FORUM: GRAND CHALLENGES

History and Technology in an Age of “Grand Challenges”

Raising Questions

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ABSTRACT: This essay introduces the forum about history and technology in an age of “grand challenges.” First, it sketches present-day political and engineering debates on technology’s role in solving or causing “grand societal challenges,” which allegedly threaten humanity and the environment. This raises the question if, why, and how historians of technology can and should engage with these intellectually tricky and politically charged debates. The essay then presents the initiative of the Tensions of Europe network to develop transnational research groups and research agendas exploring this question, and introduces the five research agendas published in this forum. Finally, it raises five overall “grand challenges” to the field: How can we trace the histories of technology and grand societal challenges across temporal, spatial, sectoral, methodological, and political divides?

This TeC forum explores if, why, and how the field of history of technology can and should engage with ongoing debates on “grand societal challenges.” Over the past decade or so, political, media, and scholarly debates have increasingly focused on the multiplication of social and environmental crises that seem to haunt our present-day world—from climate change and other environmental threats to increasing inequality; mass migration, financial, and security crises; deteriorating megacities; the threatened breakdown of unsustainable mobility, energy, and health systems, and more. Policymakers have devised programs to address these so-called grand challenges, such as the UN Sustainable Development Goals, the EU Societal Challenges, and myriad other programs of a similar nature. Scholars study the real, imagined, and contested features of these crises; discuss whether or not these characterize our current age and, perhaps even an

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earth-systemic state shift, the Anthropocene; and rethink research questions, perspectives, and concepts.¹

Technology features prominently in these discussions. It counts both as a cause of, and as a solution to, today’s social and environmental crises. From the greenhouse gas emissions and global inequalities of energy, transport, production, and consumption systems to technologies of (anti-)terrorism and ICT-shaped financial crises to the promises of smart, responsible, and sustainable innovation: technology seems to pervade most, if not all, of today’s grand challenges and the debates about them. Indeed, digital knowledge infrastructures and media technologies shape our very identifications and interpretations of current challenges and potential solutions.²

Technology’s pivotal role in today’s societal challenges is underscored, but also complicated, by the bold claims of technology’s main protagonists. Engineering community spokespersons have translated humanity’s global challenges into the so-called grand challenges of engineering that engineers need to solve if we are to “ensure that human life as we know it can continue on this planet”—so say the presidents of the U.S., UK, and Chinese academies of engineering in a common manifesto.³ Their argument: modern technology has solved major challenges before—clothing, housing, and feeding over 7 billion people, for example—and can do it again. And if technology caused some of today’s problems, that, too, implies it holds the key to the solution.⁴ This discourse to save the planet through innovation is widely shared by engineering associations, schools, and companies across the globe. However, this well-intended yet self-interested discourse is also problematic, because it tends to monopolize the problem definition and solution, silencing alternatives and ignoring the politics of technology and knowledge. Besides, science and technology studies (STS) scholars remind us, science and technology institutions also adopt “grand challenge” talk strategically in ongoing resource and reputation races.⁵ It is imperative to identify the notion of “grand challenges” as a contested actor-defined concept.

Can and should the field of history of technology engage with such debates? And if so, how? Can we relate to, but not uncritically adopt, the language of technology’s protagonists as well as its critics? Surely there is a

1. See, for example, Charles Perrow, _The Next Catastrophe_; Ulrich Beck, _World at Risk_; Manuel Castells et al., _Aftermath_; Jason W. Moore, _Anthropocene_; Christophe Bonneuil and Jean-Baptiste Fressoz, _Shock of the Anthropocene_.
2. Paul N. Edwards, ”Knowledge Infrastructures”; Simon Cottle, ”Rethinking Media and Disasters.”
4. Rutger van Santen et al., _2030_; Rutger van Santen et al., _The Thinking Pill_.
huge empirical basis for historical studies of technology and “grand challenges”: the historical record is rife with social and environmental crises, and technology and technologists have long played their ambivalent roles as prominent cause and solution to such crises. Indeed, ever since the (civil) engineering profession’s inception about two centuries ago, social challenges have co-shaped its research and innovation agendas, and technical solutions have co-produced new social and environmental problems that later generations of technologists again set out to solve. A historical perspective can uncover these and many other long-term technological dynamics of crisis.

