

Commentary  
Storia della tecnologia

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In his *Apologie de l'histoire* (Bloch 1974), Marc Bloch defines history as «l'étude des hommes dans le temps» associated with a «connaissance par traces».<sup>1</sup> Luisa Dolza undertakes the daunting enterprise of pursuing the history of western technology through a book populated by «hommes dans le temps» (with special reference to inventors and their times) and «traces» of their actions in the form of machines, representations and texts.

It is an old-style text where a pleasant literary style merges with frequent and wonderful quotes from primary sources. Despite the constraints imposed by the book series *Universale Paperback*, which demands conciseness, the Author manages to refrain from oversimplification. She does so through a very personal historical reconstruction «from the margins» – somehow akin to the spirit of the second generation of *Annales*<sup>2</sup> historians rather than to the encompassing (and somehow determinist) synopses of economic historians such as David Landes.

In the history of technology, like all other histories, moving to the borders helps one to spot the inner contradictions of the dynamics ruling the core centre. In this case, moving to the borders mainly means retargeting the attention from machines and their successes to the ideas, rules and practices

<sup>1</sup> As far as *traces* are concerned, Bloch reformulates a concept proposed by François Simiand, who referred to the «raisonnement construit sur les traces connues de [...] faits, appelés documents». See François Simiand, «Introduction aux études historiques» (1898), in *Revue de Métaphysique et de Morale*, 1898, pp. 633–641, now in François Simiand, *Méthode historique et sciences sociales*, Paris, Éditions des archives contemporaines, 1987, pp. 99–108. The quotation is at p. 4 of the electronic version: [http://classiques.uqac.ca/classiques/simiand\\_francois/methode/methode\\_09/intro\\_etudes\\_historiques.rtfp](http://classiques.uqac.ca/classiques/simiand_francois/methode/methode_09/intro_etudes_historiques.rtfp).

<sup>2</sup> I refer notably to Ruggiero Romano and his superb theoretical framework, which organises the content of sixteen volumes of *Enciclopedia Einaudi*.

that supported their invention and production, as well as to discourses and representations that give them a meaning.

This story starts from ancient times, when inventions were kept within the bounds of nature, which was ‘unveiled’ and ‘interpreted’ by the inventor. This is why mechanical arts were seen as ‘servile’ in opposition to the aristocratic ones, rooted on contemplation. Pursuant this approach, the organisation of knowledge during the middle age assigned practical activities (*factibilia*) at the lowest stage of the pyramid of disciplines, whilst the moral ones (*agibilia*) stayed in the middle and speculative activities (*scibilia*) at the summit.

The corollaries of such approach were the centrality of the concept of «limit» – a self-imposed boundary for the inventor, whose fundamental wisdom should consist in recognizing «the limits imposed by the gods» (p. 20) – and the use of memory, not intended as an individual attribute, but rather as a catalogue of models.

Surprise and wonder played an essential role in this vision, exemplified by the Author through the device of *deus ex machina* (p. 22), which ended many theatrical representations for a long time after the V century B.C., when it was first introduced. The intervention in the scene of extravagant machines was not only bound to offer a way out to the most intractable human affairs, but was also meant to engender bewilderment and wonder.

Indeed, it is wonder – along with the imagination supporting and activating it – one of the major threads of the book. Revealing quotations from original sources are there to remind us the crucial role it played. Such is the case of *Epistola* by Roger Bacon – a multi-faceted figure of monk, mystic, astrologer, and grammarian of the XIII century – writing that «it is possible to build machines by which the greatest ships, with just one man at the helm, will be able to proceed faster than if laden with oarsmen; it is possible to build carts that will move at unbelievable speed without draught-animals; it is possible to build flying machines in which a man [...] will be able to flap the air like a bird [...] machines that will allow to dive to the bottom of seas and rivers» (pp. 63–64).

