History of Engineering (and Some of Its Uses)

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EDITORIAL

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Before getting to this issue's contents I would first like to toast some good news for the journal. Every year Taylor & Francis sends me a packet of statistics, surveys, pie charts and the like showing where the journal stands. This is good information to have, and I encourage all authors and readers to accept the publisher's requests to fill in surveys about the journal – we depend on that kind of feedback. This year the packet contained a couple nice treats. In particular, our impact factor roughly quadrupled from 2017 to 2018, to a value of 0.952. We should, of course, treat such figures with due caution – that is one of the main lessons of our field, after all. But I think the increase does show that people are engaging with the journal's content. That interpretation is reinforced by the figures for downloads of our articles, which have been growing by $\sim$ 25% per year since 2012. That is a great long-term trend that I hope will continue. So if you have written something on the practice and culture of engineering and are wondering where to send it – well, I hope these figures give you some idea that this journal is drawing attention and sparking conversation.

Not a special, but a serendipitous issue

I hope that as readers look at the contents of this issue they see a certain commonality among the offerings. That does not mean this is a special issue, however. Entirely unintentionally, we received several articles and an essay review at the same time, all of which show how historical approaches can contribute to engineering studies. We have published true historical special issues before, most notably 2011's volume 3, issue 3 'Becoming an Engineer in Eighteenth-Century Europe,' edited by Irina Gouzévitch and Peter Jones.[1] But we have never before had one issue that ranged over so many 'different' intersections of history and engineering studies. As a historian myself, I find this gratifying – but one thing to emphasize is that this issue is neither for nor by historians alone. As with all of our issues, this one further underlines the journal's and the field's commitment to interdisciplinarity, even when one discipline temporarily comes to fore.

Indeed, one of the lessons of this not-so-special issue is that disciplinarity and interdisciplinarity must be mutually reinforcing: it is difficult to do good engineering studies research with a monodisciplinary outlook; yet the institutional and epistemic infrastructures offered by the disciplines are indispensable aids to good interdisciplinary research. Thus, half of the issue is devoted to two articles ('Mastering the Hard Stuff: The History of College Concrete-Canoe Races and the Growth of Engineering Competition Culture' by Amy Sue Bix; and 'Transfer of "Engineer's Mind": Kim Choong-Ki and the Semiconductor Industry in South Korea' by Dong-Won Kim) written as historical narratives by people employed in history departments. But the other half of the issue is more varied with respect to discipline. We have an essay review of anthropology and sociology research on 'Maintenance

and Repair Work' by Dominique Vinck, who himself is positioned more in the social scientific corners of Science and Technology Studies (STS). And we have a Critical Participation study of 'Archive as Laboratory: Engaging STEM Students and STEM Collections' by Tracy B. Grimm – an archivist – and Sharra Vostral – an historian with affiliations in American Studies, Women's, Gender, and Sexuality Studies, and Engineering Education.

So even more than usual I hope readers will read this issue's contents together rather than separately. They do not have the cultivated coherence of a special issue, but in some ways this serendipitous special issue conveys, in its diversity, an especially pointed message about the various uses of history in engineering and engineering studies.

History's intrinsic worth

But before we get to the uses of history, we have to acknowledge that history – like the other disciplines making up engineering studies – has intrinsic worth. Any field of study should aspire to, and be able to articulate, some wider relevance. But researchers should also have the confidence to declare that their work is important *just because*, without having to speak the language of application, instrumentalism, and cost–benefit analysis. People *just do* like history and their lives *just are* enriched by it without having to specify some narrowly instrumental way in which history makes their lives better. Not everyone enjoys history, of course; and those of us who produce historical narratives should always keep that in mind. But you do not have to search hard for evidence that many people do feel their lives are enriched by the intrinsic pleasures of history.

