

# The Historical Imagination

Professor Johan Schot, Leonardo da Vinci address,

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I have travelled many disciplines and topics. From history to sociology, and economics, and everything in between; and from history of technology, science and technology studies, transport history, agricultural history, Dutch history, history of Europe, a bit of global history, sustainable development, mobility studies, innovation policy, technology assessment, and greening of industry. Yet my home is history, in particular history of technology, and SHOT (the Society for the History of Technology) provides the space where I can meet friends shaped by a similar love for the history of technology. I feel therefore privileged and honoured to be awarded the Leonardo da Vinci medal. It feels like a recognition from my soul mates, which is important precisely because I so often travel far away from my roots, and then wonder whether historians of technology would still accept me when I come back.

Why is history of technology my home? The short answer is that I value historical imagination beyond anything else. As I will argue below, it is this imagination that is crucially important for the world confronting the next Great Transformation, to borrow a phrase made famous by Karl Polanyi.

History allows me to travel through time and space, to new worlds and to enjoy often amazing experiences. There is no greater pleasure than sitting in an archive and opening up boxes which have not been opened for a long time, reading minutes, letters and other documents, traces of other lives, and slowly construct a narrative. However, for me, history is never only about recovering the past, it is a mirror which makes us understand the presence and the future. This is not only the case because the questions we ask are fuelled by contemporary concerns, but also because through history we get a better understanding of these concerns and ultimately of ourselves. This is the first feature of the historical imagination.

History is not only a mirror, it is also a set of scenarios. It teaches us the path-dependencies which shape who we are today, roads not taken, and hidden alternatives, which still might have a future, never in a similar way as they have may have in the past, yet in an unmistakable way may shape what is yet to come. History opens up the experience, and it shows us alternative scenarios. This is the second feature of the historical imagination.

History not only opens up, it can also produce bias. It may blind policy makers and other actors to certain options because a specific way of understanding history has become embedded in the way people, and organizations think about the options they have. In this way, history shapes action, and certain options are closed because actors believe history has proven they have no future. It is this for this reason that understanding history is more powerful than you think! It will challenge ways of acting in the world, and opens up new ways of thinking about the future. This is a third feature of the historical imagination.

Now I come to the main point of my address. I would like to use this Leonardo da Vinci address to make a plea to historians of technology to use the historical imagination to engage more with the huge challenges our world is facing. The current financial and economic crisis should not be our main concern, but what is coming next: a series of connected crises: an energy crisis, an infrastructure crisis, a food crisis, a climate crisis, a migration crisis, a health crisis, and perhaps global conflict and war too. I understand that this is very much on the agenda of the next phase of the Tensions of Europe project. So come and join the project!

Technology is a crucial site in producing and solving these crises, and we historians of technology should challenge the view that there are no real alternatives: in particular, for the current unsustainable energy, mobility, food, healthcare and other sociotechnical systems in place. These are unsustainable because the costs and benefits are distributed in a highly unequal way and their so called externalities, for example CO<sub>2</sub> emissions, threaten the future of our planet. For sure, if we continue to cling to a neoliberal ideology fuelled by a belief in the power of the market to solve all problems, we will not be able to stop climate change and we will make ordinary people pay for the costs. As a society we need alternatives to these sociotechnical systems that have reached the limits of their capacity to adapt. We need to provide these alternatives, without giving up democratic ideals and giving in to a technocratic super State.

Could it be true that we as historians of technology can have any significant impact in the collective search for alternatives? My answer is affirmative. Using the historical imagination, we can help the world to understand the current situation, we can challenge the way they think about the past, and the way they think about path-dependencies, and alternative scenarios, and by doing this open up a new understanding of the present and the future. We can only do this when we are prepared to engage with the current worlds and its problems and come out of our comfort zone. I believe we might need to re-invent how we practice history of technology.

This question about the impact of human action brought me to history of technology. As a history master student, I was interested in the big questions of history. One of them was the perennial question whether history is made by individual human action or shaped by structural forces. I was looking for a pivotal case-study to explore this rather broad question. Reading the work of Jacques Ellul and Lewis Mumford, and becoming inspired by the social

constructivist work of Wiebe Bijker and Trevor Pinch, I decided to use history of technology as a case study. It is a case study I never left.

