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► **To cite this version:**

Guillaume Carnino, Liliane Hilaire-Pérez, Jérôme Lamy. The Global History of Techniques and the Globalization of the History of Techniques. *Global History of Techniques (19th – 21th century)*, Brepols, pp.11-26, 2024, 10.1484/m.techne-eb.5.136421 . hal-04762289

HAL Id: hal-04762289

<https://hal.science/hal-04762289v1>

Submitted on 2 Nov 2024

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The Global History of Techniques and the Globalization of the History of Techniques

This book is the first overall study of the global history of techniques in the contemporary period. Building on work published in the last fifteen years (Misa, Schot, 2005; van der Vleuten, Kaijser, 2006; Krige, Barth, 2006; van der Vleuten, 2008; Schot, Scranton, 2013–2019; Kohlrausch, Trischler, 2014; Hilaire-Pérez, Zakharova, 2016; Hård, 2017; Pretel, Camprubi, 2018a; Krige, 2019), it provides comparative and connected studies of technology seen as ‘techniques’ on a global scale. While it puts particular emphasis on means of production and communication, the exploitation of natural resources, major technological systems, infrastructures, and networks, it also reflects upon overarching issues that both underpin and help renew our understanding of the field, whether it be the risk governance, repair and maintenance, conflict, everyday techniques and the time scales involved in different techniques. Far from painting a simplified picture of evolutions on a global scale, this book opens with a world tour of techniques in a bid to restore the complexity of regional historiographies and of the meanings given to technical activities in society. This approach seems particularly necessary considering the return of grand narratives which, in the name of global history, fall back on the mostly Eurocentric meta-narrative that long dominated this field of research (Berg, 2013; Bray, 2015; Bray, Hilaire-Pérez, 2016; Popplow, 2016).

Part and parcel of our decentred vision, is our use of the terms ‘technique’ and ‘technology’. While ‘technology’ has become ubiquitous on a global scale and somewhat emphatically refers to the advanced technological productions of industrial societies (‘new technologies’) as opposed to traditional techniques, this meaning is rather ambiguous, and the term actually polysemic. For a long time, the term ‘technology’ did signify the science of technique (techno-logos), the science of the arts and of manufacture; in 1728 Christian Wolff defined technologia as ‘the science of the arts and works of art, the science of things that men produce by the work of organs of the body, mainly by the hands’, and in 1806 Johann Beckmann stated the same in his *Entwurf der allgemeine Technologie* or ‘General Project of Technology’

Global History of Techniques, ed. by Guillaume Carnino, Liliane Hilaire-Pérez and Jérôme Lamy, *Global Matters Culture Matérielles, histoire des techniques et circulation globale des savoirs*, 9 (Turnhout: Brepols, 2023),

pp. 11–26

10.1484/M.TECHNE-EB.5.136421

(Carnino, Hilaire-Pérez, Hoock, 2017). This sense of the concept of technology, which opened up the possibility of a science of human activity and was marked both by encyclopaedism and the political issues of different states’ efficient management of resources, faded during the nineteenth century, when the science of engineers, process engineering, and the acceptance of technology as an applied science emerged (Schatzberg, 2006, 2018). Technology then no longer referred to the reasoned and comparative study of the means of production, but rather to the industrial operation of transforming materials into products. The former, more reflexive meaning was henceforth only used in the small, yet active, circles of collection curators, philosophers, anthropologists, and ethnologists who argue