Just note how much content put out by the film, television, gaming, and publishing industries presents historical narratives – much of it content about the history of engineering and technology. Or look at the research profiled on most government funding agencies' websites: studies that deal with the past, whether through the methods of archaelogy, paleontology, historical cosmology, linguistics, or history, are often front and center. Or witness the popularity – the emotional investment generated by – crowdsourced and Citizen Science research that delves into the past.[2]

Yet we live in a moment when intrinsic worth is not enough. Around the world, undergraduate enrollments in history and other humanities and social science fields are declining, apparently because many students and parents feel that degrees in those fields provide little protection amid widespread economic uncertainty.[3] And I cannot blame them for taking that view, even though there's little evidence that history majors are unemployable. Indeed, one thing our field can do is show how such views are fostered by companies that are hoping for both a glut of technical workers who can be paid less because of over-supply *and* a shortage of critical voices from the humanities and social sciences.[4] Meanwhile, here in the Netherlands and elsewhere governments are diverting research funding from the humanities and social sciences and even medical research to engineering fields – to the dismay of many engineers themselves![5] Here I think we can be quite pointed in our critiques of a self-defeating yet widespread techno-optimism that views all of society's ills as solvable by technical means alone.[6]

But one way to sharpen that critique is to show that some of society's ills can be ameliorated by the application of humanities and social science, including history. And the contributions to this issue show us a number of ways to do that. One way is simply to leverage that intrinsic value of history: i.e. to take our attraction to historical narratives

as an opportunity to – as Grimm and Vostral put it – 'smuggle' in other insights. In using the archive as a 'laboratory' in two of Vostral's courses, they witnessed and made pedagogical use of students' fascination with historically significant archival items such as Neil Armstrong's spacesuit and Amelia Earheart's manifesto for pilot nutrition.

Grimm and Vostral write from the particular experience of teaching engineering students, and with the particular purpose of cultivating humanistic perspectives among the next generation of engineers. But their observations have much wider relevance. We are all, in some sense, like their students. There is such a thing as applied history, but it would not exist without practitioners who were drawn in by history's intrinsic worth.[7] Vostral's students found some deep meaning in being able to place themselves in the flow of events and to see themselves as part of something larger by physically touching and mentally working with objects and documents from the past. Amateur and professional historians are not any different. Placing ourselves in relationship with a past that we see as valuable *per se* is often a first step toward making that past usable.

How did we get here?

So what uses can we make of history? The contributions to this issue are not comprehensive but they do give a good sense of some possible directions. In Dong-Won Kim's article, for instance, we see a classic instance of how history fleshes out the basic point of STS: things could have been different. We can't remove the article's central actor, Kim Choong-Ki, from history so we can't know for sure, but it certainly seems as though his contingent presence at certain turning points in the history of the semiconductor industry led to outcomes that would not have happened if he were not there. Maybe South Korea would still have played as large a role in that industry, but it would have had to get there via some alternative route. And, indeed, Dong-Won Kim shows that things *were* otherwise elsewhere. For instance, in Taiwan, where there was a similar desire to grow a domestic semiconductor industry, the key players followed very different paths from Choong-Ki Kim – and hence, Taiwan and South Korea occupy quite different positions in the ecology of the global semiconductor industry today. That observation has all manner of implications. Most importantly, it suggests a certain epistemic humility: even what we *know* could have been otherwise, has been otherwise, is otherwise somewhere else, and will no doubt be otherwise someday soon.[8] That, in turn, implies that one-size-fits-all policies – most especially policies for development – are self-defeating.[9] History teaches that we can never fully overcome contingency and the importance of local conditions, so we should figure out how to work with contingency and local variation instead.

Amy Sue Bix's article in this issue likewise encourages quite a fundamental rethinking of things that we take for granted. She does that by showing how a now-common practice – student competitions in engineering education – came to be so common and unremarkable. As usual with any cultural innovation that takes off, engineering competitions solved different problems for several different groups. Those stakeholders did not need to agree on everything in order to mutually foster the growth of engineering competitions: engineering educators saw contests as stimulating student interest, professional societies saw an opportunity for good publicity, while companies were enthusiastic about recruiting winning students and/or grabbing their designs. But engineering competitions are also like

other runaway cultural forms in that their widespread adoption has become rather dysfunctional, even as some of the original problems they were meant to solve have disappeared. Getting American college students emotionally invested in engineering, for instance, was particularly challenging in the early 1970s because many young people viewed the Vietnam War as having discredited science and engineering fields. Concrete-canoe races imbued engineering with an air of eccentricity and innocence that dispelled baby boomers' association of technology with militarism and imperialism.[10] By the 1980s such concerns had receded as engineering enrollments recovered. Yet concrete-canoe competitions continued and spawned myriad other competitions across engineering education and indeed a gamification of engineering more generally.