Of course, to do in-depth empirical research, I had to find a concrete entry point. I decided to focus on farmers in Zeeland, a province in The Netherlands, who had to respond to what was presented to them as a new industrial technology. Modernizers told them there was no alternative. I zoomed in on the growing and manufacturing of madder, which is a natural red dye embedded in a root cultivated by farmers. The Dutch had been the industry leaders for several centuries but during the nineteenth century were confronted with a new type of madder product developed by French competitors. They had industrialized production. The Dutch farmers responded not by switching to the new industrial production mode, but by upgrading their decentralized way of producing madder. They did not believe that the new industrial option would deliver positive results. On the contrary they argued that innovating their own craft based tradition would produce higher quality madder, a fairer distribution of income and eventually would make it possible to preserve a strong market position, and it did.

This case study became a building block for a larger historical argument about the origins and nature of Dutch Industrialization. In the early modern period the Dutch Republic had claimed a leading position based on technological leadership but they lost this position and the United Kingdom became the birthplace of the industrial revolution, so the story goes. Based on the madder case, I challenged this view by arguing that the Dutch followed their own industrialization path, which was different, based on a form of merchant capitalism married to smaller-scale production, but it was not backward. On the contrary, it was forward looking, presenting an alternative industrialization model.

Later on with colleagues at the University of Twente, led by Arie Rip, we developed a new innovation theory which takes up the idea of concurrent development paths, but also provides a way of thinking about dynamics of radical socio-technical change. This theory is currently known as the multi-level perspective, but beforehand we advanced it as a quasi-evolutionary theory of technical change. It is a bridge between evolutionary theories of technical change, insights from constructivist scholars and historians of technology. This work on the multi-level perspective was a major input into the development of a new field called Sustainability Transitions. This is not the place to elaborate on it, but the basic insight of the multi-level perspective is that human action is not driven by rational choice, vested interest or perception. Human action is driven by routines or rule sets which are embedded in sociotechnical systems and therefore highly resilient and adaptive.

These rules provide a certain world view which make people prefer certain technological options above others. Yet while certain technological options, and the social relations which come with it, are dominant, there are always spaces (or niches) where alternative forms of behaviour and technology thrive. They might become a threat to the dominant sociotechnical rule-sets and systems. On top of that, external shocks and trends, called

sociotechnical landscapes, are important since they might create challenges which cannot be solved within dominant regimes and create windows of opportunity for niches to grow. Change or transitions of sociotechnical systems comes about through the interplay between regimes, niches and landscape factors. It always involves political struggle, crisis and political conflict, and to explain the outcome of these struggles is the core objective of the multi-level perspective. This perspective has not only been instrumental in developing the field of Sustainability Transitions, but also helped define a large-scale collective research programme on “Technology and the Making of the Netherlands: The Age of Contested Modernization”, better known in the corridors of Dutch universities as TIN-20. The multi-level perspective made it possible to integrate technology into a larger story about Dutch modernization.

Let me now move back to my call for the re-invention of the practice of history of technology. What is this about? It is about the need for deep collaboration with other disciplines, not only the social sciences and humanities but also the sciences and engineering. It is also about engaging with the stakeholders of our research, business, the policy-world and civil society, not after our research is finished, but early on in an interactive way. Finally it is about addressing head on what C. Wright Mills has called the troubles of our time.

There are many. One I would like to focus on in the coming years together with colleagues at the Science Policy Research Unit (called SPRU), at the University of Sussex, where I am based, is the next Great Transformation or perhaps we should say the crisis of capitalism. The core of this crisis are socio-technical systems which cannot be globalized and deliver growth in a sustainable way anymore. We need sustainability transitions of many socio-technical systems simultaneously, and therefore I prefer to talk about a Deep Transition instead of Great Transformation.

The First Deep Transition was a move from an early modern world to a modern one or from commercial capitalism to industrial capitalism. Since it is still early days for the Second one, it is hard to characterize, but let me try to do this by providing two opposing future scenarios: a brutal form of capitalism and a more inclusive one.