in favour have seen 'technology as a human science' (Haudricourt, 1987) and contributed to its reappearance as a field of study in the social sciences (Iribarren, 2021; Loeve, Deldicque, 2018). The way the field has developed raises a number of issues, including that of the term 'technique', which has almost disappeared from the English language in favour of the term 'technology'. While the history of technology is increasingly globalized, its research community is increasingly international. English being the lingua franca of modern globalization as well as the language of historians of globalization, the use of the term 'technology' has also increased, as John Krige (Krige, 2019: 15) has pointed out. This raises further questions and invites critical reflection, as the term 'technology' is associated with western techniques understood to be applications of science, or at best techno-scientific hybrids, that helped the economic growth that characterized this part of the globe from the eighteenth century onwards. As Mikaël Hård explains, historians generally follow 'the common understanding of technology as more akin to engineering than to material culture. For example, the hydropower plant, in its close association to the field of engineering, is more likely to be understood as an artefact of technology than, say, bows and arrows' (Hård, 2017). Faced with the limits of the term 'technology', which fails to capture techniques outside the scientific field and, as was the case for many centuries and many regions of the world, created the myth of a 'technological vacuum' in some places or time periods, historians have resorted to using other expressions, like 'useful knowledge' or 'useful and reliable knowledge', to restore cultures to their appropriate know-how, skills, and technological knowledge (Mokyr, 2002; Berg, 2007; O'Brien, 2019). Other historians have proposed an examination of the meaning given to techniques in non-western cultures by looking at words used in different societies to refer to processes or aspects of human activity. For instance looking at the word 'way' used among the vaShona hunters of Zimbabwe to refer to a means of action and displacement (Mavhunga, 2014); or 'fundu' used in Kiswahili manuals in Tanzania to refer to a group of tasks ranging from divination, carpentry, and tailoring to playing soccer (Grace, 2021); or the use 'gong', as both an accounting unit for the task and a quantity of work in Song China (Lamouroux, 2010b) helps enrich the very notion of technique (Mavhunga, 2017; Coupaye, 2021). Encouraged as we are by a historiography of techniques that has largely benefited from the contributions of the social sciences and that does not reduce techniques to efficiency, it seems important for us to maintain, and even extend, the use of the

word 'technique' to refer to human activities and know-how, whether these activities use tools or not. This position is in keeping with the modern emergence of the term 'technique', as an activity that is conceptually distinct. Socially and linguistically identified in France as 'la technique' from the end of nineteenth century to the 1940s (Camolezi, 2021), it remained connected to other human activities and interests, hence philosophers and social scientists from Alfred Espinas to Marcel Mauss for instance understanding 'technical action as a social fact' (Iribarren, 2021). It is also in this sense that the term 'technic' is sometimes employed in recent historiography (Kumar, 2019). At the same time the words 'technique' and 'technical' have increasingly been used in English to describe method, skill, and know-how (Krige, 2019; Mateos, Suárez-Díaz, 2019). We can then define 'technique' as a set of actions and processes and their cumulative material manifestation in objects produced by human beings. Technique acts as a key mediation between man and the world: in this sense, it is controlled and embodied by actions (e.g. know-how necessary to the handling of an object) while objects are informed by these actions (e.g. tools used whose very form is shaped by their use and transformed by their wear and tear). This is what properly constitutes technique. The relationship between embodied knowledge and tools started when human beings first started using tools. It conditions and defines the relationship of humans to the world. It therefore deserves a dedicated term.

We think it is important to continue to be aware of 'technology' in the sense of the science of the arts, which was its meaning in French and in German in the nineteenth century. According to recent research, this meaning has persisted in different intellectual contexts which are now gradually being better identified. At the same time, there is currently research on the complexity of the long-term codification of techniques. This raises several issues, not least that of the interaction with tacit and localized knowledge including in recent times, despite the rejection of this tacit knowledge by forms

of standardised knowledge and the automation of production (Le Roux, Guéritte, 2016; Carnino, Marquet, 2019). It is therefore also appropriate to consider 'technology as a human science' more closely, since our aim is to place technology back at the heart of intellectual history, an aspect that has long been neglected by historians who tend to reduce technology to instrumentation, applied or industrial science, and productivism. As a result all authors in this volume were free to use the word 'technology' in its different meanings, in keeping with the long history of the term. This book reflects the diverse uses of this term, the various historiographical traditions the term draws from, while chapters also contextualise the term within the specific fields and activities they examine.

Apart from this central linguistic question, this book's multifaceted perspective as it combines different levels of analysis without imposing any linear narrative to the technical transformations of the last two centuries is also explained in part by the present collection bringing together authors from different disciplines and countries. Conversely the book bears witness to the recent globalization of the history of techniques, the history of which should begin to be written. The authors and the research programmes that have given impetus to the global history of techniques are largely based in English-speaking countries, but this book forms part of a recent expansion of

this globalized outlook (Jasanoff, Kim, 2015; Pretel, Camprubi, 2018a; Krige, 2019) by presenting a wider range of research, and in particular francophone research, which has hitherto rarely been included in historiographical accounts of the field. It thereby follows another collection of essays on the global history of techniques that was recently published in France (Carnino, Hilaire-Pérez, Kobiljski, 2016) and concluded that it was necessary to think about the global history of techniques in terms of — to use the phrase coined by the French ethnologist André-Georges Haudricourt (Haudricourt, 1987) — 'technology as a human science' (Carnino, Hilaire-Pérez, 2016). Guillaume Carnino and Liliane Hilaire-Pérez suggested that one might situate the global history of technique between the search for structuring principles on the one hand, and the collection of the infinite variety of techniques on the other, bringing into play two key notions: with on the one hand convergence