The transdisciplinary field of history of technology should be in a privileged position to develop historical interpretations and narratives of technology and grand societal challenges, for it has long studied the ambivalent interactions of technological, social, and environmental change. In the past decade, a number of colleagues have advocated this direction of study. Others feel uncomfortable with political agendas and hype (including that surrounding “grand societal challenges”) setting their research agenda. How can the field proceed in this intellectually tricky and politically charged debate? The following forum explores this challenge and discusses possible research topics and questions for a history of technology in an age of grand challenges. It asks what history of technology sensitivities and insights are relevant to current public and academic grand challenge debates, and, conversely, what new historical questions present-day debates may inspire. What are the challenges, opportunities, and pitfalls involved?

Forum Background and Contributions

The forum springs from a collaborative explorative research initiative of the Tensions of Europe research network. That initiative succeeds this network’s previous program on the role of technology in European integration and fragmentation. At a meeting in the Netherlands in spring 2016 we formed a number of transnational working groups to build scholarly networks, identify relevant existing literature, and articulate research questions and agendas for particular grand challenges. Later, other teams were added either by invitation or on their own initiative; any serious scholarly group wishing to contribute to this historiographical exploration was and is welcome. By early 2019 that joint effort had resulted in over two dozen workshops and conferences, in which many relevant themes were debated

6. Erik van der Vleuten et al., Engineering the Future.
with an ever-increasing number of interested and engaged scholars. This forum presents tentative findings from five of these working groups.

We start by de-essentializing and historicizing the notion of crisis that informs much grand challenge discourse. In their contribution, Karena Kalmbach, Anna Åberg, and Andreas Marklund propose to investigate the historical interaction between crisis narratives and technological choices. They speak of a triple temporality of crisis: in periods of widespread anxiety, cultural memories and experiences of past crises and fears of future calamities were often combined into novel contemporary crisis imaginaries mediating contemporary technology choices. The authors illustrate this mechanism with examples from the realms of national security, nuclear energy, and space mining.

The next three contributions focus on a specific challenge domain. Matthias Heymann, Elena Kochetkova, Per Högselius, Ole Sparenberg, John Martin, Anna Åberg, and Frank Veraart place present-day debates on resource security in historical perspective. The authors raise historical questions about the cultural construction of such notions as “resources,” “scarcity,” and “resource crises”; highlight the spatial variety and connections of local, national, and global resource flows and associated global socioeconomic entanglements; and address the roles and limits of experts and expertise in the governance of resource crises and reconfiguration of natural environments.

Next, Ute Hasenöhrl and Jan-Henrik Meyer historicize current debates on “energy challenges” and “energy transition.” They argue that historical research can uncover and unpack how past and present energy transitions are embedded within broader societal transitions, highlighting normative and perceptive changes as well as asymmetrical power relations. As important avenues for future research, they emphasize the long history of renewables in past social and environmental contexts; the historical roots, shaping, dynamics, and implications of today’s incumbent fossil-fuel and nuclear-based energy systems; and the historical study of forces of change at work in past and present energy transitions.

Reporting from the research network on the sustainable urban-mobility challenge, Frank Schipper, Martin Emanuel, and Ruth Oldenziel enlist the notion of the “usable past” to identify historically shaped opportunities and barriers for mobility policies in cities across the globe. They confront expert discourses and social practices when historicizing today’s dominant automobile-based urban-mobility systems, retrieving sidelined practices of low-emission mobilities such as pedestrianism and cycling, and identifying infrastructure and social-practice legacies on which sustainable mobility

politics can be built. In this context they speak of a “U-turn from the present via the past to the future” in mobility history as well as policymaking.

The last contribution, finally, transcends specific crisis domains and queries the governance of science and technology in an age of grand challenges. More specifically, Efstathios Arapostathis and Leonard Laborie observe a co-shaping of global challenges and the governance of science and technology. They use the concept of science diplomacy to probe entanglements of technology, science, diplomacy, and diplomatic relations. They ask how democracy is at stake in such processes and make an argument for the historiography of science and technology to interact with political/civil society and scientific stakeholders in order to critically integrate historical stakeholder experiences into meaningful and relevant historical narratives.

