Normal Science in the Time of Corona

Citation for published version (APA):

Mody, C. C. M. (2020). Normal Science in the Time of Corona. *Engineering Studies*, *12*(1), 1-7. https://doi.org/10.1080/19378629.2020.1751397

Document status and date:
Published: 02/01/2020

DOI:
10.1080/19378629.2020.1751397

Document Version:
Publisher's PDF, also known as Version of record

Engineering Studies

ISSN: 1937-8629 (Print) 1940-8374 (Online) Journal homepage: https://www.tandfonline.com/loi/test20

Normal Science in the Time of Corona

Cyrus Mody

To cite this article: Cyrus Mody (2020) Normal Science in the Time of Corona, Engineering Studies, 12:1, 1-7, DOI: 10.1080/19378629.2020.1751397

To link to this article: https://doi.org/10.1080/19378629.2020.1751397

Published online: 29 Apr 2020.

ENGINEERING STUDIES
2020, VOL. 12, NO. 1, 1–7
https://doi.org/10.1080/19378629.2020.1751397

Routledge
Taylor & Francis Group

EDITORIAL

Normal Science in the Time of Corona

This issue of *Engineering Studies* comes out during the COVID-19 pandemic, and this editorial is being written from home under 'lockdown' conditions. Right now, it is too early to know what the long-term consequences of the pandemic will be. In the short term, our readers and authors should be patient as most of our editors and reviewers have had to prioritize matters other than journal work. There will be some delays. *Engineering Studies* is not essential infrastructure, and our articles are not going to provide a way out of this crisis. Some things – staying safe and healthy, looking after loved ones, helping friends and students who are overwhelmed – are always going to be more important than academic publishing, but especially right now. We have to put things in perspective.

But putting things into perspective also means reflecting on how our expertise *can* help, in small ways and large. This crisis has revealed much about engineers and engineering, and I predict that studies of the coronavirus pandemic will be a staple of this and other journals for some time. We have seen engineers rise to the occasion: in, for instance, helping to rapidly build makeshift hospitals and retooling factories to manufacture ventilators, masks, and hand sanitizer. We've also seen that some engineered infrastructures have adapted incredibly well. The migration of many workplaces on-line hasn't gone perfectly, but it's remarkable that it could be done at all.

At the same time, the crisis has shown us how much engineers have failed to take into account. Take the global passenger aviation system: it is a sociotechnical marvel made up of airplanes, airports, traffic control technologies, electronic booking systems, security systems, customs inspection practices, pilots and crews and schools for training them, etc., etc. Normally we hardly perceive its slip-ups, nor its incremental evolution. Yet an historical view shows that passenger aviation has occasionally had to evolve quickly and under duress because of revelations that its engineers failed to consider – or, even worse, considered but failed to act upon – fundamental flaws. Many aviation experts of the mid-1960s, for instance, thought that supersonic transports were the future of their industry – without, apparently, understanding that people wouldn't tolerate continual sound pollution from sonic booms.[1] The events of 11 September 2001 revealed that the passenger aviation system wasn't configured to prevent that style of attack. Over the past year, it has become more obvious to more people that passenger aviation is unsustainable in the face of both peak oil and climate change. The growing response, especially in some parts of Europe, has been a growing sense of 'flight shame' and hence reduced air travel – a turn that the passenger aviation system's designers also did not anticipate. Now, over the course of March 2020, it has emerged that passenger aviation was not constructed to withstand a global pandemic. No doubt the planes will fly again soon enough, but the system will not be the same.