In the same vein, according to Vasari, Brunelleschi «began penetrating the matters of time and motion, of weight and wheels by fancy [...]» (p. 80). The role played by imagination and utopias has indeed kept its centrality in furthering the frontiers of knowledge up to the XX century. Not few of the founding fathers of astronautics, for example, approached space, first of all, as a place of possible human regeneration. This was the case of Konstantin

Tsiolkovskij (1857–1935), father of the theory of rocket propulsion, an enthusiast of «cosmism» (or cosmic mysticism) which flourished in Russia at the turn of the century.

Along with the threads which make up the weft of the book (such as wonder and imagination), its warp seems to hinge mainly on two conceptual triads: the first includes man, nature and god, while the second embraces the inventor, machines and the state.

The first triad is most visible in the initial part of the story, when the Author outlines the Greek vision of the first invention, viz. fire, which was «ascribed [...] to the sign of rebellion» of Prometheus and the whole mankind with respect to the divinity (p. 46). In the middle age this approach was taken over by the idea of knowledge as «gift from God» (p. 47), as masterfully expressed by an excerpt of canon law quoted in the text: *scientia donum dei est, unde vendi non potest* (p. 47). According to Hugh of St. Victor and Thomas Aquinas, nature should be contemplated and respected without changing it (p.50). To Augustine, mechanical arts, aimed at taking « possession of the nature» (p. 48), defied God and were hence abominable. One should highlight how this vision still seem to influence, *mutatis mutandis*, Bolivian natives' arguments against the claim to patent genetic modifications practiced on Andes' traditional plants.

This approach did not compromise the tens of crucial inventions that took place in a middle age, a far from still era, characterized by a dynamic ferment that moulded the countryside and the urban landscape, as well as it prodded people to travel and trade.

The water mill (with its many different applications geared on the power produced by water wheels) and heavy plough began to be adopted widely during a long span of time from the IX to the XI century. They allowed «a rise in harvests higher than the demand connected to mere subsistence», so marking the beginning of a trading economy based on surplus, geared to the medieval town (p. 55). This process would put monasteries intended as production centres to the sidelines and would lead to the assertion of «new forms of richness through manufacturing and trade» (pp. 56–57).

Between the XIII and XIV century, technical knowledge began acquiring self-standing with respect to the machines it produced (p. 79), while guilds consolidated by setting the rules of this «intangible knowledge» (p. 79) and regulating access to work and many crucial aspects of the social life of their affiliates. The mechanic clock – according to Lewis Mumford – was a crucial

device in order to impress on labour the order and predictability that will be the keys to make it more fruitful and people more ‘productive’.

A turning point in the transformation of the way to perceive technical progress and its authors was represented by the law on privileges enacted in Venice in 1474, whose provisions allowed putting one’s name to a certain invention. This law – the first protecting the inventor and his invention for a renewable period of time (whose duration as a rule was inversely proportional to the invention’s importance) – subordinated the concession to the «not modest usefulness and benefit for our state» (p. 86). Not only did the inventor become entrepreneur, but the state began keeping a watch, regulating, celebrating and taking avail of his work.

Among the elements which would constitute the stuff European state were made of, the capacity to benefit from the useful discoveries of the time became a crucial one. In this context, war machines were due to play a crucial role. Not by chance the first printed illustrated technical book ever published (by Roberto Valturio) came out right in the territories of the *Serenissima* and dealt with military machines and techniques (*De re militari*). The *Serenissima* asserted herself as a model of state *ante litteram* and military might was one of her pillars.

«The man is at the centre, but his world is at war» (p. 100), writes the author describing Leonardo’s man inscribed in a circle. This is all the more true for the state, the new protagonist of European history and most important user of what Leonardo – in the letter to his future patron contained in the Atlantic Code – defined as «different and numberless things for offence and defence» (p. 100). Once the states were born, violence became their language and the inventor the latter’s scrupulous interpreter.