Meanwhile, the scaling-up of engineering competitions comes with significant downsides that were not apparent when a handful of undergraduates were splashing around in the lakes of Indiana and Illinois. Gamification encourages participants to see themselves and everyone else as competitors and to see everything as a struggle dividing winners from losers. The more that contests become a means for companies and governments to (ostensibly) discern quality and therefore to allot resources, then the more participants will want to win those contests by any means they can. Hence, a Matthew Effect sets in as those who have the means to support their participation in contests will win more contests and obtain the resultant resources. A charming diversion aimed at transferring the tacit knowledge of working with concrete evolves into an object lesson in ruthlessness and inequality.

New and old, innovation and maintenance

So change is one of the few constants in life: the innovation that solves one problem becomes something else as it grows and gets adapted. In his essay review, Dominique Vinck takes up that idea and explores its ramifications across engineering studies. This is, by the way, the first of our commissioned essay reviews: longer discussions of recent works in or near our field, grouped around some theme that many of our readers are – or should be – pursuing. Vinck's essay does just what I hoped these reviews would do, and credit should go both to him and to our book reviews editor, Qin Zhu.

Vinck tackles the topic of maintenance and repair – one of the forefront issues in the fields nearest to engineering studies, yet still more called-for than actually accomplished in our field itself. This journal, for instance, has been slow to publish works on repair and maintenance, even though Gary Downey and I have both recognized the centrality of that topic and have encouraged authors working in that area to see this journal's readership as eager to learn more about practices of care, preservation, conservation, adaptation, reinvention, etc.

Maintenance is inherently the kind of topic which has to be historical, and yet where historians must work with other fields. Admittedly, a few historians of technology such as David Edgerton and Lee Vinsel and Andrew Russell have drawn attention to the topic.[11] But as Vinck shows, sociologists and anthropologists are leading the way too. The next step, I hope, is for historical and contemporary perspectives to find an intersection within engineering studies and within the pages of this journal.

That is because you cannot talk about maintenance and repair without talking about change-over-time – the historian's bread and butter. Artifacts and larger socio-technical systems are subject to entropy and other forces that change them over time. Those changes

are only apparent from a perspective that looks into the past – whether offered by historians, social scientists, or practicing engineers, users, and other technologists. But at the same time, the practices of dealing with that change-over-time often elude conventional historical methods. One of the main points of maintenance and repair studies (MRS) is that maintenance is often undervalued and gets assigned to the kinds of undervalued people who – because they are undervalued – leave traces in the historical record that are harder to access than the traces left by people with more prestige. Historians have made some headway in reconstructing past maintenance practices, but it is an uphill struggle compared to reconstructing the practices of famed inventors and innovators. Luckily, maintenance is all around us, much more so than invention and innovation, so it should be amenable to social science methods such as ethnography. We cannot, of course, assume that the past is like the present, but there is plenty of scope for MRS studies of the present to sensitize historians to the kinds of issues past maintainers probably faced.

And once we are sensitized in that way, we can tell new histories that usefully subvert older narratives. Stories that begin and end with invention and innovation almost always privilege the role of individuals, particularly affluent white men, and of the Global North. That is not to say that those kinds of individuals are better at invention and innovation; rather, it is that the valuing of those kinds of stories and those kinds of individuals have been co-produced over time.[12] If we then sensitize ourselves to stories where invention and innovation are only a small and often inconsequential part of a much larger web of technologies-in-use then we can encourage ourselves to tell stories where the actors are more varied and distributed.

Notes

1. Gouzévitch and Jones, "Becoming an Engineer in Eighteenth-Century Europe," 2011.
2. Raith, "Involving Citizens in Research," 2019.
3. Schmidt, "The History BA Since the Great Recession," 2018.
4. Slaton and Ebeling, "Two-Year Colleges and the Allure of 'Nano'," 2010.
5. Chaudron, "Zelfs de bèta's verzetten zich," 2019.
6. Johnston, "Alvin Weinberg and the Promotion of the Technological Fix," 2018.
7. Heilbron, "Applied History of Science," 1987.
8. Jasanoff, "Technologies of Humility," 2003.
9. Gilman, *Mandarins of the Future*, 2003.
10. Wisnioski, *Engineers for Change*, 2012.
11. Edgerton, *The Shock of the Old*, 2007; Russell and Vinsel, "Let's Get Excited about Maintenance!,"2017.
12. Jasanoff, "The Idiom of Co-Production," 2004.

Disclosure statement

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