The COVID-19 pandemic also provides an unsettling window onto distinctions between 'high' and 'low' tech and 'skilled' and 'unskilled' labor, and the problems with seeing the

world in terms of 'technological fixes'. For those societies that are in lockdown, it turns out that the essential workers without whom we would all starve are, among others, the supermarket staff whom politicians and economists routinely label 'unskilled'. Likewise, the frontline technical experts of the day are crafters who can sew protective masks from vacuum cleaner bags. It's a reminder of a basic engineering studies finding: that the 'unskilled' label is a political choice rather than a straightforward reflection of reality.[2] Obviously, some categories of workers whom society more easily recognizes as 'skilled' are also crucial in overcoming COVID-19, most notably medical doctors. But it is telling that a relatively low-tech and much-maligned branch of medicine – public health – could have prevented the pandemic if its practitioners had been listened to. In most industrialized societies, industries, entrepreneurs, and disciplines that offer high-tech fixes have significantly more political and economic power than those that offer low-tech prevention, even if the former costs much more – in blood *and* treasure – than the latter.[3]

Whether labeled high or low tech, we're also seeing that today's pandemic 'fixes' are being readied as tomorrow's technologies of social control. Drones, infrared cameras and thermometers, testing kits, border controls, data mining of social media – all of those genies are being used to curb the pandemic now, but will be difficult to put back into the bottle once the immediate crisis is over. That, too, is an engineering studies finding – one that will no doubt be replicated often in years to come.[4]

Given the current state of the world it is somewhat surreal to put out a regular issue of an academic journal. But there is also great reassurance in preserving routine and normalcy. So in that sense it is my pleasure to say that this is not a 'special' issue of *Engineering Studies* but rather a routine, ordinary issue that shows our field to be a Kuhnian normal science capable of setting and solving problems of value both to ourselves and to wider audiences. The contributions in this issue draw on three of the classic approaches in our field: recent history of communities and institutions (Nan Wang); ethnography of engineering practice (Charles Anthony Bates and Christian Clausen); and programmatic use of short case studies (Peter Robbins, David Wield, and Gordon Wilson). All three put their own spin on those approaches, though; and in so doing, they bring engineering studies – and engineering practitioners – into contact with new ideas and interlocutors.

The three articles speak for themselves, but as an editor I'd like to situate them each relative to some works and concepts that stood out for me while reading them. Their authors – and you as readers – will no doubt see them in a somewhat different light. Which is great! This editorial establishes *a* context that might embellish your reading, not *the* context that determines *the* meaning of these articles.

We start with Bates and Clausen's 'Engineering Readiness: How the TRL Figure of Merit Coordinates Technology Development.' One of the distinctive features of this article is that it is not just an ethnographic study, but an auto-ethnography: the lead author (Bates) is both analyst and full practitioner within the ethnographic site (i.e., the company he works for). There is a venerable tradition in engineering studies and science and technology studies (STS) of practitioner-analysts and we have many studies where such scholars have drawn on their technical expertise in developing STS arguments. The aeronautical engineer, philosopher, and historian Walter Vincenti – who passed away late last year – set the standard for this approach to engineering studies.[5] There aren't many works, however, where the practitioner-analyst remains a practitioner and puts their own individual practice into the vocabulary of the analyst.[6] Perhaps the closest analogues are provided

by classic sociological and ethnomethodological studies of musicmaking by practicing musician-sociologists.[7] And, in fact, I see some interesting resonances between Bates and Clausen's study and ethnomethodology's axiom that the members of an ethnographic site are always themselves ethnographers who are attempting to understand the rules of the site.[8] This article makes the case that some STS concepts have near-equivalents in members' vocabularies in many sites of technical work, and therefore that there should be plenty of scope for two-way traffic: STS needs to understand members' vocabularies, but members – engineers, technicians, managers, etc. – can benefit from engaging with STSers' vocabulary.

In my own research, I've also observed that analogues of some STS concepts, such as tacit knowledge, easily emerge in conversation with scientists and engineers. What I had not expected was that the vocabulary of actor-network theory (ANT) would also fall into that category. The basic outlines of ANT can sometimes appear (perhaps deliberately) shocking and counter-intuitive: non-humans have no less agency than humans; and in any case it's not humans who have agency but rather assemblages of heterogeneous elements that possess agency as a property that emerges from their positioning relative to other assemblages.[9] Whew! So it's fascinating to see Bates and Clausen argue that ANT's vocabulary is enlightening not just for engineering studies practitioners but for engineers and managers themselves.