“Grand Challenges” for the History of Technology

In addition to research questions for specific crisis domains and perspectives, the notion of a history of technology for an age of grand challenges also raises more fundamental and generic historiographical questions. These questions lead us into broader historiographical debates. By way of concluding this introductory essay, let me here briefly raise some of these broader questions—about the temporality, spatiality, sectorality, methodology, and politics of (the study of) technology and crises.

First, how should we locate technology and grand challenges in time? The contributors to this forum feel that historians can and should challenge the chronocentrism of many present-day public, political, and academic debates. Each contribution articulates different answers to Paul Edwards’s provocative question: “Does it make any difference how the current state of affairs emerged?” However, this challenge may also require us to rethink conventional periodizations and caesura, and even to problematize the distinction between past, present, and future. For example, the integrated study of humans, technology, and environmental crises leads us to institutional divides in the study of the past and to the Anthropocene literature’s research challenge of bridging human time (history) and nonhuman time (geology, ecology), which requires transcending singular and linear time frames. Can parallel interacting temporalities such as Braudel’s events, conjunctures, and longue durée help interconnect, for example, terrorist attacks, financial crises, and climate change? Should we reactivate Ernst Bloch’s notion of the simultaneous manifestation of non-simultaneous historical trajectories that we know from technology history (e.g., tanks equipped with mail pigeons) as well as crisis history (unpre-

dictable accumulations of diverse historical contingencies)? How can we mobilize the historiographies of reverberating technologies and crises through time—for example, studies of crisis aftershocks and technologies’ afterlives, or conflicting and evolving cultural remembrances of technological crises such as Chernobyl 1986? And as we have seen, contributions to this forum also connect past, present, and future, asking questions about the role of imagined futures in contemporary crisis experiences, and the relevance of past sociotechnical practices and experiences for achieving a more sustainable future (the “U-turn to the future” that brings, for example, renewable energy technologies or cycling to sustainability policymaking). Finally, while exploring these matters of temporality, can we avoid reproducing once more the unreflective imposition of Western (sometimes technology-based) time frames on the non-Western world that postcolonial historians have criticized so fiercely?

This leads us to a second set of questions about situating technology and grand challenges in space. Much technology, and most present-day crises, display global dynamics or ramifications. Most contributors to this forum would agree that these cannot be properly studied in geographical isolation, much less from a Western-centric perspective. However, spatial delineation of the research topic remains a much-cited research virtue, and despite decades of critique, Western-centric historiography still thrives. How can we further strengthen histories situated in the Global South, bringing to the table a broader variety of perspectives on, for example, technology, crises, sustainability, and the Anthropocene? Should we connect such histories to Western/Global North histories or not, and if so, why and how? And considering the constant renegotiation of technology and crisis meanings on-site in specific local and social settings, can we avoid either ignoring or essentializing spatial difference? The literature on global and transnational history of science, technology, and business offers ways to study technology-mediated connections across conventional spatial delineations such as Global North/South, Western/non-Western, local/nation-state/Europe/world systems, and center/periphery. That literature speaks of multiple geographies and warns against unacknowledged reproduction of conventional spatial categories as essentialist units of historical experience, as for example much nation-centric African history, comparative history, and transfer history once did. Instead, it suggests the symmetrical study of the (un)making of spatial connections and boundaries, in-

cluding the continued relevance of classic historical formations such as the city, the nation, or world systems that persist despite multiple connections piercing their borders. Moreover, Arne Kaijser has emphasized that transnational history is also a social challenge, requiring multinational research teams. Though a few hundred scholars participated in the workshops informing this forum, the vast majority are European or North American, begging the question of how to better and meaningfully engage non-Western voices, both scholarly and lay.