— what André Leroi-Gourhan calls 'trends' (Leroi-Gourhan, 1943), what Gilbert Simondon calls 'concretization' (Simondon, 1958), and is sometimes referred to as 'codification of practice' by other authors (Schäfer, Popplow, 2015) — and on the other hand divergence, since according to Marcel Mauss, there is a myriad variations in techniques that make up the texture of human societies. These kaleidoscopic variations justify the existence of such a field as 'technological sociology', which is encyclopaedic in nature (Mauss, 1960 [1934]; Schlanger, 1991). Clearly the meaning assigned to 'divergence' and 'convergence' here is radically different from that used by economists, who consider the former as a significant break in trajectories, captured at macro level (Pomeranz, 2000), and the latter as a process of growth development leading to the inversion of economic trends (Riello, 2013: 292–94). By contrast, for us the notion of divergence refers to forms of local fragmentation (including failure and exclusion) that coexist with trends towards functional integration and convergence (van der Vleuten, 2008: 992).

Convergence and divergence thus refer to processes related to the very make up of technical objects, with the notions of concretization and deconcretization initially borrowed from the philosophy of techniques now being used by historians (Simondon, 1958: 19–23; Livet, 2005: 26–31), a binary reminiscent of the terms 'coupling' and 'decoupling' used in sociology (Flichy, 1995: 167; White, 1992; Grossetti, Bès, 2003). As Antoine Picon explains, 'it may be that technical progress does not inevitably proceed from a passage from the abstract to the concrete, in other words to the increasing integration of functions and forms, but to a successive moments concretization and deconcretization' (Picon, 1992: 387). Thus, another possible reading of the processes of concretization/convergence and deconcretization/divergence of techniques emerges, which should be considered in terms of cycles and alternations. These definitions stretch beyond the usual economic meaning of these terms, and also beyond the socio-cultural meaning of appropriation and agency, to think more specifically about techniques. Such an approach, which is inseparable from the development of the history of techniques in France in dialogue with the social sciences since the *Annales*, explains why our work

combines history with sociology, anthropology, ethnology, and philosophy. Interdisciplinarity and reflexivity play an essential role in the critical investigation of today's teleology of growth, progress

and innovation, three notions which have often kept us from properly understanding the 'mode of existence' of technical objects (Simondon, 1958; Bontems, 2019).

This book then bears the imprint of two rationales. On the one hand, it builds on research carried out internationally that rejects overarching diffusionist narratives in favour of an approach that stresses the complexity of how techniques circulate (Hilaire-Pérez, Verna, 2006; Krige, 2019), and more generally stresses the many forms of divergence that exist — what anthropologists call socialized technique and which economic historians are just beginning to consider (Davids, 2019). On the other hand, this book's chapters contribute to asking new questions because of their self-critical approach (Lamy, 2018; Crépel, Lamy, Petitjean, 2017; Grunwald, 2018; Heßler, Weber, 2019; Böhn, Möser, 2010), their attention to terminology (Schatzberg, 2006, 2018; Carnino, Hilaire-Pérez, Hooek, 2017), to issues of scale, and because they highlight the complex role of various timescales on techniques (Grunwald, 2012; Benoit, 2020).

In line with current research, this book also adopts a critical point of view on the history of techniques (Feenberg, 2004; Jarrige, 2014; Jasanoff, Kim, 2015; Hård, Jamison, 1998). As the authors of a dossier on infrastructures and their place in the ideologies of power and modernity put it, 'While the Silicon Valley's industrial, institutional and financial infrastructures are now a model that is spreading to many parts of the world, while so-called 'Smart Cities' are fashioning the deployment of new urban surveillance and control infrastructures, the humanities and social sciences cannot simply stand by and describe evolutions: they must also interrogate them and analyse the deeper ideological issues at work' (Jarrige, *Le Courant*, Paloque-Bergès, 2018: 8).