The specific use they make of ANT resonates with other recent work that emphasizes that 'non-human actants' can be just about anything. In classic ANT works actants were generally animals, objects, and machines – seatbelts, speed bumps, oysters, microbes. But the possibility always existed that actants could be ideas, calculative techniques, even deities.[10] Bates and Clausen examine an actant known as the Technology Readiness Level (TRL), which they see as a calculative device that facilitates the coordination of various members and actions in an engineering project. There is certainly an ANT tradition of looking at such devices.[11] There are other strands of STS and engineering studies that do the same, though, and it might be interesting to read Bates and Clausen in conjunction with them. In particular, Donald Mackenzie's work on a number of different calculative devices – from Moore's Law to financial derivatives – comes to mind.[12] There's also a line of work in cognitive anthropology – some of it, again, inspired by ethnomethodology – on the distribution of cognition among assemblages of humans, technologies, and calculative devices.[13] For all of these literatures the TRL would make a fascinating case.

Let me turn now to Nan Wang's 'Origin and Operation of the Chinese Academy of Engineering: An Interaction between Expertise and Politics.' The research puzzle in this article is that the People's Republic of China only began the process of founding an Academy of Engineering long after the founding of the Chinese Academy of Science (1928, reorganized 1949), and even after the founding of the Chinese Academy of Social Sciences (1977). Moreover, the process leading to the establishment of the CAE took some sixteen years. All this in a country where engineers are reputed to have a great deal of political influence.

I leave readers to discover Wang's solution to that research puzzle for themselves. But to set the scene I'd like to point out some continuities and differences between her study and notable works in the history and sociology of science and engineering. First, Wang rightly starts with some etymology, since it is not straightforward to know what exactly was being institutionalized when we do cross-national comparisons of the institutionalization of 'engineering'. This section of the paper nicely contributes to a conversation about terms such as

'technology' that authors such as Eric Schatzberg and Carl Mitcham have tracked over both space and time.[14]

The main body of the article sits at the intersection of at least three other conversations. A number of classic studies have looked at societies in which engineers have wielded political power, often to the detriment of both society and engineering. The 1920s and 1930s, in particular, seem to have been a high point for such thinking across quite disparate political systems: from the Technocracy movement to Herbert Hoover's corporatist capitalism to Franco's Spain to the Soviet Union.[15] Wang's story of Chinese engineers and politics in the 1980s is somewhat different and perhaps more successful, though some of the same questions about the relationship between technical and political facts are still at play. Second, a staple of our field are cross-national comparisons of the organization of engineering labor in different countries, with engineering in China and East Asia more generally very much at the fore.[16] And third, there are a number of influential studies – some, indeed, engineering studies – that have looked at national academies of *science* during political revolutions, particularly revolutions identified with the political left.[17] There is considerably less work on academies of engineering anywhere, but especially in revolutionary or post-revolutionary socialist regimes. That's a gap partly filled by Wang's article. There's also an emerging literature on academies of science in post-socialist states, especially in Eastern Europe.[18] Wang's articles offers an interesting contrast, in that the PRC's transition was more gradual and its current state is not exactly 'post:' the Communist Party still dominates institutions such as the Chinese Academy of Engineering, even if that same party also happily participates in a global capitalist marketplace.

Lastly, Peter Robbins, David Wield, and Gordon Wilson's 'Engineering for Development as Borderland Activity.' Here the authors borrow an analytic concept – borderlands – that is associated with historical studies, and apply it to contemporary engineering.[19] Their point is that engineering for development (or E4D) is a provincial field within engineering, always closer to some adjoining engineering discipline than to the center of its practitioners' own fields. In the same way, borderlands have historically been provincial places, always closer to another country than to the capital of their own.