Third, we may need to trace technology and crisis not only across temporal and spatial borders but also across sector borders (e.g., between energy, transport, food, financial, security, and military systems). Policymakers acknowledge this challenge in multisector programs such as “Inclusive Green Growth” programs or the “Water, Energy and Food Security Nexus.” However, most political and research programs—including our own—tend to reproduce a single-sector focus. Can we transcend sectoralism next to chronocentrism and Eurocentrism? Ongoing research on connected transitions or deep transitions across multiple sociotechnical systems suggests different actors and arenas germane to the study of cross-sector crises and transitions. These include system builders who entangle different sociotechnical systems (system entanglers); users in the consumption junction; mass media; governance actors; and metarules governing the dynamics of multiple systems. As for time and space, the trick seems to be addressing crisis and transition across, as well as within, sector boundaries. For example, empirical studies of incident reports across critical infrastructure sectors found that crises regularly cascaded across sector boundaries, but also that most crises were contained within a few cascade pathways or particular sectors and died out before cascading into catastrophic societal collapse.

The historical study across sectoral divides leads us to a fourth set of questions, about inter- and transdisciplinarity, and particularly about the methodological pluralism needed to track technologies and grand challenges across and within sector boundaries. The virtues of interdisciplinarity have been amply advocated, and the field of history of technology has long positioned itself as an interdisciplinary—and sometimes a transdisciplinary—discipline. It is when we turn to methodology that many scholars hit the brakes, for what counts as good knowledge and good knowledge

16. Per Högsléus et al., Europe’s Infrastructure Transition; Schot, Confronting”; Erik van der Vleuten, “Radical Change”; Laur Kanger and Johan Schot, “Deep Transitions.”
18. Melvin Kranzberg, “At the Start.”
production remains central to much academic identity and boundary work. Methodological divides between the “two cultures” of the humanities and the sciences seem especially difficult to bridge.

And yet here, too, the notion of crisis seems to inspire crossovers. For example, discussions on mixed qualitative and quantitative methods have long been a rarity in the field of history of technology. Yet colleagues in the resource-challenge working group have recently combined quantitative sustainability measurement and historical time series with qualitative study of historical actor articulations of societal problems in order to track (un)sustainable development in time and space. What possibilities and pitfalls do such mixed-method approaches imply for the study of technology and grand challenges? Likewise, notions of crisis (not least a “crisis of the humanities”) feature in crossovers between history and computer science (i.e., digital history and the digital humanities). And the crisis-of-all-crises concept of the Anthropocene, according to Helmut Trischler, has become a trading zone for cross-disciplinary encounters between the humanities and the sciences, with—Trischler proposes—historians as prominent traders. Should and can we live up to that promise and extend it to mixed-method methodologies?

This leads us to a fifth set of questions about the relationship between history and politics. All contributors to this forum feel that it is important to engage with the big issues of our time and bring in sociotechnical dynamics and inequalities into technology and crises research. Yet in our internal discussions, they disagreed about how to engage. Some cherish the divide between professional history and politics; reminiscent of the many abuses of history for political purposes in the nineteenth and twentieth centuries, they insist on studying the dynamics of technology and crises without preference for political priorities, public hype, or commercial interests (which, of course, in itself is a political choice). Others explicitly seek to intervene in ongoing political, public, and business debates and interact with relevant stakeholders; they build on such concepts as “policy-oriented history,” “the usable past,” knowledge “co-creation,” and other ways of interfacing between history and policy. How should scholars balance professional integrity and relevance? Or should we emphasize that this is not a zero-sum game and disentangle the question of history’s contributions to policy, on one hand, from current policy debates inspiring innovative historiography, on the other? And can a rich tradition of STS

19. Harry Lintsen et al., Well-Being. Sustainability and Social Development; Frank Veraart et al., “Connected by Oil.”


work on the politics of knowledge help us be more reflective about the politics of our own knowledge-producing and disseminating activities, be it in an ivory tower or stakeholder co-creation mode?

Meanfully and reflectively engaging across professional, intellectual and experiential divides in time, space, sector, methodology, and politics seem to me “grand challenges” for the history of technology in an age of “Grand Challenges.” Needless to say, the questions raised here, like the other questions raised in this forum, are explorative and tentative; they are hereby submitted to broader scholarly debate.

Bibliography


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