This is also the approach of some authors who outline the hidden and paradoxical issues at stake in European technologies, including their vulnerabilities (van der Vleuten, Högselius, Hommels, Kaijser, 2013), and others who focus on the role played by 'technocratic experts', from engineers to economists, in the establishment of post-colonial hierarchies via asymmetrical technical transfers (Pretel, Camprubi, 2018b). Our book reflects these current positions, investigating the central role played by innovation, growth, and techno-sciences in the history of techniques. This critical approach is particularly well represented in France in relation to the environmental impacts of technology (Bonneuil, Fressoz, 2016; Jarrige, Le Roux, 2017), to notions of risk and technical uncertainty (Fressoz, 2012; Fridenson, 2012; Le Roux, 2016), to those of breakdowns and accidents (Lambert, Raveux, 2019) and to workers' opposition to machinism (Bourdeau, Jarrige, Vincent, 2006; Biagini, Carnino, 2010; Jarrige, 2014).

At the heart of these approaches is the paradigm of the construction of technopolitical regimes, an idea that underpins the global history of modern techniques and has dominated the literature for a generation (Winner, 1980; Noble, 1984; Hecht, 1998, 2012; Mitchell, 2011; Kurban, Peña-Lopez, Haberer 2017; Krige, 2019), inviting us to re-read transnational political processes — such as European integration for instance — in the light of the history of techniques — with the ideas of a 'hidden integration'

and a 'hidden fragmentation' (Misa, Schot, 2005: 3). This political dimension was the focus of Larissa Zakharova's work on the global history of techniques, and it has largely inspired this book (Zakharova, 2020; Hilaire-Pérez, Zakharova, 2016). Going against any nationalistic appropriation of techniques, a tendency as potent in France as in the USSR, Larissa Zakharova showed that supposedly national techniques resulted in fact from multiple encounters that resulted in an 'interdependence of territories' — whether the latter be desired or imposed, embraced or negated (Hilaire-Pérez, Zakharova, 2016: 25) — and led to various forms of adaptation rather than any homogeneity (Zakharova, 2016, 2020). This book, therefore, seeks to understand and contextualise these nationalistic narratives in the light of a political history of techniques at the same time as it uncovers complex processes made up of hybridizations, multiple timescales, and territories,

highlights polysemic notions and controversies. This calls for the adoption of a variety of points of view, methods, and conceptual tools.

What this book also does, beyond simply mapping out the field of the global history of techniques today, is to highlight the diversity of reflections and conceptual tools at work. Several choices made for this book bear witness to specific points that we feel it is important to make. One of these is the relationship between techniques and globalization. At the beginning of this book we emphasize the multiple pitfalls that threaten any attempt to reconstruct a history spanning more than two centuries of technological practices on a global scale. One major focus is the definition of globalization itself. The term is often used as an alternative to such terms as 'connected', or 'transnational'. This is not merely a linguistic issue. Each term is connected to a historiographical project, so that clarity is important. David Edgerton defines globalization as a means of studying 'all places that use technology, not just the small number of places where invention and innovation is concentrated' (Edgerton, 2006: xiii). Focusing on the analysis of how technologies are used rather than invented, Edgerton calls for 'a history of technology engaged with all the world's population, a population, which is mostly poor, non-white, and half female' (Edgerton, 2006: xiii). Globalization here thus refers to an actual situation. Technology considered as techniques, that is as a means of acting on the world is therefore part of his analysis. In a way, this global history of material practices is based on a naturalization of diffusionism. The study of centres of technical production and innovation and how technologies circulated from these centres was at the core of traditional anthropology and prehistoric studies (Leroi-Gourhan, 1943, 1945; Haudricourt, 1987). The fact it echoes with current reflections on the globalization of techniques explains its recent revival (Gazagnadou, 2008). Due to the prevalence of information infrastructures (Mattelart, 1992, 1999) and very large-scale energy flows (Gras, 2015) in the contemporary period, among other things, globalization has been taken for granted as a key factor for the circulation and adaptation of techniques.

In contrast with this vision, we first need to remind ourselves that long-distance communications were used prior to the nineteenth century. It is also important to stress that the supposed fluidity of globalization processes is by no means obvious (Didry et al., 2004): issues linked to the (in)compatibility of various national norms

(Méadel, 1994), path dependency (David, 1985; Gardey, 1998), various instances of resistance (Jarrige, 2014; Fischer, 2022), and state control of flows (Krige, 2019) all contradict such neat narratives of technologies smoothly spreading around the world. The predominance of science (to the detriment of techniques) in the study of globalized forms of exchange and appropriation poses another difficulty that needs to be navigated. Asymmetry is not a new concept (Febvre, 1935), but it calls for increased vigilance here. In fact, recent attempts to develop a framework for the global history of science (which incidentally often includes techniques although this is not clearly stated) have led to the West being overvalued (Roberts, 2009) and techniques to be seen merely as components of scientific activity (Fan, 2012).