Brutal capitalism will generate economic growth driven by innovation, but outcomes are a very unequal distribution of wealth, unequal access to opportunities and uneven quality of life, and an unequal exposure to pollution and the effects of climate change. These effects were mainly unequally distributed between North and South, but instead will now also produce ruptures within the North. Inequality is on the move, and is becoming transnational. The state is called upon to safeguard a fairer distribution, but is not able to deliver since its power is eroded by many developments, including the emergence of megacities and new technocratic supranational structures and interdependencies.

Inclusive capitalism will also generate economic growth driven by innovation, but a different type of growth, one which prevents the generation of huge inequalities. In this type of capitalism we do not expect the national state to redistribute ex-post some of the benefits of economic growth. Instead distribution issues are dealt with ex-ante, through a process of inclusive innovation which does not generate such huge distribution issues anymore. This type of capitalism is building on the creativity of entrepreneurs and civil society.

I want to emphasize that I am not negative about the accomplishments of capitalism. Let's not forget capitalism, and modernity, provided growth with benefits for many and it led to the welfare state. It also led to democratisation of mobility, both socially and geographically, but also politically. It inspired the creation of nation states which was once a liberating project. It produced citizens and led to the inclusion of people, both man and women, in a democratic system. This is historically a very positive result.

But how do we define capitalism? One of the most salient features of capitalism is its relation with technological innovation. This feature is the main reason why we historians of technology should engage with the debate about the future of capitalism. Let me explain what I mean by this. The rise of capitalism was accompanied by the emergence of a set of institutions which rewarded innovation, and disconnected innovation from its impacts. In a capitalist system, promoters of innovation are not responsible for its wider impacts on employment, the quality of a society and/or the natural environment. In other words, capitalism nurtured the development of a specific modernist practice of science and technology politics in which science and technology should be stimulated as much as possible. They are seen as value-free tools to bring progress, material wealth, health, and a better life. Capitalism turned science and technology into the Holy Grail, the lever of riches citing Joel Mokyr, the harbinger of progress and the measure of man citing Michael Adas.

In the early modern period this unconstrained freedom for science and technology did not exist. Technological change was embedded in religious and social institutions, in a moral economy and always from the start assessed against social norms. This assessment took place in guilds, for example, but also through protest, and eventually could also lead to machine breaking, which was a legitimate practice to influence technological choice. This does not mean that guilds or for that matter machine breakers were against innovation. They were against specific innovations which would do harm to their values, the society and their vision of the future. They wanted to open up spaces for discussing technological choice and redirecting innovation. During the First Deep Transition, the responsibility for the negative impacts of innovation was transferred to the nation-states. They had to provide regulation and arrange the distribution of wealth and income through taxation.

This separation of promotion and regulation of innovation is at the heart of the crisis of capitalism. And it is for this reason science and technology are central to the Second Deep Transition, not because they can fix problems, but because the emergence and institutionalizing of a new way of embedding science and technology could help to shape a

new form of inclusive capitalism. Inclusive because more actors and factors will be included in the assessment and development of one of the central motors of capitalism: innovation.

My invitation to historians of technology is to engage with this Second Deep Transition, not just individually but also collectively. There are many issues to explore. Just free examples in areas in which historians of technology potentially could make important contributions:

1. The military were important promoters of innovation during the First Deep Transition, and also wars, both hot and cold, shaped the course of the transition. We have to ask the question how wars and the military will influence the further development of capitalism, and in particular the Second Deep Transition we are experiencing today. In a lot of history of technology research, we tend to neglect the violent and dirtier aspects of our history.
2. Innovation did not only originate in the North or the West. It is not the case that the South was not participating in the build-up of capitalism. Contrary to conceived wisdom, England was not the only birthplace of capitalism and the industrial revolution. What is true is that England and the West benefit a lot more than the South, they appropriated the rewards. This reminder should lead us to ask questions about who will appropriate the benefits of the Second Deep Transition. The issue of social inequality should be made much more central in history of technology research.
3. Although Capitalism was built around the holy grail of innovation and the assumption of the neutrality of science and technology, in reality it involved technological choice, and the input of many actors. Capitalism was not only built by engineers, and entrepreneurs, but also by users, civil servants and activists. Important question then arise around the politics of the Second Deep Transition, and the past and future of democracy.