In my view, history proves difficult to overcome in this essay. First, as the authors hint in their introduction, E4D inherits a long history of schemes to use engineering to 'develop' provincial places. Many engineers were complicit in various metropoles' colonial projects to build dams, railroads, and telegraph lines to extend imperial control.[20] Engineers have not been as diligent in recognizing their complicity as practitioners of other disciplines such as anthropology. On the other hand, engineers were also prominent in a number of anti-imperial independence movements, and training engineers was an important objective of newly independent post-colonial regimes.[21] The authors also cite the appropriate technology (or A/T) movement of the 1970s as a forebear of today's E4D. I think that is correct, but it should also be mentioned that A/T is widely regarded as having failed.[22] The more modern antecedents and relatives of E4D are therefore organizations such as Engineers without Borders and various Silicon Valley-inspired attempts to 'hack' global poverty, often using philanthropic funding from Silicon Valley entrepreneurs.[23] Of those forebears, A/T probably came closest to the authors' argument that engineers' contact with (post)colonial societies can change engineering everywhere for the better.

In a sense, the authors use of the borderlands concept to make that argument is metaphorical. Borderlands has been tremendously useful in helping historians overcome

nation-centric thinking, and in that way the concept helps us to understand *both* the borderlands and the traditional nation better. The borderlands approach is part of a broader move to 'provincialize Europe' (and European settler societies) – i.e., to make the supposedly universal rationality and knowledge that claims its Europeanness seem just as contingent and parochial as any other rationality or body of knowledge.[24] For this article, the metaphorical translation would be to provincialize dams, canals, bridges, nuclear power plants, space shuttles, and other supposedly universal, privileged forms of engineering. By looking at E4D, we see that contingent, parochial forms of engineering – engineering to solve undervalued problems in undervalued places – are at least as innovative and fundamental as engineering's 'metropoles' of bridges and reactors.

But the metaphor is more than a metaphor. The same Eurocentrist and narrowly nationalist historical perspective that the borderlands concept undermined is also responsible for the 'prestige asymmetry' whereby some forms of engineering are seen as fundamental and universal while some are depicted as limited and parochial.[25] Building a cheap satellite is just as fundamental a challenge as building an expensive one, but the latter has traditionally had more prestige conferred on it than the latter. Here we return again to the problem of 'high' and 'low' tech that I brought up in connection with COVID-19. I'd like to employ the term 'high' engineering for the kind of engineering that has traditionally been valued, at least in the Global North. It is 'high' in the sense that it draws on the 'high-tech', supposedly science-based industries associated with Silicon Valley. But it also rests on the 'high modernist' ideology explored in James Scott's *Seeing Like a State*: the modernism of grand, sweeping built spaces, model villages, and straight lines imposed on chaotic nature.[26] As Scott shows, high modernist technologies such as dams failed disastrously, especially in places like the Soviet Union where engineers wielded political power. That kind of high modernist faith in grand technologies took root in many post-colonial settings as well, such as India – where it proved equally disastrous.[27] A different paradigm, rooted in the provinces of engineering and in the provincial places of the world, might be healthier. There, we find a 'low' form of engineering: an engineering that builds networks and alliances, that discovers universal knowledge in local challenges, that prides itself on thrift and making do. As the case studies in this article show, provincial, borderlands engineering can be 'best' engineering. 'best' is not the opposite of 'appropriate;' the best should be what *is* appropriate to the local situation. And if that is true, then the best engineering will often not be 'high' engineering.