The privileges and, later on, English patents (1552) are «the vantage point to interpret the dynamics of innovation» (pp. 130–131) in the XVI and XVII centuries during which, little by little, a new vision of labour arose, no more intended as punishment by God, rather as progress towards knowledge and grace. No wonder that many of the discoveries of this period focused on lessening people’s fatigue and increasing labour productivity.

In order to get the inner meaning of the very concept of patent, Dolza puts it into the context of the innovative discourse about propriety that marked the development of western legal and political thought since 1690, date of publication of the first edition of John Locke’s *Second Treatise on Civil Government*.

Property right – to which Dolza ascribes patents (and the defence of inventors against third parties) – became part and parcel with a restricted number of ‘natural’ rights upon which natural law doctrine was built, as well as the modern idea of citizenship as a group of rights that the sovereign was asked to ‘recognise’ – and not to ‘bestow’. An essential stage of the transformation of bestowal into right was the law on *découvertes* passed during the Revolution, on the 7<sup>th</sup> of January 1791. Establishing a link between inventor and invention, the patents transformed human talent in one of the foundations of individual rights.

At the same time, however, the right to property of discovery privatised knowledge, perverting its original meaning into something heavily «monetized». Interested learning substituted disinterested contemplation as the core of the relationship entertained by the inventor with nature. Utilitarian rationale turned nature – and knowledge along it – from *province of mankind* to subject of exploitation and speculation, even of a financial kind. Dolza hints as the «frantic activity» and following huge losses (harbinger of later frenzies...) incurred by those ingenuous English citizens who, at the beginning of the XVIII century, acquired shares in societies that bought patents of illusory value (p. 167).

From now on patents became a microcosm reflecting the contradictions of a world where *cash nexus* (in the words of Thomas Carlyle) based on monetary exchange came to substitute the traditional social bonding, or ‘connections’, of older times. Patents would cease to be considered a ‘natural right’ of the inventor on the product of his work, but rather as a remuneration and protection of an investment. If it is fair to say that the dynamics of capitalism cannot be understood properly without looking at the enlargement of markets, the changes in the interactions between capital and labour and at the new technologies incorporated in the productive processes, Dolza enriches this vision by looking at how technological progress has come to be intermingled with modernization.

The role of institutionalized power pops out again and again in the chapters devoted to the XVI–XVII century. Let’s take, for example, Francis Bacon, who not only did advocate the foremost relevance of experiments and control instruments for the progress of mechanical arts, but also «foreshadow[ed] a state policy for sciences and arts» (p. 137).

In this context, the transformation of patents into monopolies (*Statute of Monopolies*, 1624) gives rise to some fundamental questions. Which is the

aim of the state and which are the interests it serves? Which kind of economic development is targeted by modern capitalism? The one that rises or, at least, safeguards employment or the one leading, in the words of the puritan Samuel Hartlib, to «the enrichment of the few» (p. 138)?

If it is true – as the author recalls – that in the XVII century the universe began to be represented as a huge machine (p. 140), it is in the same century that the state was thought and rendered as a «machine of machines». Among the practices leading to the consolidation of modern states (i.e. control, measure, war and production of richness), it is by no way difficult to discern the centrality of XVII century inventions regarding land surveying, topography, latitude measuring and ballistics (p. 144).

This is how a new triad linking inventors, machines and the state emerged as protagonist of modern technological development. This linkage became explicit, for example, in the public policies adopted by Jean Baptiste Colbert, who in 1663 consolidated in the Academy of Sciences those groups of scientists already operating in this sense (p. 154).

The Author refers to at least two paths of possible analysis to be followed in order to seize the complexities of the changes introduced by this new link. On the one hand, one could look at how technological progress contributed to the consolidation and economic development of the European national states, searching for the evidences – which become clearer from the XVIII century onwards – of a «politicisation of techniques» (*politicizzazione della tecnica*) (p. 159). On the other hand, one could look at the ambiguities of the impact of this link on inventors, as an impingement in their freedom of research and, at the same time, as an opportunity of social and economic rise.