When I make a plea for engagement with troubles of our time, I am not only speaking to you as individual scholars, but I am also calling upon us as a collective and I am calling upon SHOT as a platform where we meet and discuss our research. I am a firm believer and practitioner of collective research projects in which advanced researchers, as well as early career and PhD students can thrive but also form a community working together on a shared set of issues and concerns. This brings a lot of excitement, pleasures and excellent scholarship as the participants of the various collective projects I have been involved in, from Greening of Industry, TIN-19, TIN-20, Knowledge Network on System Innovation and Transitions, to Tensions of Europe can testify.

Over the years I have worked with many people, and I owe a lot to all of them. Here I can only mention only a few.

First, Harry Lintsen who is the father of the rebirth of the Dutch history of technology in the late 1970s and 1980s. He has been my mental coach throughout my career. I met Harry for the first time when I was a passionate history Master student. I had started my work on madder industry and was already reading larger implications into my single case study. At that time Harry had begun a larger study of Dutch industrialization from the point of view of

history of technology. When I met him for the first time, I immediately questioned his approach. Harry did not respond in a defensive way, but rather encouraged me to develop my thinking, asked further useful and pertinent questions, and eventually invited me to join his gang which consisted of Martijn Bakker, Ernst Homburg, Dick van Lente, Giel van Hooff, and Geert Verbong. Collaboratively, we were writing the history of Dutch industrialization in the nineteenth century, and Harry was our fearless leader. Later on when I was leading similar large-scale collaborative research efforts, his advice helped me through difficult moments and trade-offs involved in such endeavours. He taught me to be reflexive about my own role.

Second, Arie Rip, my PhD supervisor and teacher. I tend to adventure into new fields, but Arie was always ahead of me, pointing at interesting ways to go, forcing me to go deeper and not to accept too easy answers. Arie has shaped my thinking, even to the extent it was difficult to understand where his thinking ended and my own thinking started. Arie is a very generous intellectual, always willing to share his ideas. I have profited from his deep insights in a myriad of ways. He invented the multi-level perspective which became so crucially important to my research and that of many others.

Third, Ruth Oldenziel, whom I met for the first time at the SHOT meeting in Sacramento in 1989; my very first SHOT conference. Over the years Ruth has contributed tremendously to my thinking by questioning its assumptions, showing its limits and opening up new perspectives. For example, about gender, about the role of users in history, about the importance of culture, and fundamentally how to think about technology. She made me better understand what it is to be a historian of technology. During the early 1990s, we started working together, with a larger group of Dutch scholars, on a new Dutch twentieth century history which resulted in the so called TIN-20 book series. We have been working together ever since, in particular in founding the Tensions of Europe project and shaping its intellectual agenda, again with a large group of scholars, several of whom are in the room today. Both projects were an adventure and it had been a privilege and pleasure to have Ruth with me during both journeys from start to finish.

Finally I would like to thank the people behind the scene, who made it possible for me and others to do these large-scale collaborative projects.

1. The industrial Board members of the Foundation for the History of Technology, a unique organization in our field. The Board Members often passionately helped getting funding for projects and discuss history of technology insights.
2. The Board members of the Technical University of Eindhoven who always have supported history of technology research and teaching at their university.
3. The staff members of the Foundation, in particular Jan Korsten, with whom I have worked together since 1998 and without whom the Foundation would not exist and TIN-20 and Tensions of Europe would not have been possible.

4. Last but not least all personal assistants. It would not have been possible to work on all these networked collaborative projects without their support: Lidwien Kuipers, Sonja Beekers, Iris Custers, and currently at the Science Policy Research Unit – SPRU, Pip Bolton.

I am looking forward to working with a new group of wonderful colleagues at SPRU on Second Deep Transition issues. In doing this, I will seek to employ the historical imagination. Our world in transition is facing difficult grim, difficult and urgent problems. We are not in the position to stay complacent. A sense of urgency is necessary without, however, nurturing fear since, as Andy Stirling one of my colleagues at SPRU, has argued, this closes down debate and leads to bad solutions. During his entire life, the founder of SPRU, Chris Freeman embraced an "Economics of Hope" which embodies a positive view of the potential of mankind to use its resources constructively. In this spirit, I would like to finish this address expressing my hope that many more historians of technology will engage with our world in transition.