In this collection of essays we use the term globalization in the sense of a relational capacity of individuals to produce, transmit, appropriate, transform, contest, and even ignore techniques. The large cultural areas defined in the first part of the book thus exemplify congregated coherent technological structures as well as areas of more or less stable technical exchanges. These divisions make it possible to identify different levels of appropriation, standardization, and circulation. These are by no means rigid structures limiting the possibilities of a multifaceted approach to the continuous mutation of technical appropriation.

Connected history, unlike comparative history, intends to focus on the social, political, and cultural processes where the 'local and specific' meets the 'supra-local' (Subrahmanyam, 1997: 745). One of the difficulties in discussing techniques lies in the material nature of the exchanges at stake. Roger Chartier asked with regard to this type of approach:

How can we think about the relationship between appropriation and acculturation, between inventive reuse and cultural uprooting? How can we define the processes of "interaction" or

“negotiation” (...) depending on whether they operate within relations of domination or in relations of exchange? (Chartier, 2001: 123).

The quest for an illusory ‘global’ overarching template — a grand narrative accounting for the supposed formalization of techniques — is another major pitfall for any attempt at dealing with the history of techniques on a global scale. The period spanning the nineteenth, twentieth and twenty-first centuries has too narrowly been studied through a purely economic lens: industrial revolutions, the transformations of modern capitalism, the massive monetization of human activities and endeavours and since the 1970s, the deployment of a neoliberal programme supported by international institutions (IMF, World Bank) have resulted in a focus on economic models (Pretel, Camprubi, 2018a). From this perspective, techniques have been considered as a variable that can explain any increase in trade, the speed of communication, increased productivity, etc. (Verley, 1997). Taken for granted techniques are included in a purely economic narrative. However some current studies attempt to disentangle the analysis of techniques from such a reductive economic understanding: In the face of the often simplistic discourse that the spectacular transformations of present-day Chinese society give rise to, it seemed essential for us to recall that

these have a history, a history during which the activity and technical knowledge that bring about change have never depended solely on economic conditions, and techniques here cover the unequal capacity of different groups and individuals to act on their environment and to legitimize this activity (Lamouroux, 2010a: 161).

Generally speaking, in response to the questions of ‘who invented what’ and which techniques may have generated increases in productivity, historians increasingly tend to examine the multiple issues related to techniques, their fitness to purpose, and their transmission in specific societies before embarking on large-scale comparisons and grand narratives of globalization.

The search for homogeneity in the history of technology also applies to attempts at model building like Immanuel Wallerstein’s world-systems (Wallerstein, 2009). The multiple criteria used (economic, political, cultural, ideological, etc.) obfuscate the specific characteristics of technical practices so that it becomes impossible to identify them. On the other end of the spectrum is the division of technical practices into a myriad of case studies (Douki, Minard, 2007: 18) that explain each process in all its finest detail, but do not attempt to define a more comprehensive intellectual framework that might account for the processes at work.

In order to overcome these various conundrums in the historiography of the globalization of techniques, we have chosen to focus on the processes of circulation, a position which means taking into account actors’ situations and motivations, potential failures, intermediaries, while transport and communication infrastructures are put into context (Hilaire-Pérez, 2008). Even the most modern dematerialized data cannot be abstracted from stubborn materiality (Laumonier, 2019). Using circulation as a lens draws attention to a variety of operations: it allows for the debunking of apparently self evident notions such as innovation (Sainsaulieu, Saint-Martin, 2015) and for the exploration of various facets of human activities to identify forms of technical appropriation. Connections and exchanges are studied along instances of miscommunication and of techniques failing to spread: techniques thus emerge as infinitely varied practices that are inseparable from global processes, be they political, cultural, economic, or social.