Notes

1. Suisman, "The American Environmental Movement's Lost Victory."
2. Doing, "'Lab Hands' and the 'Scarlet O'"; Hicks, *Programmed Inequality*.
3. Johnston, *Techno-Fixers*.
4. Monahan, *Surveillance in the Time of Insecurity*.
5. Vincenti, *What Engineers Know and How They Know It*.
6. But see Doing, "'Lab Hands' and the 'Scarlet O'."
7. Becker, "The Professional Dance Musician"; Sudnow, *Ways of the Hand*.
8. Garfinkel, *Studies in Ethnomethodology*.
9. Latour, *Reassembling the Social*.
10. Jarrahi and Sawyer, "Networks of Innovation"; Latour, "What Is Iconoclash?"
11. Latour, "Circulating Reference."
12. Mackenzie, "Economic and Sociological Explanations"; Mackenzie, *An Engine, Not a Camera*.

13. Hutchins, *Cognition in the Wild*; Goodwin, "Professional Vision."
14. Schatzberg, "'Technik' Comes to America"; Mitcham and Schatzberg, "Defining Technology and the Engineering Sciences."
15. Jordan, *Machine-Age Ideology*; Graham, *The Ghost of the Executed Engineer*; Camprubí, *Engineers and the Making of the Francoist Regime*; also Johnston, *Techno-Fixers*.
16. Meiksins and Smith, *Engineering Labour*; Christensen et al., *Engineering, Development, and Philosophy*.
17. Josephson, *Physics and Politics in Revolutionary Russia*; Alder, *Engineering the Revolution*; Neushul and Wang, "Between the Devil and the Deep Blue Sea."
18. Heinecke, "On the Route Towards Renewal?"
19. Hämäläinen and Truett, "On Borderlands"; Knotter, "Changing Border Regimes."
20. Moon, *Technology and Ethical Idealism*.
21. Bassett, *The Technological Indian*.
22. Pursell, "The Rise and Fall of the Appropriate Technology Movement."
23. Edwards, "Gates, Google, and the Ending of Global Poverty."
24. Chakrabarty, *Provincializing Europe*, 2000.
25. Martin, "Prestige Asymmetry."
26. Scott, *Seeing Like a State*.
27. Bhadra, "This Fissured Democracy."

References

Alder, Ken. *Engineering the Revolution: Arms and Enlightenment in France, 1763–1815*. Princeton, NJ: Princeton University Press, 1997.

Bassett, Ross. *The Technological Indian*. Cambridge: Harvard University Press, 2016.

Becker, Howard S. "The Professional Dance Musician and His Audience." *American Journal of Sociology* 57 (1951): 136–144.

Bhadra, Monamie. "This Fissured Democracy: Nation-Building, Civic Epistemologies, and Nuclear Politics in India." PhD dissertation, Arizona State University, 2016.

Camprubí, Lino. *Engineers and the Making of the Francoist Regime*. Cambridge: MIT Press, 2014.

Chakrabarty, Dipesh. *Provincializing Europe: Postcolonial Thought and Historical Difference*. Princeton, NJ: Princeton University Press, 2000.

Christensen, Steen Hyldgaard, Carl Mitcham, Bocong Li, and Yanming An, eds. *Engineering, Development, and Philosophy: American, Chinese, and European Perspectives*. Dordrecht: Springer, 2012.

Doing, Park. "'Lab Hands' and the 'Scarlet O': Epistemic Politics and (Scientific) Labor." *Social studies of science* 34 (2004): 299–323.

Edwards, Michael. "Gates, Google, and the Ending of Global Poverty: Philanthrocapitalism and International Development." *The Brown Journal of World Affairs* 15 (2009): 35–42.

Garfinkel, Harold. *Studies in Ethnomethodology*. Upper Saddle River, NJ: Prentice-Hall, 1967.

Goodwin, Charles. "Professional Vision." *American Anthropologist* 96 (1994): 606–633.

Graham, Loren R. *The Ghost of the Executed Engineer: Technology and the Fall of the Soviet Union*. Cambridge: Harvard University Press, 1993.

Hämäläinen, Pekka, and Samuel Truett. "On Borderlands." *Journal of American History* 98 (2011): 338–361.

Heinecke, Steffi. "On the Route towards Renewal? The Polish Academy of Sciences in Post-Socialist Context." *Science and Public Policy* 45 (2018): 246–256.

