (Edwards et al.: 2007), to understanding a fiercely debated policy issue - global warming - by looking at the information infrastructure that monitors the atmosphere. For those main reasons, this ample book is worth reading for quite different audiences such as researchers of IT, science and technology, political sciences, global warming, and public understanding of science. Right in the introduction, the author provides a good reading map that outlines what is relevant from different perspectives.

This research, which comprises information science, international relations, earth observation, scientific knowledge production among others, is in two respects innovative. First, it shows how information infrastructures underpin our conceptualization of climate change. Second, it provides a remarkable example of how concepts, methods and ways of framing and problematizing developed in information infrastructure research can be used to practice reflexivity beyond information science in order to contribute to research on widely relevant societal issues. In particular, infrastructural inversion and data friction are exploited to their full potential. The former is the overall methodological approach of this study. The latter, data friction, provides a plausible explanation for the fragmentation of the study of the atmosphere into the three disciplines climatology, meteorology, and weather forecasts. Later in this historical reconstruction, technology plays a key role in explaining emerging interdisciplinary research among them.

The empirical basis of this work is the evolution of the information infrastructure for collecting and analyzing data about atmospheric conditions, that has been taking place since the 19th century. Although "a vast machine" was envisioned in 1839 already, it is amazing to see how a huge variety of technologies, organizations, and historical contingencies contributed to shape an infrastructure now embedded in our daily, taken-for-granted activities such as checking weather forecasts or trying to reduce the carbon footprint of our behaviors. Edwards proposes a suitable metaphor to synthetize the challenges of developing such an infrastructure: it is like trying to make a movie out of photographs taken by different people with different cameras (climate data collected over more than 150 years has varied in resolutions, locations, time frames, reliability, elaboration process, etc.). This illustrates major challenges of handling frictions between datasets, and gains epistemological relevance in explaining a lasting separation between forecast (relying on recent data), empirical climatology (searching patterns in long data series) and theoretical meteorology (aiming at deriving atmospheric conditions from mathematical models). The role of historical contingencies like wars and related macro political strategies is taken seriously in the explanation of the evolution of this vast machine. An interesting example from after WWII is the convergence of diverse disciplines towards weather control to be used for military purposes. The key methodological approach adopted here is "infrastructure inversion", which deserves particular attention. It is a gestalt switch reversing figure and ground: it entails looking at what has become taken for granted, invisible and unpacking it to see how it actually works. By doing it for atmospheric data infrastructure, Edwards sheds new light on the basis upon which knowledge about climate change relies, including related institutions such as the Intergovernmental Panel on Climate Change (IPCC). He argues convincingly that "an established fact is one supported by an infrastructure". This is a novel contribution to studies of science in public arenas, especially because he makes also clear that infrastructures are not neutral, but inscribe limits of knowledge. Thus, we are not in positivist, universalist territories. Neither in relativist, as discussed later.

A relevant outcome of tracing back the evolution of this infrastructure is the concept of 'infrastructural globalism', a permanent world-scale complex generating and sharing globalist information. This globalism marks a shift from voluntarist internationalism, that depends on temporary shared interests. Along this line, it is interesting to see how the establishment of the World Meteorological Organization overlaps with the space race during the Cold War, establishing some stable collaborations between nations and reducing tensions, also behind the scene. Kennedy's grand vision of reserving space for peaceful use translated into making a global data infrastructure a Cold War strategy, which in practice meant homogenizing data, procedures, technical standards, and regulations across the iron curtain. But the history of climate data infrastructure as a large scale effort of institution building is not only discussed in real-politik terms. Utopias like the 'forecast factory', based on industrial revolution imaginary, are presented in their long-term effects of being able to mobilize action and resources beyond actual results (as myths do according to Mosco: 2005).

So, why should scholars of science and public policy read this fascinating journey through an information infrastructure evolution, theoretically informed by an approach à la Bowker and Star (1999)? For two entangled reasons: first, to see in detail how different sciences and the unfolding of policies and diverse social activities affect the evolution of a large systems which is beyond the control of any single actor.

Saetnan (et al.: 2010) would ask “for whom the bell curves?” hinting at the mutual construction of statistics and society. Here it is added that when the bell is curved in a specific way, it has its voice, especially when it can veto human will (in actor-network theory terms), by not doing what is required. The second reason is that an artificial construct like an infrastructure is the only possible bedrock for natural sciences’ claims of climate change. After reading about supersonic transport, ozone depletion, acid rains, and nuclear winter as concerns affecting this infrastructure, the reader will feel that politics is everywhere, but not that it is everything. Bare empirical data does not exist, but this does not imply that science is just one of several many possible belief systems. Waiting for real data about global warming is illusionary because the dichotomy data vs. models does not exist. By unpacking the infrastructure one finds data-model symbioses all the way down. Therefore, decision makers seem to have to gamble about what tough decisions are required by a future simulated by a vast machine. What is the scientific credibility and social legitimation of a hugely dispersed layered patchwork of sensors, databases, protocols, computers, sedimented interests, contingencies and socio-technical activities? This is where the conclusions move to an epistemological level rejecting radical relativism that characterized the second wave of STS (Collins: 2009). This story does not leave us in the limbo of uncertainty, but defends expert knowledge based on infrastructures by enriching our understanding of the always provisional nature of scientific knowledge with technology. After this story, the reflexive awareness of uncertainty of climate change needs to include the actual limits of each infrastructure, which are compensated by cross checking across different simulations, comparisons between findings from different sources (like glaciers depletion monitoring), transparent procedures. All these independent paths of research point to global warming. Thus, evidence based policies cannot claim universal truth, but this rejection of positivism does not entail that ‘anything goes’. The book moves along this crucial faultline, and shows the performativity and transformative role of technology.

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