Another contention of the volume is to challenge the traditionally event-driven approach to the history of techniques. In the same way as the Annales school was founded upon the rejection of the history of great kings and famous battles (Burguière, 2006), it seems important today to initiate a radical departure from the event-driven history of techniques. Instead, it is crucial to embrace a much more ambitious approach which forgoes the anecdotal and any simplistic focus on particular discoveries or inventions, to adopt a multiscale perspective. French historiography in particular has developed the study of the temporality of techniques with specific emphasis on the *longue durée*. This particular historiographical development owes both to the notion of ‘technical systems’ and to Fernand Braudel’s tripartite vision of time that has made it possible for historians to think about

techniques unfolding over different timescales (Hilaire-Pérez, Jarrige, 2020). We also want to build on David

Edgerton's critique of novelty (2006) while refraining from seeing practices as a cure-all go-to concept offering protection from the evils of an over-fascination for innovation. If attention to social developments once partly succeeded in debunking the grand narrative of progress (Bijker, Hughes, Pinch, 1987), today's received wisdom tends to downplay the role of techniques in favour of social factors. But in the name of avoiding technical determinism what is foregrounded is often an equally simplistic vision dominated by social determinism. If issues of the social uptake, circulation and appropriation of techniques is obviously important, the widespread deployment of a technique over an entire territory is also shaped, and in turns gives rise to, crucial phenomena that require analysis. Insisting on the scale of technical implementations in particular eschews the twin issues on the one hand of the diffusionist paradigm (which we know to be a mere fiction) and on the other of the fragmentation of the narrative into a myriad factors making any causal analysis impossible. Having an emphasis on critical masses also makes it possible to move beyond the false debate centred on the notion of innovation, opposing rupture and continuity or, for the history of techniques, invention and imitation. Shunning the usual focus on the inventive, creative, and god-like moment of invention, and foregrounding instead the development of structured technical systems as Thomas P. Hughes (1983; 1989) suggested a while ago already, is a way of highlighting actors' ability to hybridize, build and negotiate between different systems and techniques. Leaving the event-driven history of techniques behind shifts the focus from inventors (who are no longer described as brilliant and misunderstood individuals: Huges, 1989; Hilaire-Pérez, 2000; Carnino, 2015) to system builders, and at the same time unsettles the other false dichotomy between social determinism and technique, revealing crucial elements that are played out in diverse places and times in each phase of any technical deployment (van der Vleuten, Oldenziel, Davids, 2017). The emergence of a coherent technical universe then invariably contributes to the closing and opening of new worlds. If we pay attention to the various sizes and geographies of technical devices, we can put today's burning question of social inequalities back center stage at last. Factoring in technical issues when analysing colonization thus provides, for example, a way towards understanding certain formative events, such as the battle of Omdurman at the end of the Anglo-Egyptian conquest of Sudan. Winston Churchill recounts that on 2 September 1898, after five hours of fighting (during which, according to him, the infantry fired calmly, while the enemy was still far away), twenty English men, twenty of their Egyptian allies, and 11,000 Dervishes had been killed (Headrick, 1981). Clearly, the spread of techniques and technical diffusionism are two sides of the same colonial coin, they are part of the same power dynamics (Headrick, 1988; Pessis, 2019).

These methodological stances have informed the structure of the present work.

Our criticism of global reductionism has therefore prompted us to devote the first part of the book to a world tour of techniques, which aims to preserve the uniqueness of each region of the globe during the specified period and to highlight reappropriations as well as misunderstandings: in an unabashedly arbitrary fashion, and in order to curtail any ethnocentric bias, the chapters in this first section take

the reader on an intellectual journey around the world from Oceania — which all too often gets short changed in the existing literature — just as it has done in power dynamics — to South America. Some chapters are more historiographical, others focus more on the specific contexts of some developments, but all provide a critical analysis of contemporary techniques at the crossroads of global and local dynamics.

The emphasis on the large scale deployment of techniques rather than supposedly revolutionary inventions has led us in the second part to focus on sectors whose importance seems critical to the constitution of the modern world although the relative importance of each sector in today's world is open to discussion naturally. We start with a chapter on heavy industries, and end with urban techniques, but this order should not be invested with more meaning than it carries.

Distinguishing between technique and technology is a means to avoid reducing phenomena to their materiality and makes it possible to think about significant trends. The third part of the book focuses on various structural issues that have dominated technique in the last three hundred years. The section starts with a discussion of technology and, with each chapter leading to the next, weaves its way from labour to social conflicts, from the body to gender or from technology of the everyday to food.

Whatever the section, authors have been expressly instructed to cover all time periods, themes or historiographical debates that they felt were important for their topic. If the adoption of a comprehensive approach from a chronological, thematic, and historiographical point of view was a guiding principle, each author was then left free to choose a particular element or approach. Any work of this type also unavoidably has lacunae. Some topics — such as musical instruments, packaging or technical failures — unfortunately have had to be left out because the specialist authors who could have written on them were either unavailable at the time of the project or unwilling to conform to its format. These shortcomings are, of course, also caused by the constraints of an already very full but we hope rich volume.

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