Hicks, Marie. *Programmed Inequality: How Britain Discarded Women Technologists and Lost Its Edge in Computing*. Cambridge: MIT Press, 2017.

Hutchins, Edwin. *Cognition in the Wild*. Cambridge: MIT Press, 1995.

Jarrahi, Mohammed Hossein, and Steve Sawyer. "Networks of Innovation: The Sociotechnical Assemblage of Tabletop Computing." *Research Policy* X1 (2019): 100001.

Johnston, Sean F. *Techno-Fixers: Origins and Implications of Technological Faith*. Montreal: McGill-Queen's University Press, 2020.

Jordan, John M. *Machine-Age Ideology: Social Engineering and American Liberalism*. Chapel Hill: University of North Carolina Press, 1994.
Josephson, Paul R. *Physics and Politics in Revolutionary Russia*. Berkeley: University of California Press, 1991.
Knotter, Ad. "Changing Border Regimes, Mining, and Cross-Border Labor in the Dutch-Belgian-German Borderlands, 1900–1973." *Journal of Borderlands Studies* 29 (2014): 375–384.
Latour, Bruno. "Circulating Reference: Sampling the Soil in the Amazon Forest." In *Pandora's Hope: Essays on the Reality of Science Studies*, 24–79. Cambridge: Harvard University Press, 1999.
Latour, Bruno. "What Is Iconoclash? Or Is There a World behind the Image Wars?" In *Iconoclash: Beyond the Image Wars in Science, Religion, and Art*, edited by Bruno Latour and Peter Weibel, 14–41. Cambridge: MIT Press, 2002.
Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press, 2005.
MacKenzie, Donald. "Economic and Sociological Explanations of Technological Change." In *Knowing Machines: Essays on Technical Change*, 49–66. Cambridge: MIT Press, 1996.
MacKenzie, Donald. *An Engine, Not a Camera: How Financial Models Shape Markets*. Cambridge, MA: MIT Press, 2008.
Martin, Joseph D. "Prestige Asymmetry in American Physics: Aspirations, Applications, and the Purloined Letter Effect." *Science in Context* 30 (2017): 475–506.
Meiksins, Peter, and Chris Smith, eds. *Engineering Labour: Technical Workers in Comparative Perspective*. London: Verso, 1996.
Mitcham, Carl, and Eric Schatzberg. "Defining Technology and the Engineering Sciences." In *Philosophy of Technology and Engineering Sciences*, edited by Anthonie Meijers, 27–63. Amsterdam: North Holland, 2009.
Monahan, Torin. *Surveillance in the Time of Insecurity*. New Brunswick, NJ: Rutgers University Press, 2010.
Moon, Suzanne. *Technology and Ethical Idealism: A History of Development in Netherlands East Indies*. Leiden: CNWS Publications, 2007.
Neushul, Peter, and Zuoyue Wang. "Between the Devil and the Deep Blue Sea: C. K. Tseng, Mariculture, and the Politics of Science in Modern China." *Isis* 91 (2000): 59–88.
Pursell, Carroll. "The Rise and Fall of the Appropriate Technology Movement." *Technology and Culture* 34 (1993): 629–637.
Schatzberg, Eric. "'Technik' Comes to America: Changing Meanings of 'Technology' before 1930." *Technology and Culture* 47 (2006): 486–512.
Scott, James C. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press, 1998.
Sudnow, David. *Ways of the Hand: The Organization of Improvised Conduct*. Cambridge: Harvard University Press, 1978.
Suisman, David. "The American Environmental Movement's Lost Victory: The Fight against Sonic Booms." *The Public Historian* 37 (2016): 111–131.
Vincenti, Walter G. *What Engineers Know and How They Know It: Analytical Studies from Aeronautical History*. Baltimore: Johns Hopkins, 1990.

Cyrus Mody
Maastricht University
c.mody@maastrichtuniversity.nl