Along with the institutional consolidation of the relationship between the state and inventions, there begins a power struggle opposing science and technique – almost a class struggle between aristocrats (the scientists) and plebeians (the technicians) – that will mark the following development of history of technology. For a while the Royal Academy of Sciences in Turin – established in 1773 – seemed to succeed in reconciling the opponents with a motto (*veritas et utilitas*) accompanied by an insigne where «a young woman, refined and proud, representing the *veritas* offers her hand delicately but condescendingly to a prosperous country-girl laden with cornucopias, *utilitas*» (p. 171). The Academy's involvement in the controversial question related with dyeing – notably the one with indigo, the colour of the Kingdom's uniforms – would clearly show the limits of this supposed reconciliation.

The book proceeds in a *crescendo*, merging in one chapter the XIX and XX centuries. Two centuries of history of technology proceed at fast pace and the different plots are once again hinged on the figures of the inventors. Somewhat a national hero in a XIX century eager of founding myths, the inventor – now owner of a patent and beneficiary of royalties, in the prototype figure of James Watt – enters in a complex relationship with the users of his most famous but not only invention, i.e. the steam machine, a relationship that often degenerated into open struggle. The users were especially the mine owners, interested in draining deep pits – a problem that had arisen several centuries earlier but acquired centrality during the golden age of iron and steel industry when coal demand rose consistently. Sale conditions of the patent would prejudice their profits and, on the other hand, would hinder «improvements and innovations in the steam technology» (p. 184). We assist here to the birth of what will evolve during the XX century into what was defined by Joseph Schumpeter as the crucial difference between invention (the creative spark) and innovation (its fruitful application to manufacturing) (p. 216).

The dramatic images of the ‘modern’ exploitation of mines in Britain during the XIX century offer another interpretative thread for this history of technology getting closer and closer to contemporary times. Marx’s *Gewalt der Gesellschaft* (a mix of force and violence characterizing societies based on trade and profit) offered revolutionary insights into the effects of the industrial revolution and the techniques it embodied on the unfortunate class of peasants-turned-city-dwellers that represented its backbone. The real megamachine was no more the state (a simple administration for profiteers’ interests, according to Marx), with its territorial and legal boundaries, but rather the XIX century capitalism, with the global reach of its markets, the exploiting nature of its productive system and its absence of accountability.

An enlightening quotation from Benjamin introduces what has been seen from many as an age of violence *par excellence*, the XX century, in whose endeavours science and technology played a crucial role. The many useful inventions exploited for the benefit of humanity during this time (from penicillin to the telephone, from the airplane to birth control techniques), do scarcely seem to compensate the insanity of the projects technology has been most deeply associated with, from the Shoa to the launching of the atomic bomb on Hiroshima and Nagasaki.

The XX century is indeed the period in history when the contradictions of technological development emerge most blatantly. Its spreading out does not

necessarily mean progress and greater accessibility does not always stand for greater democracy. The first potential victim of these trends is the state. Once privileged guardian of knowledge and techniques (and responsible for public choices related to them), the state is more and more giving ground to private initiative in the field, but has still to cope with their most perverse effects. The second potential victim is our planet, or *Spaceship Earth*, whose inherent fragility has been so convincingly demonstrated with the help of satellite technology (one should only look at the images of Latin American mega mines to appreciate the magnitude of the destructions they imply). The third victim is the Man, intended as both individual and community, the potential beneficiary of a progress more and more intolerant of limits. While the roads opened by biogenetic practices challenge his very «human» essence, patents connected to eatable and medicinal plants, according to many observers, make traditional communities liable of being denied autosustainability.

Confronted with the vastness of these challenges, the author wisely chooses to conclude in a low key, at the same time lauding the endurance of the principle of public protection for the invention and pondering over the decline of the ‘romantic’ figure of the inventor –no more partaker of the Great Chain of Being but, more prosaically, of the global value chains.

#### REFERENCES

Bloch, M. (1974). *Apologie de l'histoire ou métier de l'historien*. Paris: Armand Colin.